RoadNet

FINAL REPORT
Traffic Impact Study

Area 14 Urban Investigation Area (Ocean Drive between Lake Cathie and Bonny Hills)

for

Port Macquarie Hastings Council

April 2010

SYSTEM CERTIFICATION ISO 9001:2008 SGS

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Document Status	**Final**

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1.0 Executive Summary

Area 14 is a future residential area located between the existing townships of Lake Cathie and Bonny Hills. The 180 hectare parcel of land will cater for almost 10,000 future residents with schools, sporting fields, community facilities, in addition to commercial and light industrial precincts, while preserving open space and habitat corridors.

Ocean Drive, which runs through the western portion of the future growth area, is an arterial road which will connect Area 14 with the Camden Haven area to the south and Port Macquarie to the north. Recent growth in these coastal centres in recent years has seen traffic along Ocean Drive increase dramatically.

Houston Mitchell Drive is located adjacent to the proposed Area 14 precinct and connects Ocean Drive to the Pacific Highway. Development of the existing coastal townships and Area 14 will result in a large increase in traffic volumes on Ocean Drive and turning movements at the Houston Mitchell Drive / Ocean Drive intersection.

Manual traffic counts were taken at the intersections of Ocean Drive with Bonny View Drive, Houston Mitchell Drive and Abel Tasman Drive to determine current traffic volumes and intersection movements. Traffic volumes to be generated by the proposed Area 14 development were then estimated based upon the land use types and at various stages of development. Estimates of future traffic volumes on Ocean Drive were also derived, based upon estimates of future growth in the neighbouring townships, as provided by Council.

Modelling (Paramics) of various traffic networks has been undertaken to provide information regarding the capacity of the existing road network to cater for the proposed population and traffic growth, and to investigate options for future road upgrades and intersection treatments.

The modelling showed that Ocean Drive and associated roads within the study area are currently operating well within capacity. However, the roads do not have the capacity to cater for future growth, and the following upgrades and intersection treatments are recommended by 2019 (partial development):

- Ocean Drive requires two lanes northbound between Bonny View Drive and Abel Tasman Drive;
- Houston Mitchell Drive / Ocean Drive requires upgrading to a signalised intersection, which provides two through lanes along Ocean Drive. Pedestrian crossings are recommended across the Houston Mitchell Drive, Primary School Access and the southern approach of Ocean Drive;
- Houston Mitchell Drive requires two lanes eastbound between Forest Parkway and Ocean Drive with a 'Keep Clear' to be line marked at the give way intersection at the Industrial Precinct access;
- a signalised intersection is required on Ocean Drive at the proposed Commercial Precinct;
- Bonny View Drive / Ocean Drive requires upgrading to a roundabout with two lane approaches and circulating lanes;
- Abel Tasman Drive / Ocean Drive intersection requires upgrading to a signalised intersection with two lane approaches.

- a new roundabout intersection is required along Ocean Drive between Abel Tasman Drive and the Commercial Precinct. This roundabout requires two lane approaches and circulating lanes; and
- four lanes (two lanes in each direction) are required along Ocean Drive between the Houston Mitchell Drive and the Commercial Precinct.

By 2029 (full development), the following road network improvements are required:

- Ocean Drive requires four lanes (two lanes in each direction) between Bonny View Drive and Abel Tasman Drive;
- Houston Mitchell Drive / Ocean Drive intersection requires two right turn lanes from Ocean Drive north to Houston Mitchell Drive;
- Houston Mitchell Drive requires four lanes (two lanes in each direction) between Forest Parkway and Ocean Drive;
- The signalised intersection fronting the commercial precinct requires two lane approaches from both the commercial precinct in the south and residential area in the north. The right turn lane from Ocean Drive to the Commercial Precinct requires extension to 165 metres.

During the final stages of this project, RoadNet personnel attended two Area 14 Working Group Meetings where the Paramics Modelling was presented as preliminary and preliminary final modelling for the project. After these meetings the Working Group provided comments on the modelling. These comments were considered and where appropriate incorporated into the model.

The Draft Report was circulated to key stakeholders for comment. Submissions were received from two companies (King and Campbell and Tierney Property Services) representing affected landowners. They raised issues in relation to the degree of road infrastructure upgrading required. Council's Technical Services Manager requested that the modelling be reviewed in light of the comments. Accordingly, a peer review was undertaken by RoadNet's Transport Planner.

The review concluded that the modelling contained in the study is sound and satisfactorily reflects likely future traffic conditions for the road networks considered. It also raises wider network planning issues such as the need to upgrade Houston Mitchell Drive and address access and safety issues at its junction with the Pacific Highway. A copy of the review is included in Appendix A and should be read in conjunction with this report.

The following Figures show the network improvements required in 2019 and 2029.

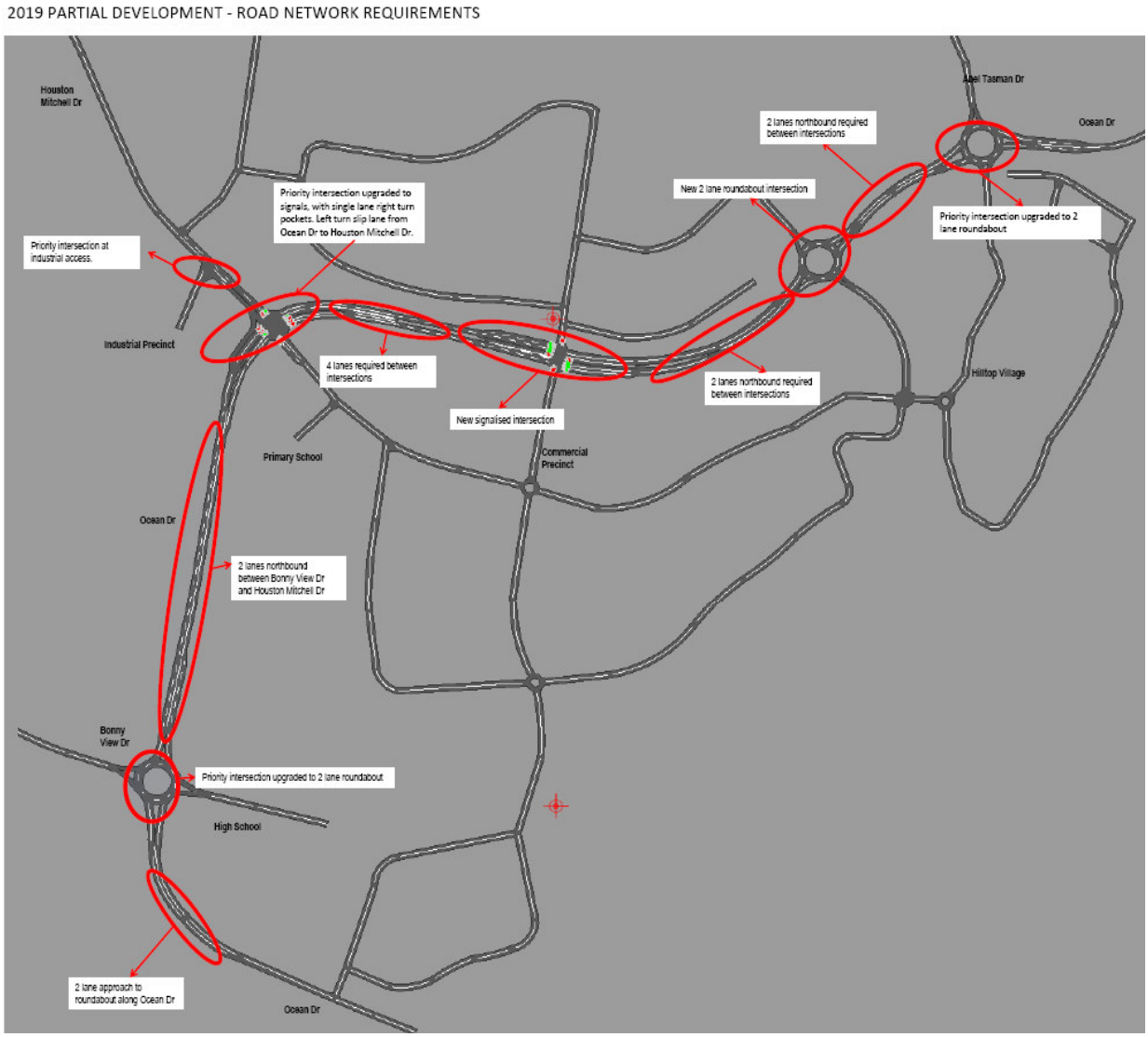

Figure 1.0: Intersection requirements for 2019

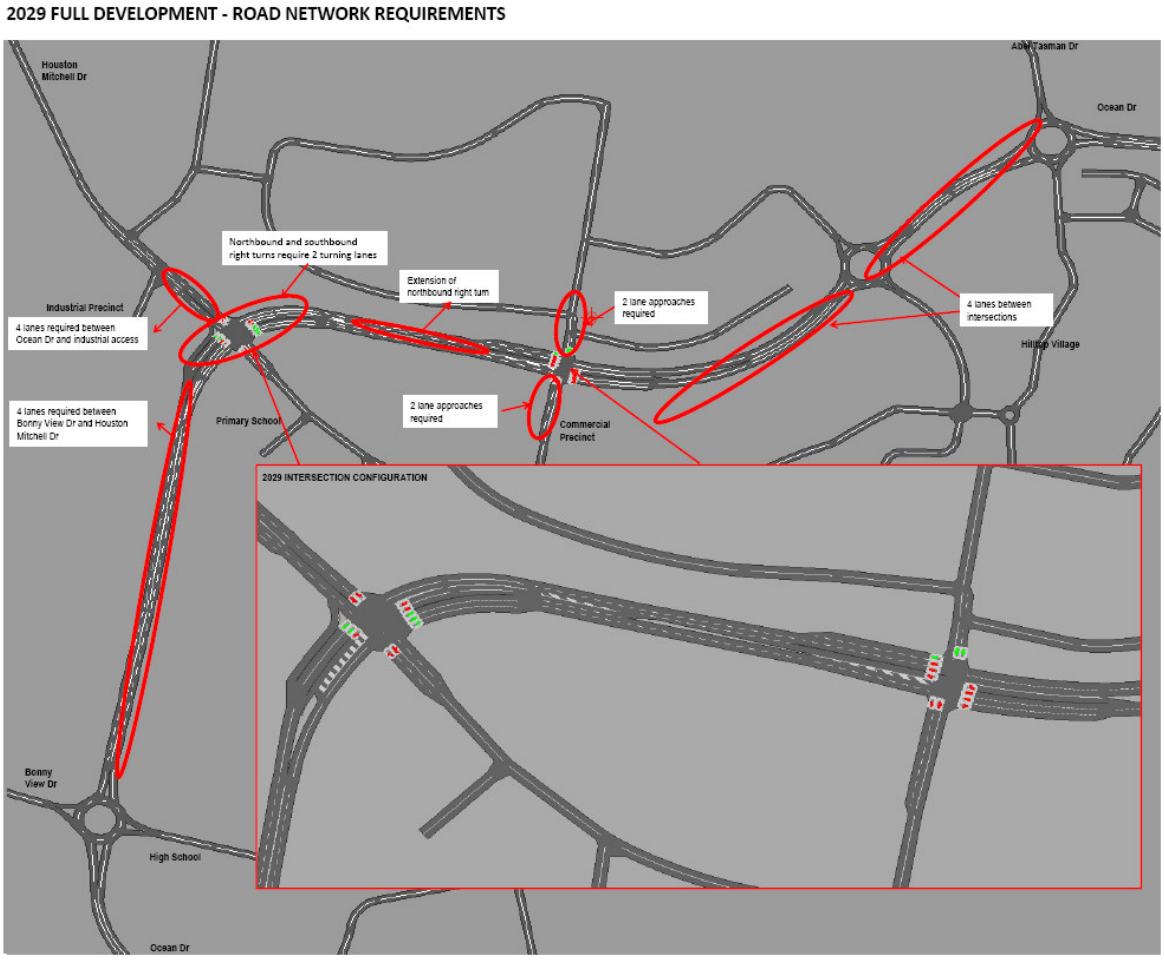

Figure 1.1: Road Network and improvements 2029

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2.0 Introduction

2.1 Background

A 180 hectare parcel of land located along Ocean Drive between the townships of Bonny Hills in the south and Lake Cathie in the north has been zoned for residential development (*Residential 2A(1)*) by Port Macquarie Hasting Council. This area was the subject of the Greater Lake Cathie and Bonny Hills Urban Design Master Plan in 2003.

Port Macquarie Hasting Council adopted this Master Plan for the Area 14 Urban Investigation Area in 2004. The Master Plan provides a framework for new urban development along Ocean Drive between Lake Cathie and Bonny Hills, which may ultimately cater for 9,900 residents in what is proposed to be known as the Broader Rainbow Beach Area. Figure 2.1 demonstrates the Area 14 study area.

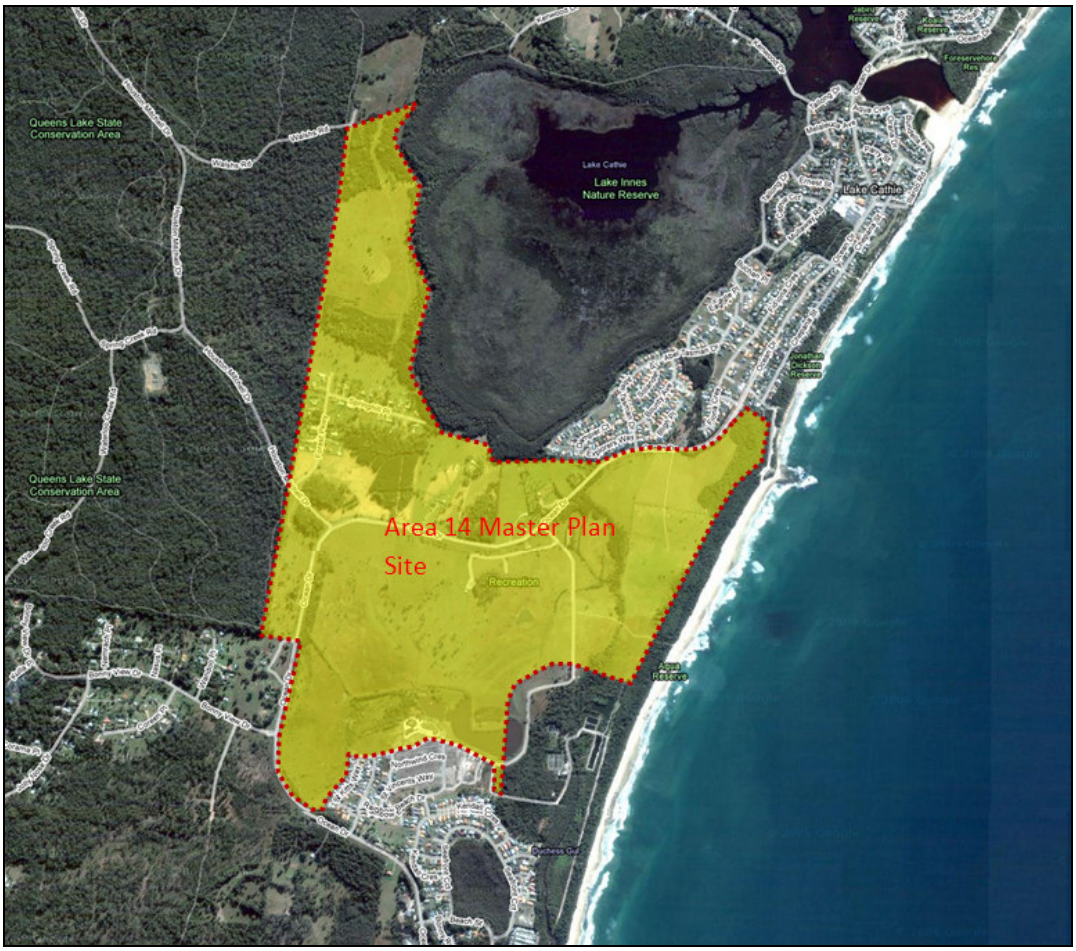


Figure 2.1: Area 14 Study Area

Area 14 is proposed to include the following land uses:

- Approximately 2,160 new dwellings;
- Two School Sites
- District Sporting Fields
- Town Centre
- Open space/Habitat corridor
- Hilltop village centre proposed in the north east sector
- Light Industrial precinct to the west of Ocean Drive
- Future Eco-Tourism development site in the south east sector
- Future urban investigation area to the north off Forest Parkway

Ocean Drive, which runs through the Area 14 study area, is the primary arterial road connecting the coastal town centres of Bonny Hills, Laurieton and Lake Cathie to the regional centre of Port Macquarie. Growth of these coastal centres in recent years has seen traffic along Ocean Drive increase dramatically.

Houston Mitchell Drive is a key connector to the Pacific Highway for these local centres, and as these centres grow, so will the volume of turning movements at the Houston Mitchell Drive / Ocean Drive intersection.

2.2 Scope

Council has stated that the principal objective of this study is to provide traffic information and advice sufficient to enable Council to plan for a road network that:

- is safe and functional;
- operates to an acceptable level of service (LOS) well into the future;
- can be staged in an orderly and cost effective way to service planned land development; and
- establishes a road hierarchy suitable for projected traffic patterns.

Bitzios Consulting and RoadNet have been commissioned to assess the road network and intersection requirements based on Council's indicative network plan as shown in Figure 2.2.

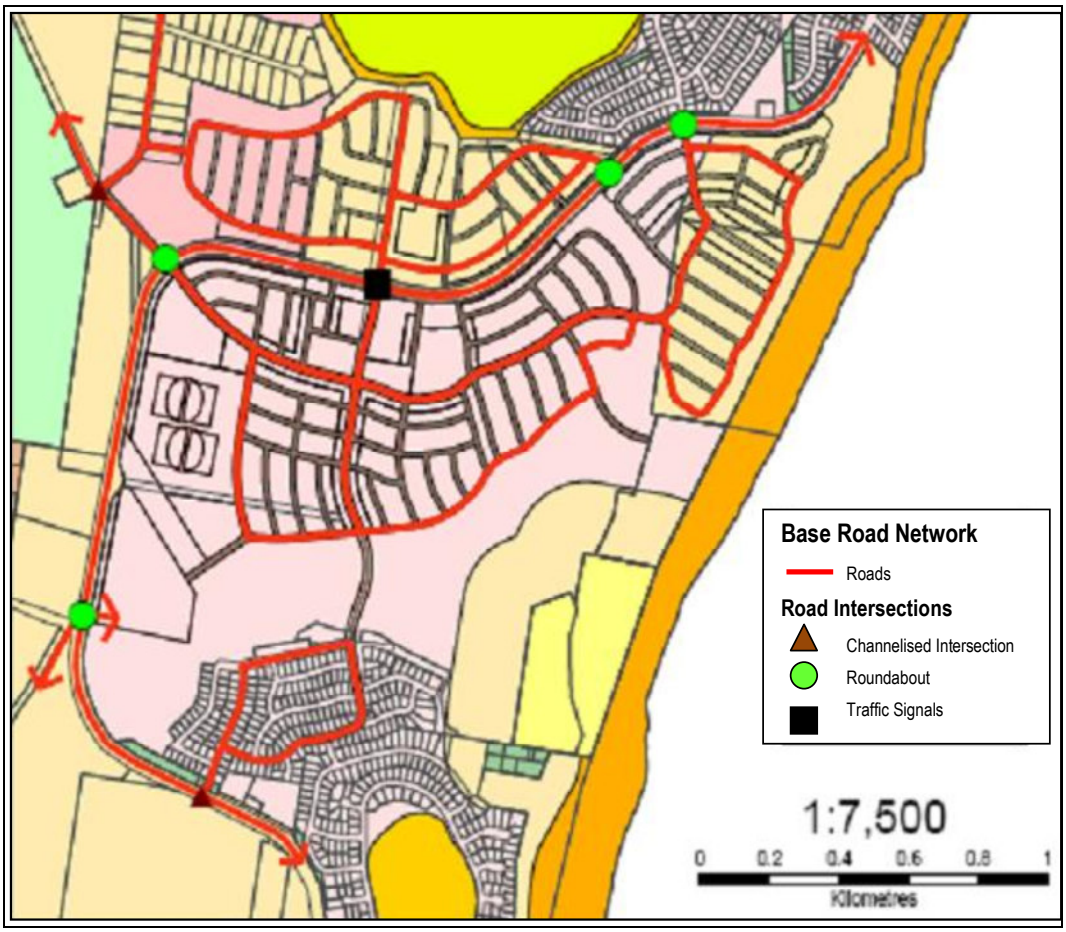


Figure 2.2: Council's Road Network Plan

To enable the testing of alternative road and intersection improvements for future years, a Paramics micro-simulation traffic model was deemed as being necessary for the study area.

This report details the Paramics modelling and traffic infrastructure needs assessment undertaken for the Area 14 Study Area. The scope of this work included:

- undertaking traffic surveys during morning and afternoon peak periods;
- creating and validating base year (2009) AM and PM peak period Paramics models for the study area;
- creating future year (2019 and 2029) AM and PM peak period Paramics models under various network scenarios as follows:
  - Base Existing (Do Nothing);
  - Scenario 1 Development as planned; and
  - Scenario 2 Development with additional residential and link road.

- providing recommendations for improvements considered necessary to the current planned road network, including intersection locations and types.

2.3 Limitations of Use

While the Paramics modelling includes sections of the internal road network to allow development traffic into the model, it should noted that detailed modelling has not been undertaken for the internal road network as part of this study. Some consideration and recommendations have however been included on what impact the internal road network has on the intersections and traffic volumes along Ocean Drive.

Recommendations within this report coincide with the development and land use layout at the time of the study and any changes to the layout require assessment on the impact of the recommended intersection layouts.

2.4 Overview of Paramics

Paramics is a traffic micro-simulation modelling package. Unlike strategic traffic models which "average" conditions over the assessment period and use a limited number of relationships between flow and delay, micro-simulation models assess the movement of each vehicle in the network. This is achieved by simulating the movement of each vehicle relative to other vehicles and the road environment considering parameters such as gap acceptance, acceleration, deceleration, vehicle following behaviours and so on.

By simulating the position of each vehicle at fixed time slices (e.g. every half a second) simulation models are able to estimate queue build up and dissipation, as well as dynamic route choice, as congestion builds.

A number of traffic assignment algorithms are available with varying levels of assumed knowledge of congestion and willingness to divert to alternative routes.

To develop or 'code' the Paramics Model, information such as the existing road network, speed limits, traffic counts, maximum queue lengths and traffic signal data is required. Using the traffic movement (count) data an Origin-Destination Matrix is developed.

Figure 2.3 demonstrates the processes required to develop the Paramics model and some of the possible capabilities of the Paramics package.

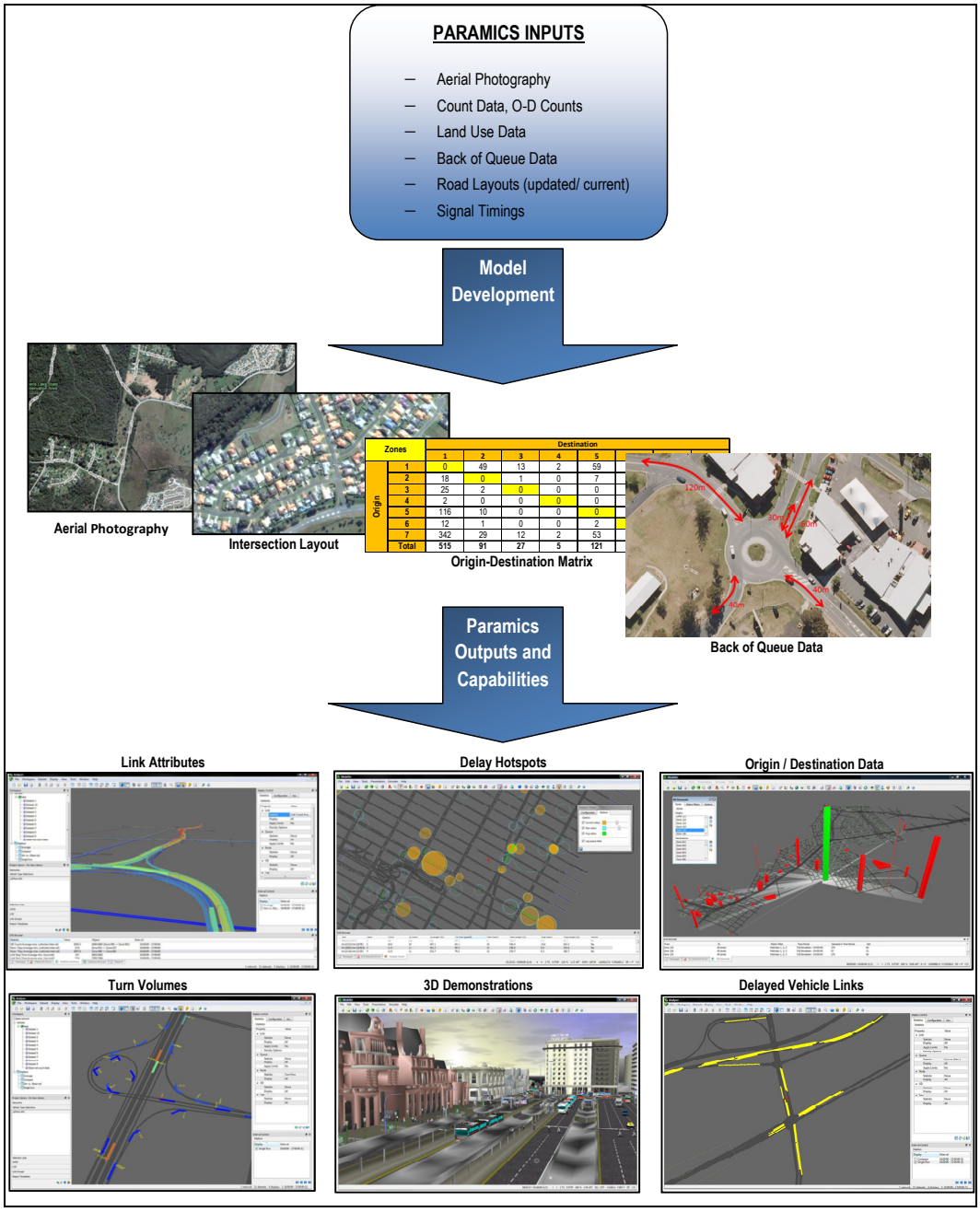


Figure 2.3: Paramics Model Process and Capabilities

3.0 2009 Base Model

The purpose of the 2009 Base Model was to calibrate the model to existing conditions in order to use it for future year assessment option testing. This section details the process of developing the base model and understanding the existing configurations and issues at the intersections in the study area.

3.1 Base Model Input Data

3.2 Base Model Validation and Performance

Validation of the 2009 Base Model was undertaken by comparing the survey count data against the link and turn volume outputs from the 2009 AM and PM Base Models. Standard practice for validating Paramics micro-simulation models is to determine the GEH Value of the network. The GEH statistic compares the observed count data against the modelled output data, using a combination of comparing both relative and absolute differences. GEH is calculated by using the equation below:

$$GEH = \sqrt{\frac{(M-O)^2}{0 \cdot 5 * (M+O)}}$$

Where: M = Modelled Counts; and
O = Observed Counts.

When using the GEH to determine the accuracy of a model, the average GEH value for all links within the network should be compared to the following criteria:

- GEH < 5 - Modelled flows can be considered an accurate fit to observed counts;
- 5< GEH < 10 - Modelled flows required further refinements to observed flows; and
- GEH > 10 - Modelled flows are not considered accurate to the observed flows.

Figure 3.4 shows the comparison between 2009 'observed' survey data and the 'modelled' link volumes from the 2009 AM and PM Base Models. Table 3.1 demonstrates the GEH validation for the 2009 Base Models.

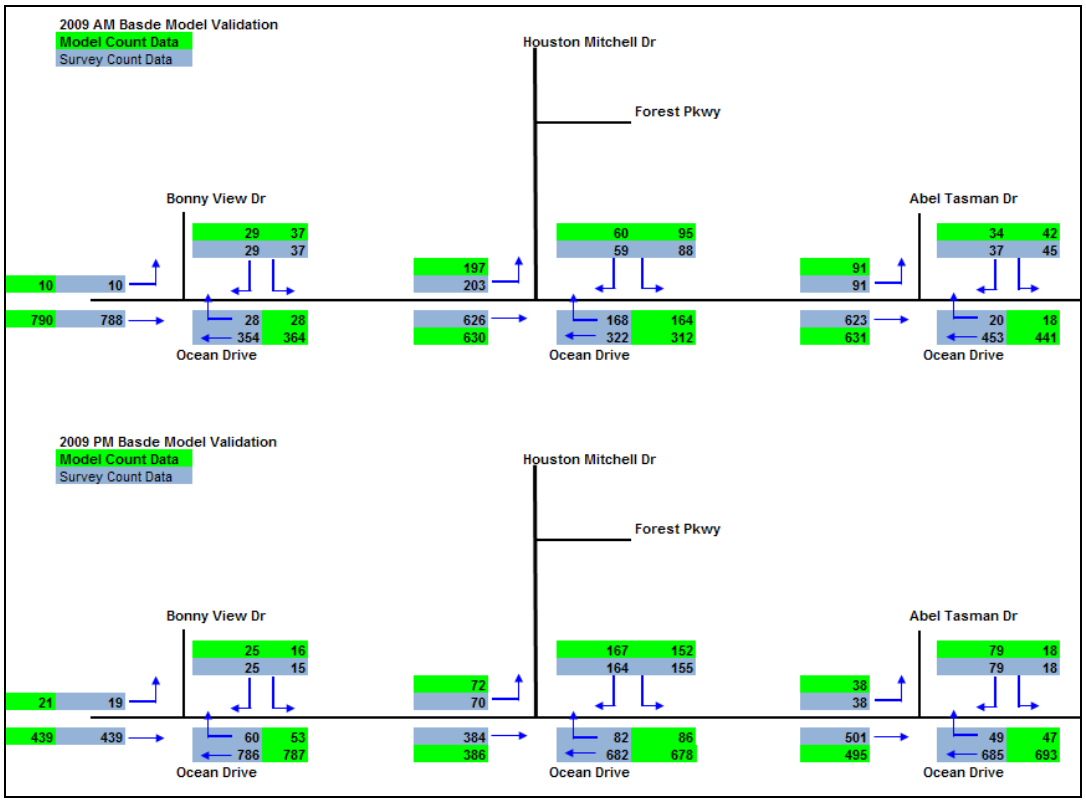


Figure 3.1: 2009 AM and PM Peak Turn Volumes Comparison

Table 3.1 2009 Base Model GEH Validation

Intersection	Approach	Movement	AM Peak		GEH Value	PM Peak		GEH Value
			Observed Count	Modelled Count		Observed Count	Modelled Count	
Ocean Drive / Bonny View Drive	Ocean Drive sth	left	10	10	0.0	19	21	0.4
		though	788	790	0.1	439	439	0.0
	Bonny View Dr	right	29	29	0.0	25	25	0.0
		left	37	37	0.0	15	16	0.3
	Ocean Dr nth	right	28	28	0.0	60	53	0.9
		though	354	364	0.5	786	787	0.0
Ocean Drive / Houston Mitchell Drive	Ocean Drive sth	left	203	197	0.4	70	72	0.2
		though	626	630	0.2	384	386	0.1
	Houston Mitchell Dr	right	59	60	0.1	164	167	0.2
		left	88	95	0.7	155	152	0.2
	Ocean Dr nth	right	168	164	0.3	82	86	0.4
		though	322	312	0.6	682	678	0.2
Ocean Drive	Ocean	left	91	91	0.0	38	38	0.0

Intersection	Approach	Movement	AM Peak		GEH Value	PM Peak		GEH Value
			Observed Count	Modelled Count		Observed Count	Modelled Count	
/ Houston Mitchell Drive	Drive sth	though	623	631	0.3	501	495	0.3
	Abel Tasman Dr	right	37	34	0.5	79	79	0.0
		left	45	42	0.5	18	18	0.0
	Ocean Dr nth	right	20	18	0.5	49	47	0.3
		though	453	441	0.6	685	693	0.3
			Average GEH		**0.3**	**Average GEH**		**0.2**

The average GEH value for both the AM and PM base models is 0.3 and 0.2 respectively, which is well within the allowable margin of error of less than 5. As a result, the 2009 base models provide and accurate representation of the observed count data.

Back of queue data was taken during the AM and PM peak periods and used for calibrating performance of intersection approaches. The majority of approaches to intersections with Ocean Drive did not demonstrate queues in excess of one to two vehicles during the peak periods.

Houston Mitchell Drive exhibited maximum queues of approximately 5 vehicles during both the AM and PM peak period. The queues at this intersection were for the right turn movements from Houston Mitchell Drive and Ocean Drive southbound. Figure 3.2 demonstrates the calibrated queues at Houston Mitchell Drive / Ocean Drive intersection within the 2009 AM peak base model.

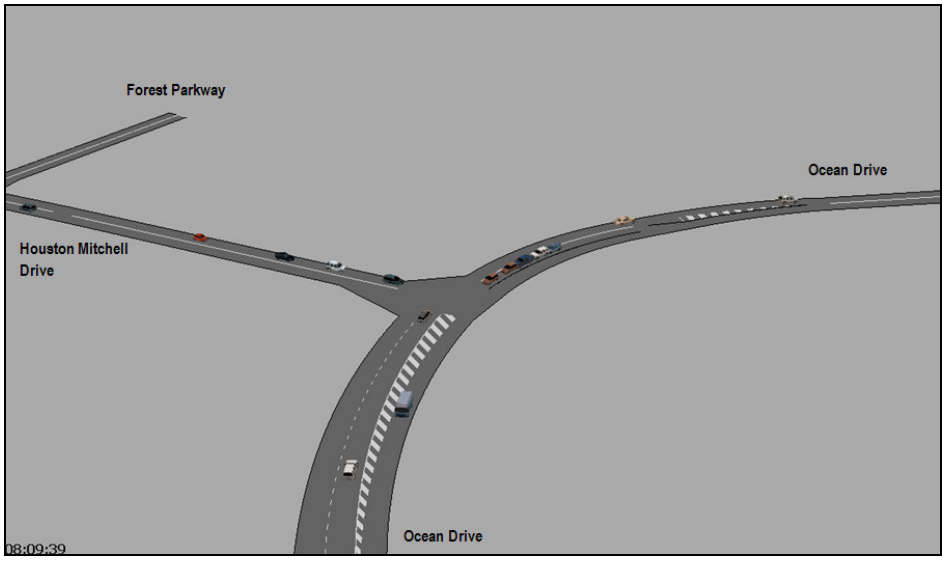


Figure 3.2: Houston Mitchell Drive / Ocean Drive Intersection

During the 2009 AM and PM peak periods, intersections along Ocean Dive within the study area perform within capacity and do not experience adverse intersection delays or queues which extend beyond allowable distances.

Table 3.2 provides the LOS for 2009 Base Model case.

Intersection	2009 AM	2009 PM
Abel Tasman Dr / Ocean Dr	A	A
Houston Mitchell Dr / Ocean Drive	A	A
Bonny View Dr / Ocean Dr	A	A

Link	2009 AM	2009 PM
Ocean Dr (North of Abel Tasman Dr)	A	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	A	A
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	A	A
Ocean Dr (South of Bonny View Dr)	A	A
Houston Mitchell Dr	A	A

3.2.1 Road Geometry and Intersections

Aerial photography was provided by Port Macquarie Hasting Council for the study area and used on a basis for coding road geometry into the model (nodes, links, "kerblines", "stop points", etc). These configurations were verified through site observations. Posted speed limits and intersection priorities were applied to the links in the base model based site observations. Figures 3.3 to 3.5 detail the configuration at intersections along Ocean Road.

Figure 3.3: Abel Tasman Drive / Ocean Drive Intersection

Figure 3.4: Houston Mitchell Drive / Ocean Drive Intersection

Figure 3.5: Bonny View Drive / Ocean Drive Intersection

To provide locations for traffic to be input into the road network, zones have been included within the 2009 model based on the existing road extremities of Ocean Drive, Houston Mitchell Drive, Abel Tasman Drive, Forest Parkway and Bonny View Drive. Figure 3.6 demonstrates the zone system used for the 2009 base model.

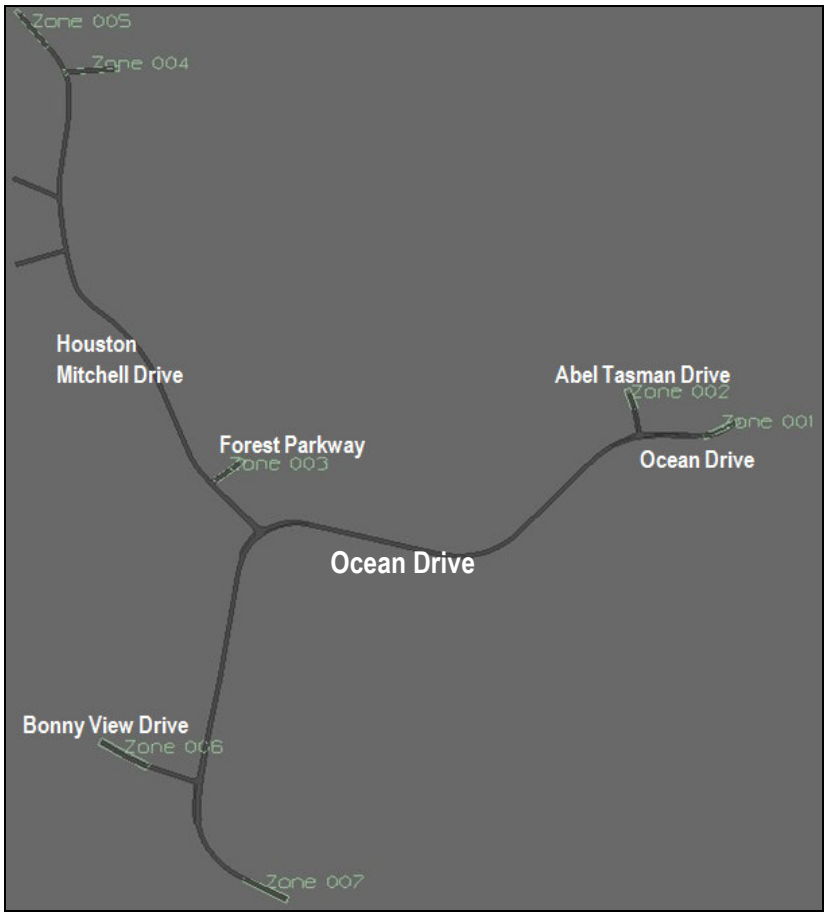


Figure 3.6: Base Model Zone System

3.2.2 Traffic Survey Data

Traffic surveys were undertaken at the key intersections in the study area on Wednesday 18th March and Thursday 19th March 2009 during the AM and PM peak periods. In addition, Council provided 24 hour tube counts across select roads in the study area from Tuesday 17th March to Tuesday 24th March. Numberplate surveys and tube counts were undertaken at the following locations and are shown in Figure 3.7:

Number Plate Survey Locations

1. Houston Mitchell Drive / Ocean Drive;
2. Bonny View Drive / Ocean View Drive; and
3. Abel Tasman Drive / Ocean View Drive.

Tube Count Locations

1. Houston Mitchell Drive, west of Forest Parkway;
2. Forest Parkway, north of Houston Mitchell Drive;
3. Ocean Drive, between Bonny View Drive and Houston Mitchell Drive; and
4. Ocean Drive between Houston Mitchell Drive and Abel Tasman Drive.

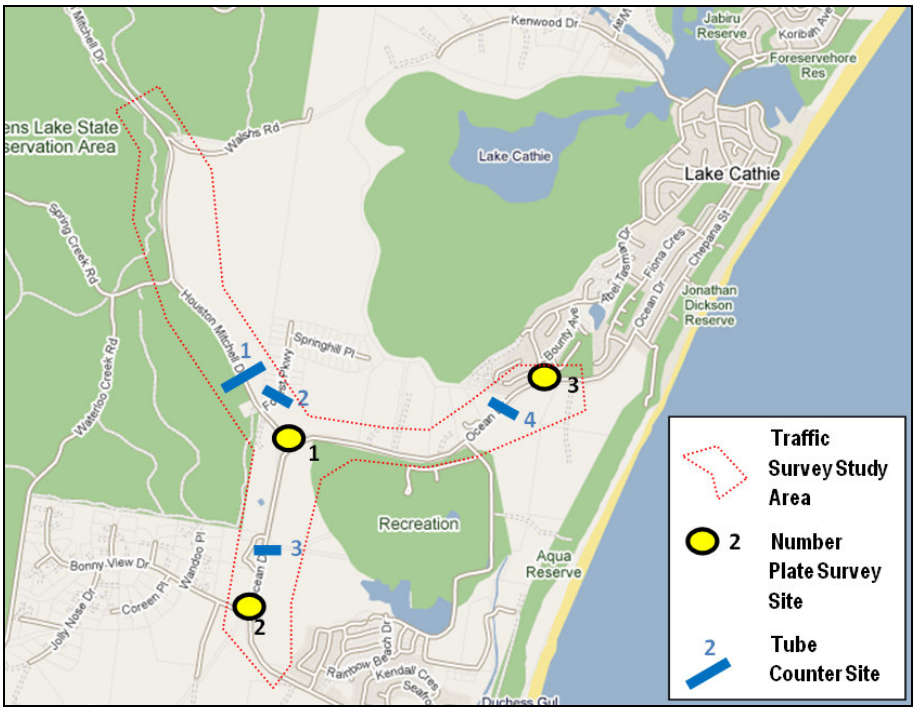


Figure 3.7: Traffic Count Locations

The traffic counts were undertaken during the AM (7:00am – 9:00am) peak and PM (4:00pm – 6:00pm) peak periods and involved recording numberplate data. The numberplate data includes only the 1st three digits of the numberplate which were tabulated at 15 minute intervals for each of the allowable movements at the survey intersections. The numberplate data provides important information including the turning volumes for each movement as well as a basis for creating an Origin-Destination Matrix for the Paramics model.

Tube count data was compared to provide peak hour screen line volumes as well as confirm approach volumes undertaken during the numberplate survey.

The 15 minute intervals for recording the traffic survey data enables the data to be compared and give an understanding of the peak hour traffic profile. Figure 2.3 provides the peak hour percentage of traffic flow for Ocean Drive for AM and PM peak periods. As Ocean Drive is the main thoroughfare through the study area and all surveyed approaches exhibit a similar pattern, the demand profiles shown in Figure 3.8 were utilised for the 2009 base models.

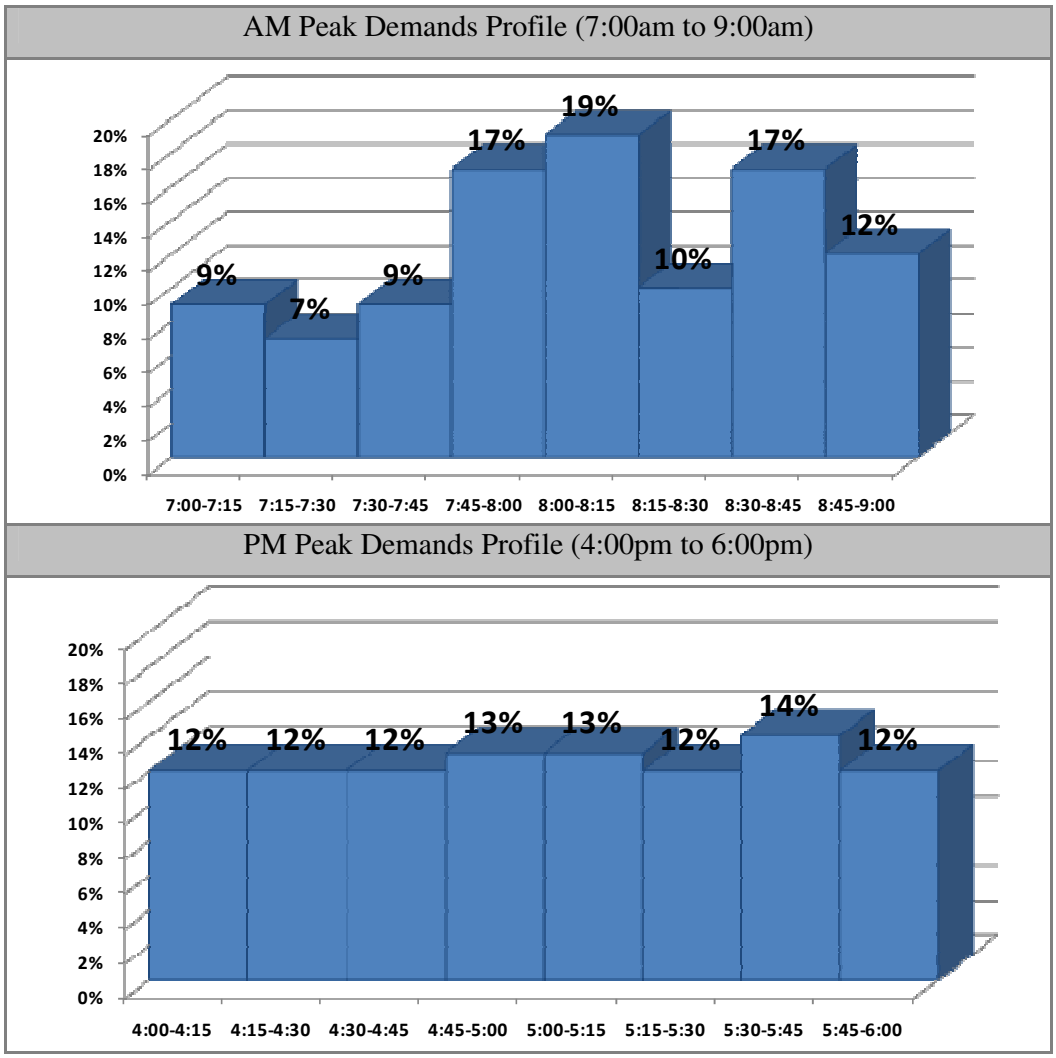


Figure 3.8: Peak hour Profile for Ocean Drive

The AM peak demand profile shows a clear increase in traffic between 7:45am and 8:15am. This can be attributed to tidal flow traffic from Bonny Hills and Laurieton to Port Macquarie. The AM peak is expected to have concentrations over the 2 hour period as worker start times (and subsequent travel patterns) generally coincide. In addition, school traffic also coincides with commuter traffic during the AM peak period.

Alternatively, the PM peak is relatively consistent across the two hour period as worker end times vary during the afternoon and school traffic is not included.

3.2.3 Site Observations

During the AM and PM peak period the following observations were made for the road network and traffic patterns within the study area:

- there is a distinct northbound tidal flow along Ocean Drive in the AM peak and subsequent southbound flow in the PM peak;

- the AM demand profile shows sharp increases between 7:45am - 8:15am as well as 8:30am - 8:45am;
- the PM demand profile is relatively consistent across the 2 hour peak period;
- Houston Mitchell Drive also exhibits a tidal flow (AM westbound and PM eastbound) as vehicles access the Pacific Highway;
- during the PM peak period, turning vehicles from Houston Mitchell Drive to Ocean Drive southbound conflict with southbound traffic (both through and right turns) on Ocean Drive;
- Vehicles were witnessed performing a u-turn at Abel Tasman / Ocean Dr intersection as to access the Medical Centre;
- bus stops along Ocean Drive have issues regarding acceleration and deceleration storage areas as well as pedestrian access particularly near the residential area at Abel Tasman Drive; and
- the 100kph speed limit on Ocean Drive through the Bonny View Drive intersection was perceived to be a safety issue and is exacerbated by the presence of school children boarding and alighting school buses.

4.0 Future Model Development

4.1 Future Growth

Models were developed for future year scenarios of +10years (2019) and +20years (2029). Future growth percentages were developed using The Hastings Road Traffic Study Annual Average Daily Traffic (AADT) produced by SMEC.

The Hastings Road and Traffic Study was undertaken to provide Council with a framework to manage its expanding road infrastructure assets. Projected traffic data for major roads was developed using information such as current jobs data from the Hasting Business Enterprise Centre (BEC), Hasting Urban Growth Strategy (HUGS 2001), population projections and historical traffic count data. Table 4.1 shows the historical and projected AADT volumes for Ocean Drive in proximity to the Area 14 study area.

Table 4.1: Estimated Future Volumes and Growth for Ocean Drive

Location	SMEC AADT's			2001 to 2011 growth (%).p.a	2001 to 2021 growth (%).p.a	2011 to 2021 growth (%).p.a
	2001	2011	2021			
Ocean Dr, north of Lake Cathie	4100	5800	7300	3.5%	2.9%	2.3%
Ocean Dr, south of Bonny Hills	4700	8400	10800	6.0%	4.2%	2.5%

Short term traffic growth (2009 to 2011) is expected to be consistent with recent historical traffic growth (approximately 5%p.a compounding). Interim growth (2011 to 2021) is expected to reduce slightly compared to short term growth as areas become more congested. In the long term, traffic growth is expected to ease or even plateau. This is not expected to occur within at least the next 20 years for areas such as Lake Cathie and Bonny Hills due to the availably of land zoned for development, as well as the envisaged continuation of people being attracted to coastal living along Australia's east coast. Based on historical and future projected volumes along Ocean Drive the following compounding growth rates were applied to calculate future background traffic:

- 2009 to 2011 - 4.8% p.a.;
- 2009 to 2019 – 3.6% p.a.; and
- 2009 to 2029 – 2.4% p.a.

4.2 Proposed Development

4.2.1 Development Details

The study area is likely to include development is proposed to include;

- 780 – 900 residential lots;
- Primary school and High school;
- Playing fields;
- Open space;
- Commercial Precinct providing a retail and business centre;
- Ecotourism site as part of the proposed Hilltop Village; and
- Light Industrial Precinct adjacent to Houston Mitchell Drive.

Figure 4.1 demonstrates the location of land uses within the proposed development.

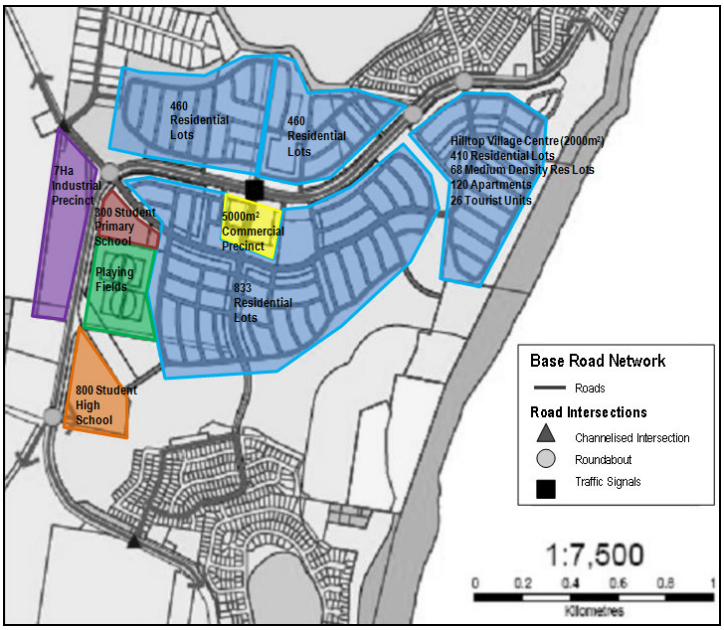


Figure 4.1: Scenario 1 Proposed Development

In addition to the proposed development, an additional residential component has been proposed with a new north-south link road from Forest Parkway to Kenwood Drive (see Figure 4.2). This influence this additional residential development and new link road has on the road network has been assessed as 'Scenario 2' for both 2019 and 2029.

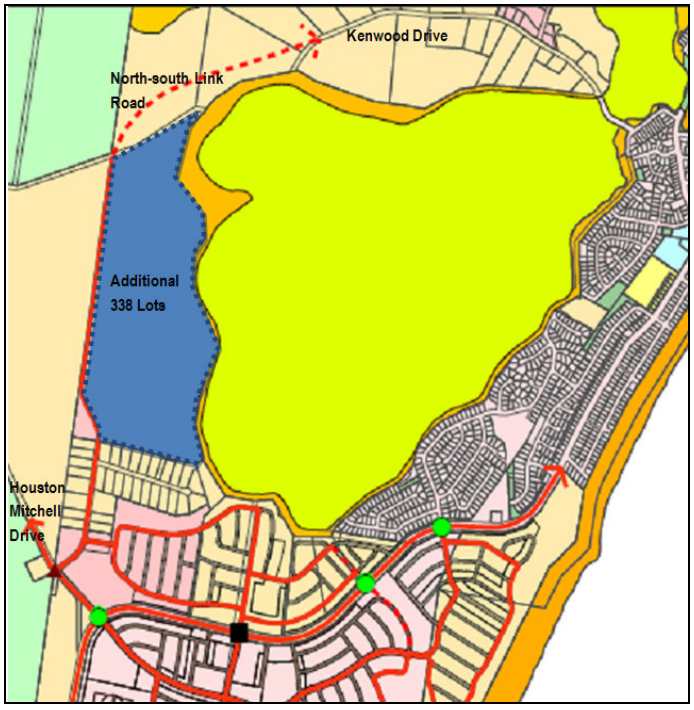


Figure 4.2: Scenario 2 Development

In addition, an assessment was also undertaken on a possible link road between the existing residential area to the south and the proposed residential/commercial area east of Ocean Drive as shown in Figure 4.3.

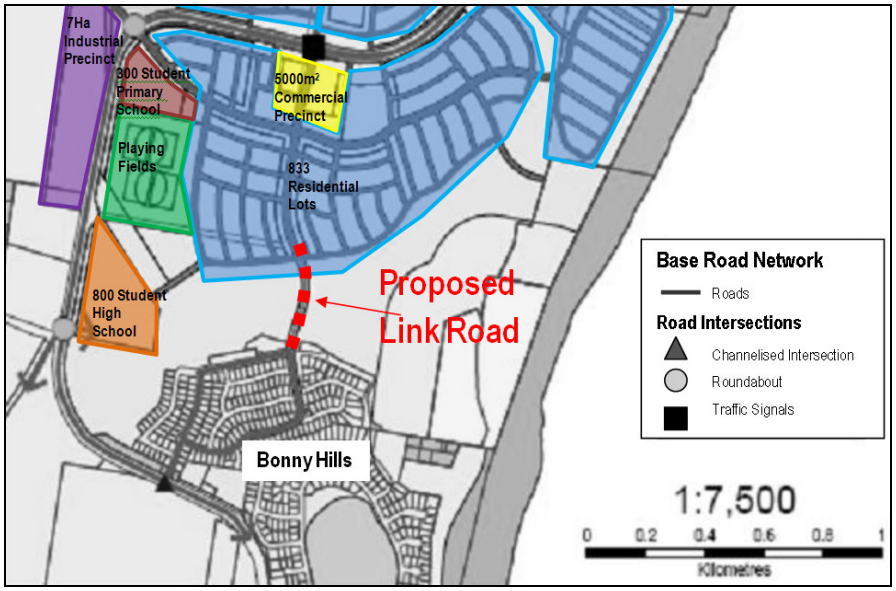


Figure 4.3: Proposed Link Road

4.2.2 Development Traffic Generation

The distribution of traffic to/from development areas was based on relative size (attractiveness) of the other zones in the network as well as considering current travel patterns within the study area.

Route choice within the network is undertaken within Paramics by calculating the perceived quickest time between the origin zone and destination zone through network. Many of the routes through the Area 14 network from zone to zone have only a single path, however some zone to zone movements have various alternate route paths for which the simulation model calculates the optimum path.

4.2.3 Development Staging for Future Years

As the proposed development is not expected to be fully occupied and 'completely developed' at year of opening, staging assumptions needed to be made for the interim year of 2019. These are:

- 2 Primary school sites
- Commercial areas fully developed including the Hilltop Village;
- All Residential areas 50% developed; and
- Industrial areas fully developed.

Scenario 2
2019 will see the inclusion of 50% of the additional residential component located north of Forest Parkway and assess the perceived impact of the connection to Kenwood Drive.

5.0 2019 Base Model

Prior to assessing the requirements of the development in future years it is important to determine the base performance due to background traffic only. By applying growth factors to the 2009 counts Figure 5.1 shows the base traffic volumes for 2019 for major intersections along Ocean Drive within the study area.

Figure 5.1: 2019 2 Hour Peak Intersection Turn Volumes

5.1 2019 Base Model Performance

While traffic increases at intersections within the study area in 2019, the existing pattern of predominately through traffic along Ocean Drive is expected to continue.

However, it is expected that by 2019 the increase in traffic travelling on Ocean Drive and vehicles turning onto/off Ocean Dive is expected to exacerbate the existing safety concerns, due primarily to the existing posted speeds.

During the AM peak, the key issue within the network is that the Houston Mitchell Dr / Ocean Drive intersection suffers from conflicting movements; namely the right turn from Houston Mitchell Drive southbound conflicts with the opposing right turn from Ocean Drive. This results in queues along Houston Mitchell Drive to extend to a maximum of nine vehicles. However, maximum queues only occur during the AM peak period between 8:00am and 8:15am. Figure 5.2 demonstrates maximum queues at Houston Mitchell Drive / Ocean Drive intersection during the 2019 AM peak.

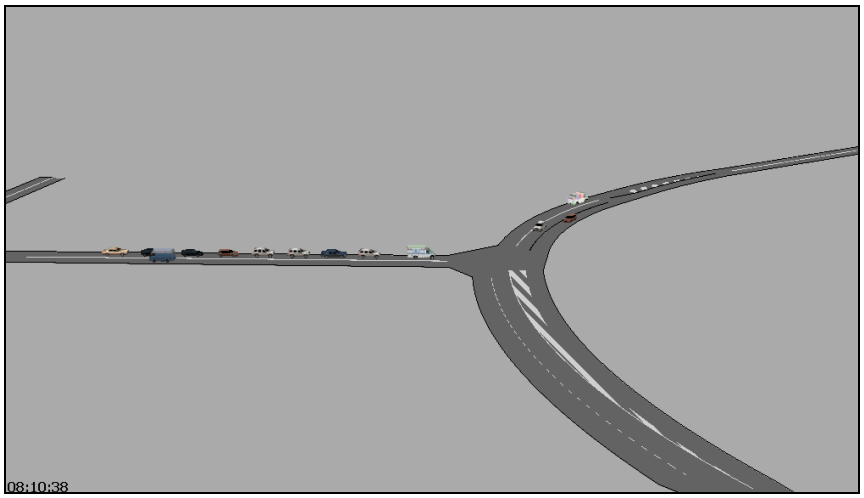


Figure 5.2: 2019 AM Peak Queues – Houston Mitchell Drive / Ocean Drive Intersection

During the PM peak, the southbound flow on Ocean Drive restricts the right turning vehicles from Houston Mitchell Drive. This subsequently restricts the left turns from Houston Mitchell Drive as a result of the single lane approach as shown in Figure 5.3.

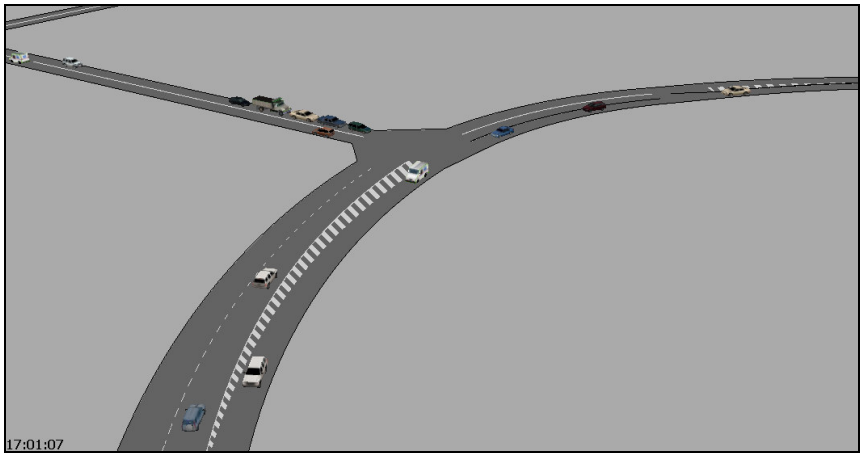


Figure 5.3: 2019 PM Peak Queues – Houston Mitchell Drive / Ocean Drive Intersection

Table 5.1 provides the LOS for 2019 Base Model case.

Intersection	2019 AM	2019 PM
Abel Tasman Dr / Ocean Dr	A	A
Houston Mitchell Dr / Ocean Drive	B	A
Bonny View Dr / Ocean Dr	A	A

Link	2019 AM	2019 PM
Ocean Dr (North of Abel Tasman Dr)	A	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	A	A
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	A	A
Ocean Dr (South of Bonny View Dr)	A	A
Houston Mitchell Dr	A	A

6.0 2019 Partial Development

6.1 Scenario 1 Proposed Development

6.1.1 Preliminary Network

Development in the area by 2019 is expected to generate the need for the addition of two new intersections along Ocean Drive between Houston Mitchell Drive and Abel Tasman Drive.

The new developments and subsequent intersections along Ocean Drive introduce a more local function for this section of Ocean Drive which was originally used for through traffic only. Previously Ocean Drive was a primary north-south connection between south town centres of Bonny Hills and Laurieton to Port Macquarie. With the proposed development, Ocean Drive includes more access points for traffic as well as intersections which now change the function of Ocean Drive from an arterial road to a collector/distributor road. Figure 6.1 demonstrates the initial road network and intersection configuration for 2019 partial development.

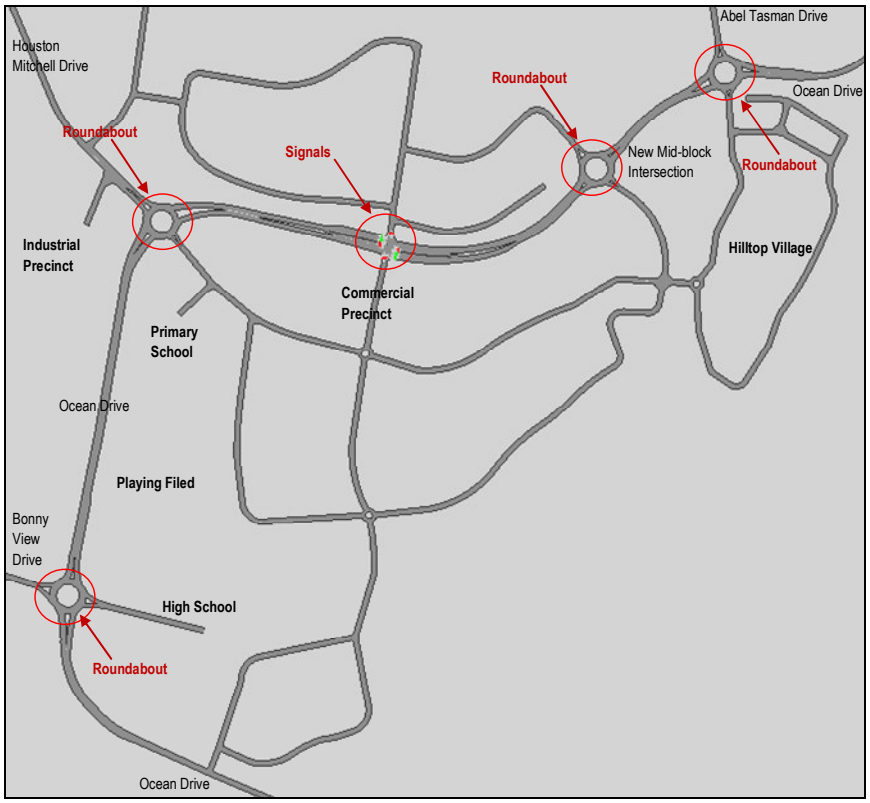


Figure 6.1: Initial Road Network for the 2019 partial development

For the initial study area network, a series of standard intersections were used as a base, with refinements then made at each intersection based on the observed traffic performance two lane roundabouts were required at all Ocean Drive intersections primarily to retain the through traffic level of service (LOS) along Ocean Drive.

In order to maintain travel times and through capacities along Ocean Drive, 80kp/h speeds were retained between Bonny View Drive and Abel Tasman Drive, although speed reductions were required through intersections.

Failure of the intersections in the preliminary network occurred during the AM peak period as a result of the concentrated peak. The following section discusses the specific failure mechanisms and subsequent required improvements for the partial development scenario in 2019.

6.1.2 Ocean Drive

Based on the existing 2019 base road network, Ocean Drive was initially modelled as a single lane in each direction and opening to 2 lane approaches and exits at the intersections. With the addition development traffic, considerable queues developed along Ocean Drive northbound in the AM peak from Houston Mitchell Drive, through the 2 new intersections and north to Abel Tasman Drive. This occurs due to the additional turn movements at each of the intersections along Ocean Drive as a result, reducing the though capacity for the northbound movement. Figure 6.2 demonstrates the queues along Ocean Drive with a single lane northbound, and also demonstrates the need for providing two lanes northbound.

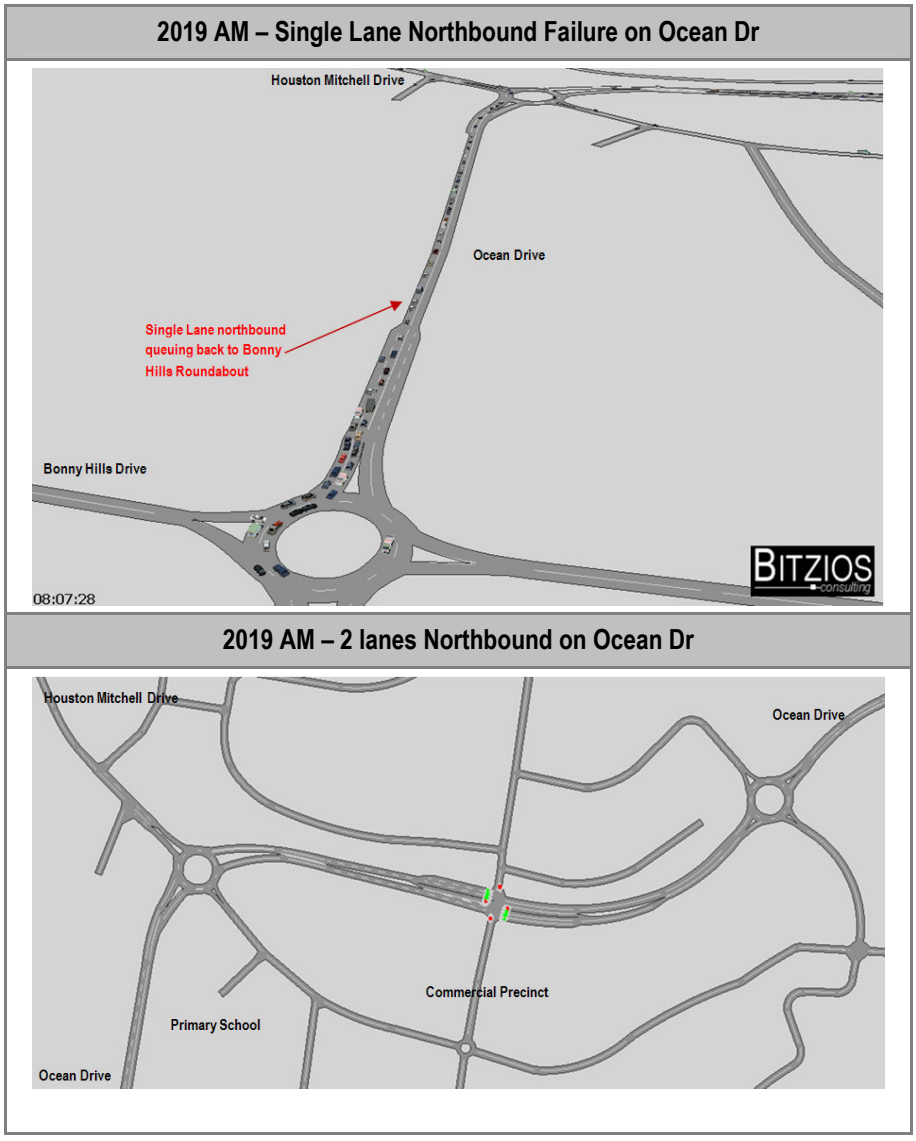


Figure 6.2: Single Lane Failure and Required Improvement

For Ocean Drive southbound, a single lane is still sufficient between intersections for 2019, except between the commercial precinct signalised intersection and Houston Mitchell Drive. This is due to the benefits of platooning of vehicles southbound from the signalised intersection.

6.1.3 Bonny View Drive / Ocean Drive Intersection

The two lane roundabout intersection at Bonny View Drive is observed to be within capacity in 2019 as shown in Figure 6.3. There is an increase in turn volumes as a result of the high school access, however this does not cause excessive delays or queuing for the through movement in either the AM or PM peak period.

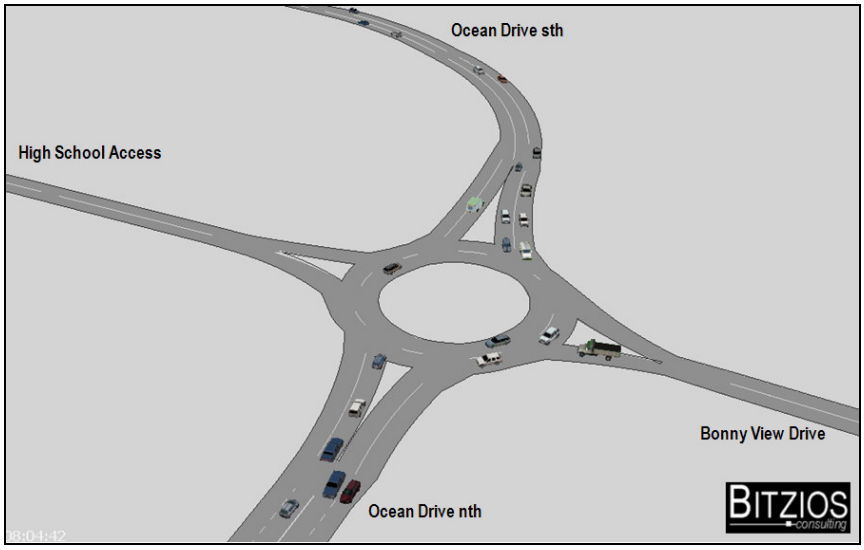


Figure 6.3: 2019 AM Bonny View Drive / Ocean Drive Intersection Performance

6.1.4 Houston Mitchell Drive / Ocean Drive Intersection

The proposed development includes an additional (fourth) approach to Houston Mitchell Drive intersection which results in additional movements to be added to at this intersection. The two lane roundabout was initially proposed for Houston Mitchell Drive / Ocean Drive intersection, however this intersection experiences long queues northbound during the AM peak period as shown in Figure 6.4.

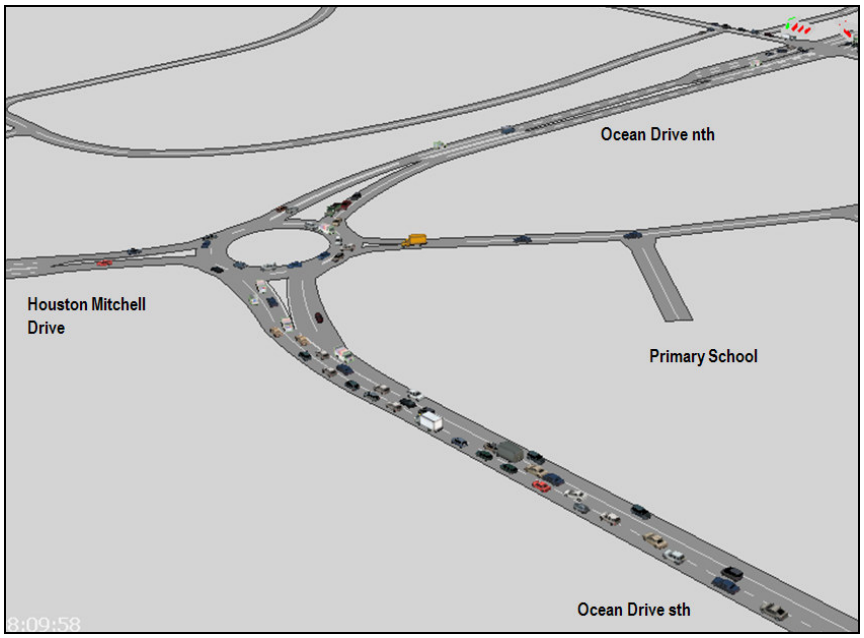


Figure 6.4: Northbound queues at Houston Mitchell Drive Roundabout

During the AM peak, right turning vehicles from Ocean Drive southbound to Houston Mitchell Drive westbound conflict with the northbound through movement along Ocean Drive. The queues northbound along Ocean Drive however only reach considerable lengths and cause long delays during the concentrated peak periods between 7:45 and 8:15. It is not expected that the two lane roundabout will provide sufficient capacity for future traffic volumes to 2029 and beyond.

The new intersection north of Houston Mitchell Drive accessing the commercial precinct is required to be signalised. The interaction between these intersections causes vehicles approaching Houston Mitchell Drive to be 'platooned' into the roundabout intersection. This causes circulating traffic on the roundabout to reduce headways between vehicles and 'bunch', which reduces the allowable acceptance gaps for vehicles entering the roundabout.

Another major concern at Houston Mitchell Drive is the provision for pedestrians, as this intersection is in close proximity to the proposed primary school. With the additional residential developments on both sides of Ocean Drive, it is expected that school children as well as other residents would need a sufficient pedestrian and cycle crossing across Ocean Drive in the vicinity of Houston Mitchell Drive.

The initially proposed roundabout intersection configuration is not expected to provide a sufficiently safe crossing facility for pedestrians. If a marked crossing or 'manned stop' crossing was provided, this would be expected to greatly reduce the through capacity of Ocean Drive.

Based on the initial roundabout configuration performance and need to provide for pedestrians, it is proposed to provide a signalised intersection at the Houston Mitchell Drive / Ocean Drive intersection as shown in Figure 6.5.

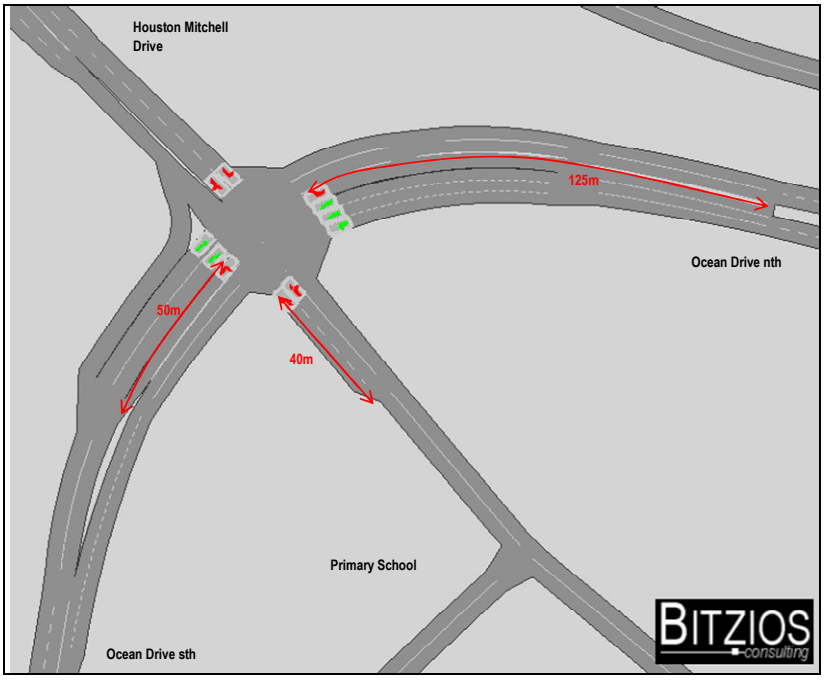


Figure 6.5: Signalised Intersection Configuration Houston Mitchell Drive / Ocean Drive

The signalised intersection requires two lane approaches from Ocean Drive with dedicated turning lanes. The southern approach includes a left turn give-way as this movement is high in the morning peak and runs in conjunction with the northbound through movement.

The southbound right turn is required to be 125 metres long as to provide sufficient storage for turning vehicles.

Houston Mitchell Drive requires two lanes approaching the intersection with the kerbside lane for left turns only and median lane for right and through movements. As the industrial precinct is located off Houston Mitchell Drive and in close proximity to Ocean Drive intersection, it is recommended that a 'keep clear' area be line marked at the give-way intersection to the industrial precinct.

A major benefit to the intersection is the signal coordination potential with the adjacent signalised intersection to the north. As a result, cycle times can be off-set to enable platooning of traffic to arrive at the next intersection with minimal delay. The provision of pedestrian crossings at the intersection will also reduce the allowable green time and subsequent capacity at the intersection. In order to reduce this impact, pedestrian crossings are recommended to be provided across all approaches except the northern approach. In addition, the pedestrian crossing across the southern approach of Ocean Drive is recommended to be staggered due to the number of lanes required to cross. This will also require sufficient pedestrian storage spaces within the median Figure 6.6 demonstrates the propose signal phase times for Houston Mitchell Drive / Ocean Drive intersection.

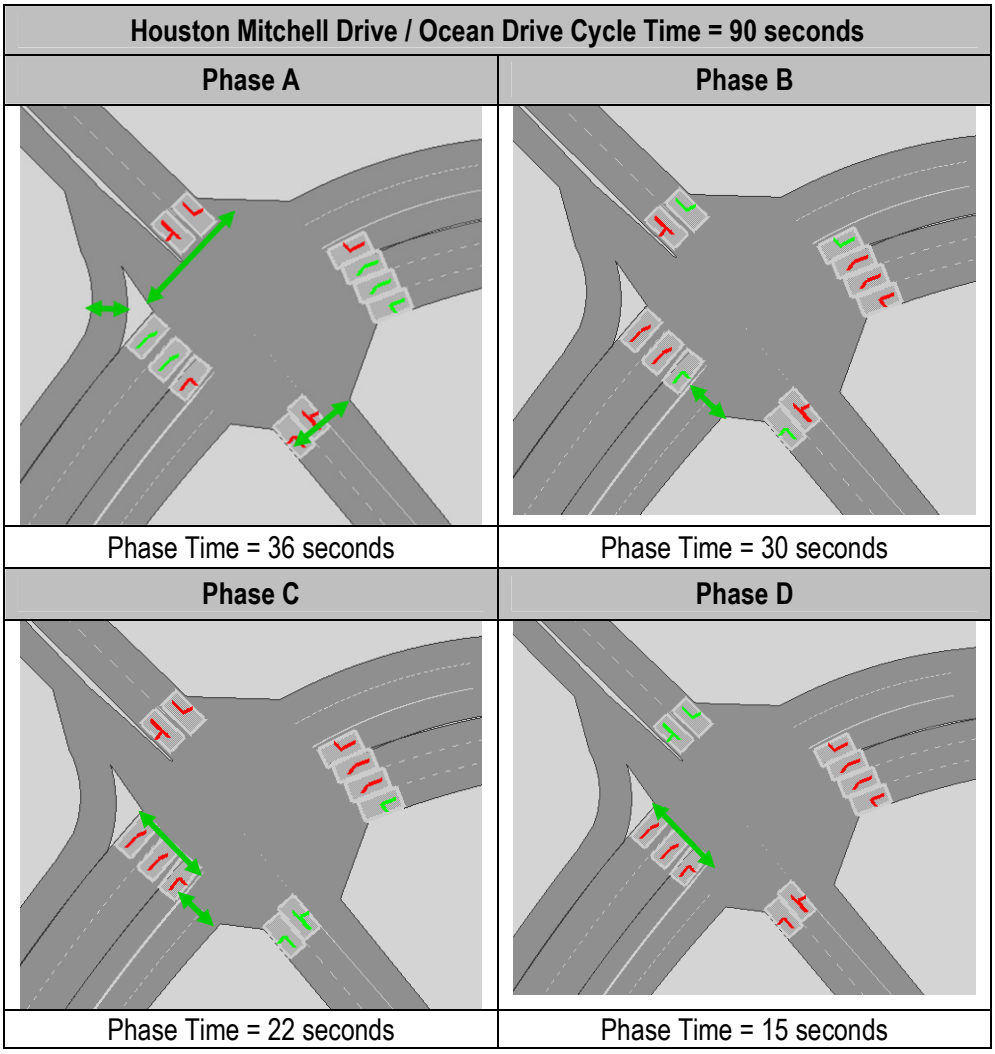


Figure 6.6: Signal Phase Configuration for Houston Mitchell Drive / Ocean Drive

Figure 6.7 demonstrates the performance of the signalised intersection during the AM peak period. Queues for each approach now clear within each and signal coordination between the two signalised intersections facilitates an increase in through capacity. The signalised intersection configuration is also expected to provide an extended life compared to the roundabout option. Any required land for upgrades as part of the 2029 future assessment should be taken into consideration when staging construction of this intersection.

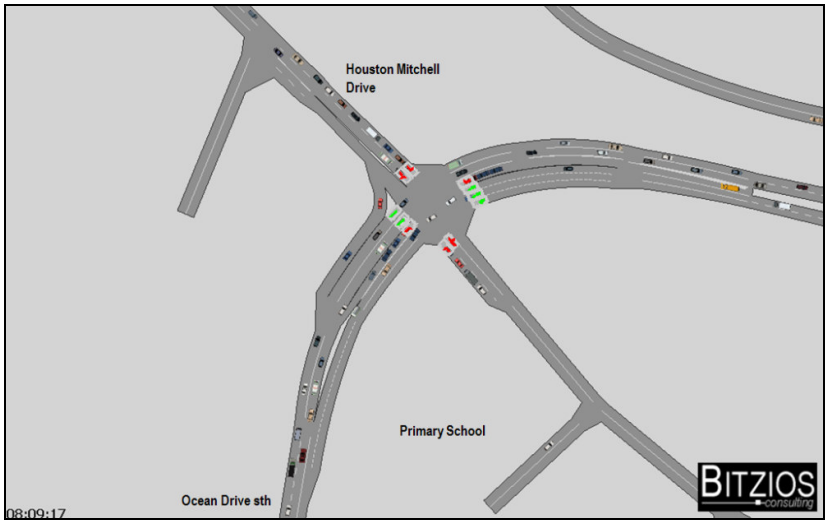


Figure 6.7: Signalised Intersection Performance - Houston Mitchell Drive / Ocean Drive

6.1.5 Commercial Precinct Intersection

The commercial precinct intersection requires a signalised intersection for similar reasons as stipulated for Houston Mitchell Drive / Ocean Drive intersection, namely:

- new turning movements to/from the residential development north of Ocean Drive and commercial precinct to the south;
- pedestrians are expected to be frequently crossing this intersection to access to commercial/retail centre; and
- signal timing will run concurrently between Houston Mitchell Drive intersection and the commercial precinct intersection to retain through movement flow along Ocean Drive.

To provide sufficient through capacity the intersection requires two through lanes with additional turning lanes. In addition it is recommended to construct relatively long turn lanes as to allow turning vehicles to access the lane instead of contributing to the through lane queue lengths. Figure 6.8 demonstrates the required intersection in 2019 including minimum turning lane lengths.

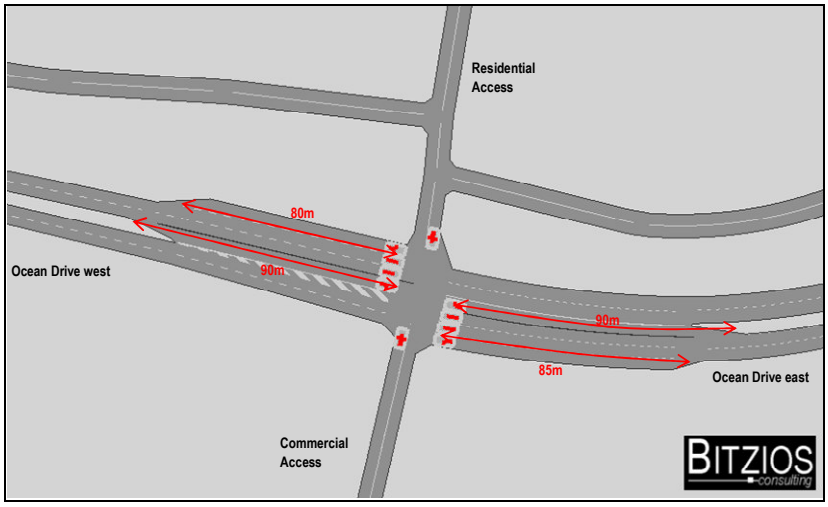


Figure 6.8: Required Commercial Precinct Intersection Configuration for 2019

As the residential component is assumed as only 50% developed by 2019, a single lane approach is all that is required. However, the existing internal road network includes residential side streets in close proximity to the Ocean Drive intersection. As a result queuing at the intersection is expected to impact on access in/out of these side streets. Further refinement is required into the distance between internal roads and intersections.

The commercial precinct has also been provided with only a single land approach and exit lane to the intersection. This forms part of a strategy to reduce the amount of through traffic along the commercial street. The street links have also been give attributes of to high traffic impedance and low vehicle speeds, as to simulate a commercial/retail centre high pedestrian interaction across the street.

This intersection will operate with a Level of Service (LOS) of D with an average delay of 49 seconds out of the commercial precinct.

Figure 6.9 demonstrates the intersection performance in 2019 during the AM peak period.

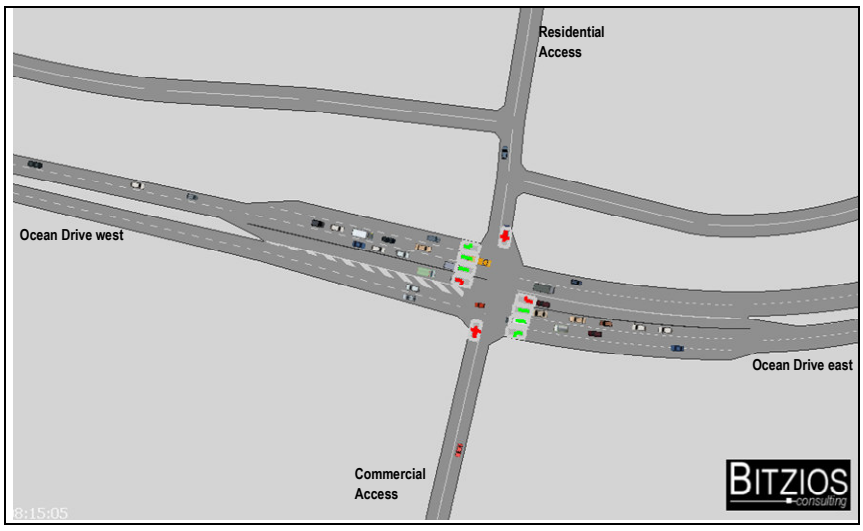


Figure 6.9: Commercial Precinct Intersection Performance - 2019 AM

6.1.6 Abel Tasman Drive and New Residential Mid-block Intersection

Both Abel Tasman Drive and the new mid-block intersection on Ocean Drive have been provided with roundabout intersections for 2019. As these intersections predominately provide access to residential areas turn movement in 2019 perform within capacity, while still maintaining major through movements along Ocean Drive. Figure 6.7 demonstrates the acceptable performance of the roundabout intersections along Ocean Drive.

The southern approach to Abel Tasman / Ocean Drive intersection required refinement due to the proximity of the internal access street as shown in Figure 6.10 (and previously mentioned for the commercial intersection assessment).

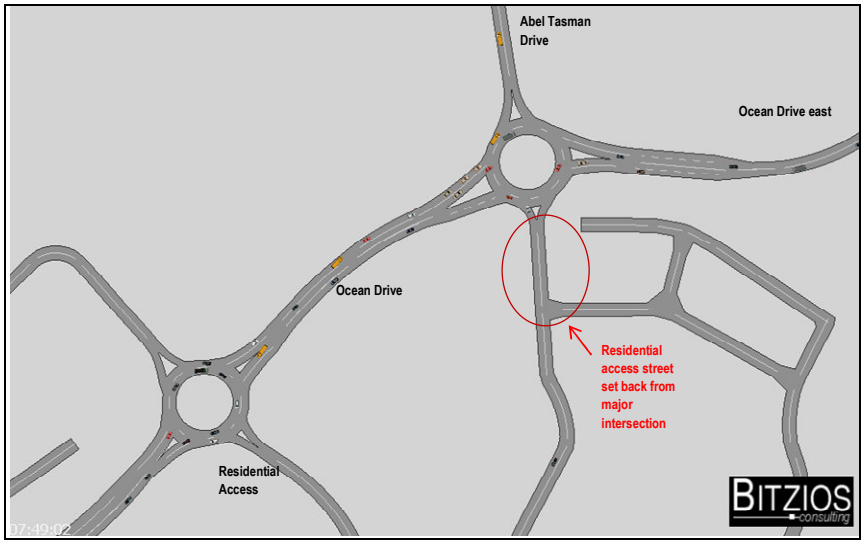


Figure 6.10: Roundabout Intersection Performance - 2019 AM

Whilst the Roundabout at Abel Tasman Drive performs well with development and background traffic at 2019, council have indicated that pedestrian provision across Ocean Drive is currently an area of concern. This can be attributed to residents living off Abel Tasman Drive and associated streets frequently crossing in the vicinity of Abel Tasman Drive to access the beach.

6.1.7 2019 Network Requirements

By 2019 and with partial development of the site, the following road network improvements are required:

- Ocean Drive requires two lanes northbound between Bonny View Drive and Abel Tasman Drive and two lanes southbound between the commercial intersection and Houston Mitchell Drive;

- a roundabout intersections with two lane approaches and circulating lanes is required for Bonny View Drive, Abel Tasman Drive and the new residential access intersection with Ocean Drive;
- Houston Mitchell Drive / Ocean Drive intersection requires a signalised intersection to provide sufficient capacity for vehicles as well as providing pedestrian amenity across Ocean Drive.
- a signalised intersection is required at the commercial precinct access; and
- Houston Mitchell Drive eastbound requires two lanes between Forest Parkway at Ocean Drive, in addition to a 'Clear Zone' within the give-way intersection to the industrial precinct.

Figure 6.11 provides a summary of the required intersection requirements.

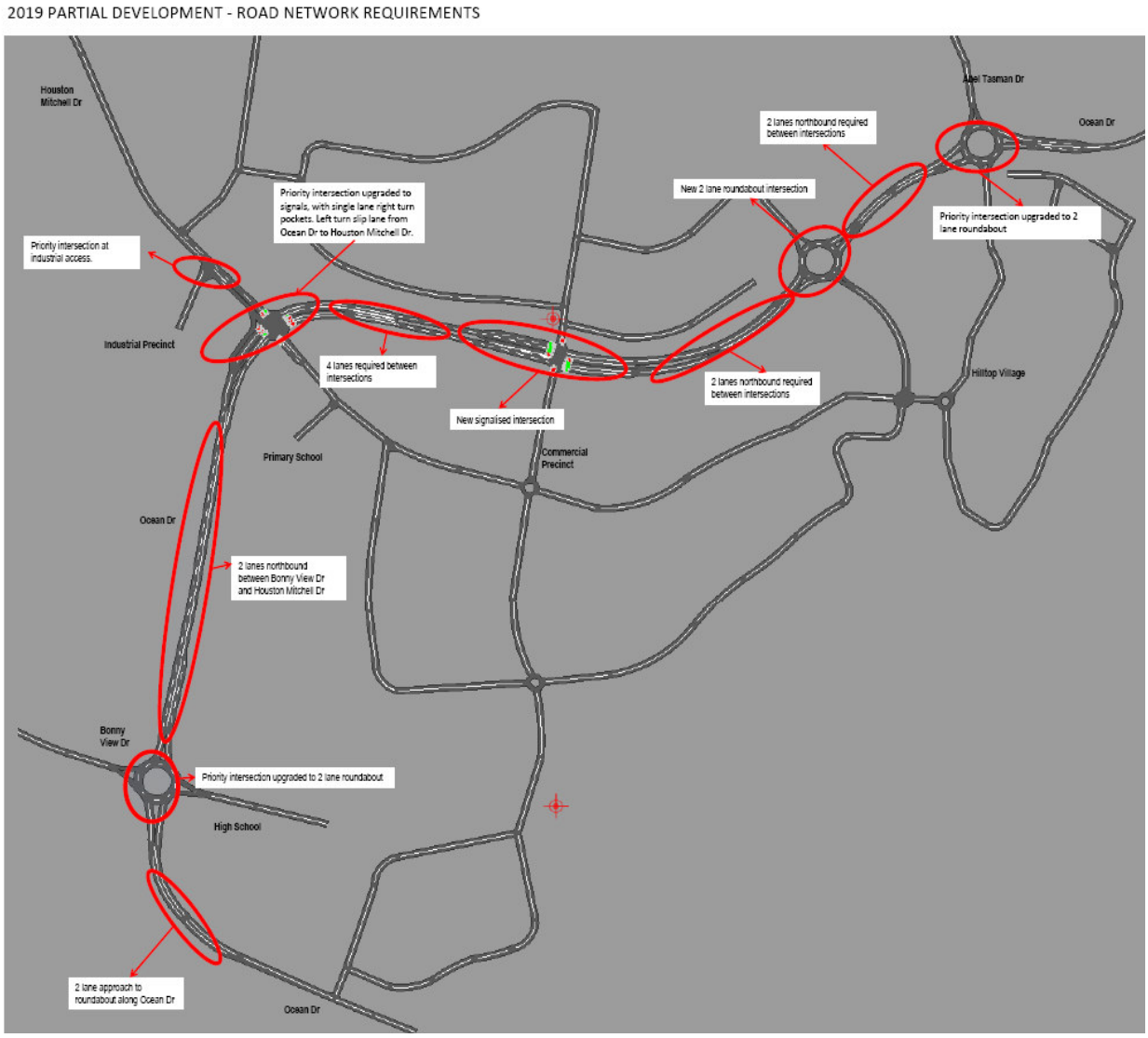


Figure 6.11: Intersection requirements for 2019

Table 6.1 provides the LOS for 2019 Development Model case.

Intersection	2019 AM	2019 PM
Abel Tasman Dr / Ocean Dr	A	A
Houston Mitchell Dr / Ocean Drive	C	C
Bonny View Dr / Ocean Dr	A	A
New Midblock Intersection	A	A
Commercial Precinct	D	C

Link	2019 AM	2019 PM
Ocean Dr (North of Abel Tasman Dr)	A	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	A	A
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	A	A
Ocean Dr (South of Bonny View Dr)	A	A
Houston Mitchell Dr	A	A

6.2 Scenario 2 Performance

6.2.1 Proposed Additional Residential Component

A future investigation area has been identified to the north of the existing 2(a4) zone off Forest Parkway which could cater for up to 221 additional residential lots

Based on the 2019 assumption of the 50% development within residential developments, the inclusion of additional residential developments on the north-west corner of the site in 2019 does not require any additional road network requirements. Traffic from the residential area enters the network from either Forest Parkway or via the additional intersections on Ocean Drive at the commercial precinct.

The directional split of traffic from this development has been based on the internal road network layout north of Ocean Drive. During 2019 the primary route is along Forest Parkway to access Ocean Road via Houston Mitchell Drive. These intersections can adequately cater the additional traffic based the proposed development extension.

6.2.2 Influence of Additional North-South Connection Road

In 2019, the amount of traffic using the north-south connection road around Lake Innes and connection to Kenwood Road would depend greatly on the design of the proposed link road. The link road is expected to carry a percentage of the residential traffic from Forest Parkway in order to access Lake Cathie and Port Macquarie. But exact traffic volumes would depend

on the travel time savings in compared to using Ocean Drive is it becomes more congested in future years.

It is not expected that the proposed road will divert traffic from using Ocean Drive to travel north or south by 2019, as long as proposed intersections along Ocean Drive cater for expected traffic volumes.

Further analysis is required on the impact of this proposed road to the road network and intersections within Lake Cathie to the north.

6.3 Residential Link Road – 2019

The proposed link road between the existing residential development at Bonny Hills and the proposed residential and commercial area has the ability to greatly impact on the through traffic along Ocean Drive as well as the function and success of the residential and commercial areas of the proposed development.

In order to limit through traffic using the link road instead of Ocean Drive, it is recommended to include local area traffic management schemes (LATM) to reduce the attractiveness of this route. If intersection improvements along Ocean Drive are not in place to allow free flowing through movements and the link road is not supplied with adequate LATM measures, then travel times for through movements will be perceived to be quicker along the proposed link road. In addition, the link road is proposed provide a relatively direct connection to the commercial precinct. This may be seen as an easier or even less stressful route when compared to turning right off Ocean Drive at signals further north.

Figure 6.12 demonstrates the queues through the commercial precinct if no LATM measure were undertaken along the north south road with the inclusion of the internal link road.

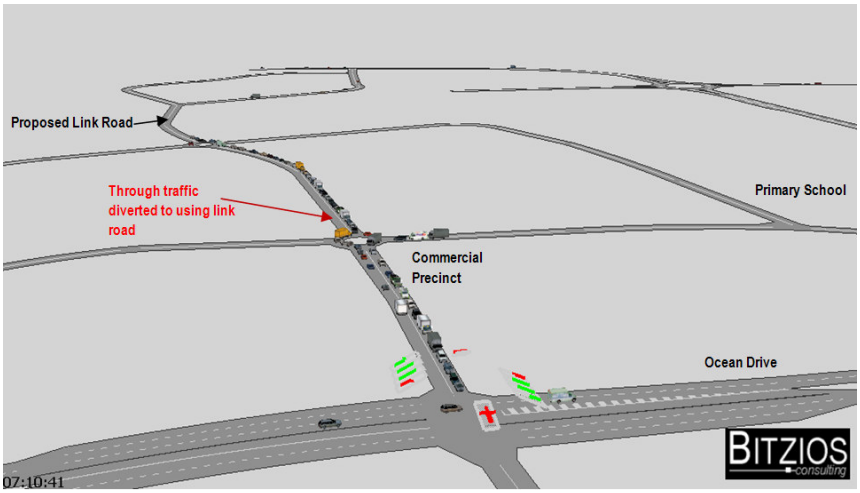


Figure 6.12: Queues due to No LATM along Internal Link Road

7.0 2029 Full Development

By 2029, it is expected that the site will be fully developed and background traffic will continue to grow as a result of continuous growth at nearby local centres such as Bonny Hills and Laurieton. As a result, the recommended network will require refinements to cater for the projected future traffic volumes. This section details the specific issues and requirements for Ocean Drive and each of the intersections within the study area for 2029. In addition, recommendations and areas of concern are also included to provide more information how the proposed site layout and internal road network function as a whole.

Table 7.1 provides the LOS for 2029 Development (No Improvements in the network between 2019 and 2029) Model case.

Intersection	2029 AM	2029 PM
Abel Tasman Dr / Ocean Dr	F	A
Houston Mitchell Dr / Ocean Drive	F	E
Bonny View Dr / Ocean Dr	D	A
New Midblock Intersection	D	A
Commercial Precinct	F	D

Link	2029 AM	2029 PM
Ocean Dr (North of Abel Tasman Dr)	A	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	E	C
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	C	A
Ocean Dr (South of Bonny View Dr)	B	A
Houston Mitchell Dr	A	A

7.1 Ocean Drive

With the inclusion of 'double' the residential traffic compared to 2019, turning movements in and out of the intersections have increased as have through volumes along Ocean Drive. This puts added pressure on Ocean Drive as the main arterial route through the study area. By 2029, Ocean Drive requires two lanes in each direction between Bonny View Drive and Abel Tasman Drive. Figure 7.1 demonstrates the queues along Ocean Drive southbound as the single lane configuration does not provide enough capacity between intersections.

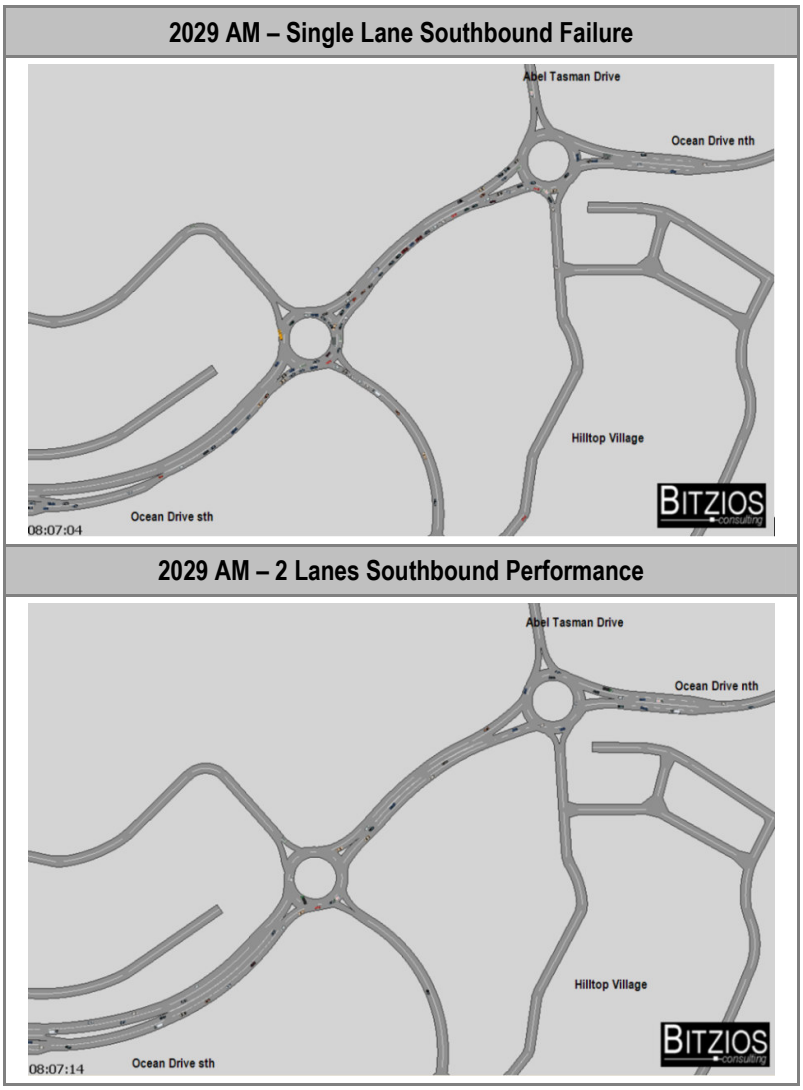


Figure 7.1: 2 Lane Southbound on Ocean Drive

7.2 Houston Mitchell Drive

Houston Mitchell Drive is the primary intersection for development traffic to/from the south via Ocean Drive and the west via Houston Mitchell Drive. With the proposed development increasing in size and expected increase in background traffic, the right turn from Ocean Drive to Houston Mitchell Drive experiences long queues which extend beyond the storage lane length and back into the previous intersection as shown in Figure 7.2.

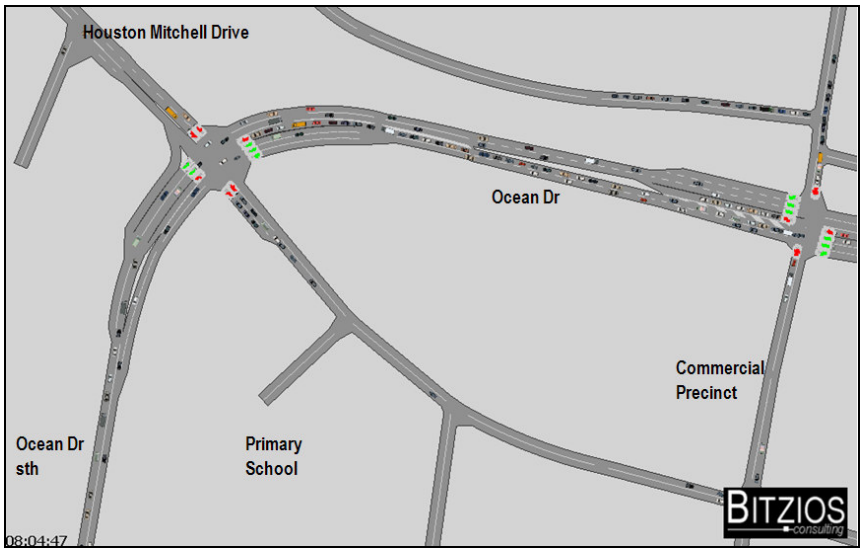


Figure 7.2: Right Turn Lane failure - 2029 AM Peak

Additional right turn lane length is required and can be provided by either extending the right turn pocket or by providing a second turning lane. If the single right turn lane is extended the signal timing will also be refined to provide more green time as to allow the stored vehicles clear. This would however require a large percentage of green time in order to clear the single lane queues.

A double right turn movement would not require additional green time, however would require re-alignment of the road to cater for the additional lane. The double right-turn would also provide additional spare capacity for future years. It is recommended to provide a double right turn as shown in Figure 7.3, as this is a more efficient solution in the long term. In order to provide adequate exit lanes, Houston Mitchell Drive westbound requires extension of the deceleration lane onto the industrial precinct to provide two lanes westbound.

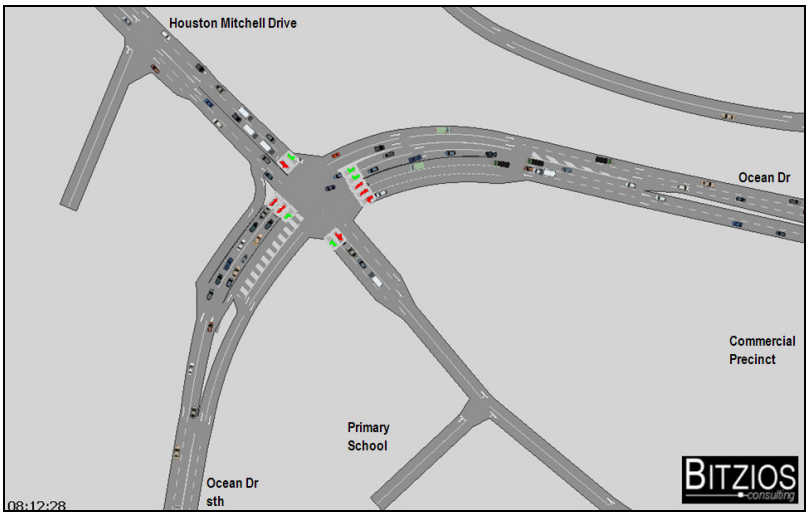


Figure 7.3: Double Right Turn Performance - 2029 AM Peak

The northbound right turn from Ocean Drive to the primary school also exhibits long queues, however these queues do not warrant the need for an additional turning lane. Instead, width required within the central median as a result of the southbound double right turn is recommended to be utilised as pedestrian refuge for the proposed staggered crossing.

It should be noted that the right turns from Ocean Drive at the primary school access and commercial precinct access work concurrently to provide access form Ocean Drive south. The length of the turn lanes is recommended not to be based only on the maximum turning queues as the through traffic queues will extend beyond the turning lane length and limit the ability to access the lane for turning vehicles.

7.3 Commercial Precinct Intersection

Figure 7.4 shows the performance of the commercial precinct intersection in 2029 without any improvements. The side street approaches from the northern residential area and the southern commercial precinct exhibit queues as a result of the single lane approach. As previously mentioned for 2019 assessment, the residential access queues extend beyond the internal intersections.

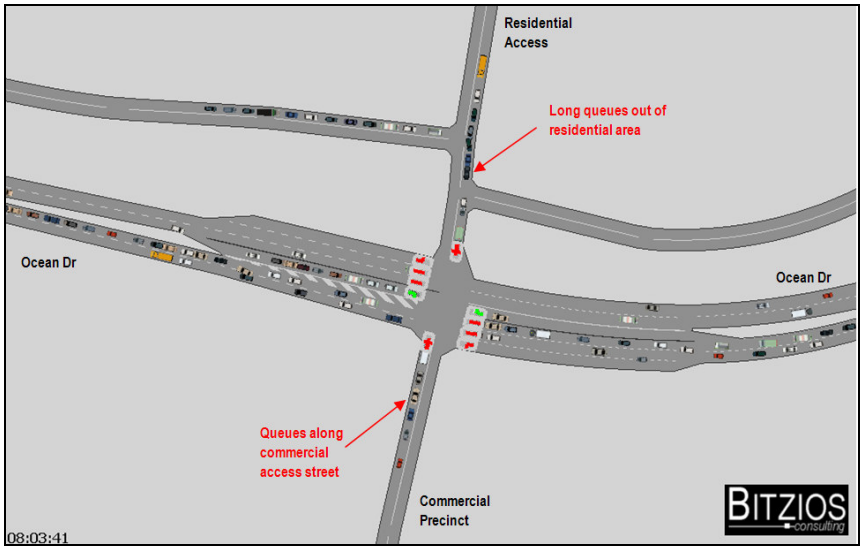


Figure 7.4: Commercial Precinct Intersection - 2029 AM Peak

The southern approach from the commercial precinct requires a two lane approach, comprising of a left turn lane and a shared right/through lane.

It is envisaged that extensive traffic queues along the commercial precinct 'promenade' would be detrimental to the function of the road and commercial centre success.

Currently traffic to/from the commercial precinct access Ocean Road via a single intersection.

Design studies into physical framework planning of the commercial precinct were undertaken by Design Collaborative in 2008. This report detailed the proposed design option of a north-south road through the commercial precinct which connects Ocean Drive to an internal east-west collector/distributor road. The report also details the option of a possible left in/left out road to the east of the commercial precinct to the possible location of an off-street car park.

The northern access from the residential area requires two approach lanes, with the kerbside lane extending 45metres from the stop line. This additional lane is required to both provide storage and also to allow left turning vehicles to access the left turn. As previously mentioned within the 2019 assessment, further investigation is required into the internal road layouts in reducing the influence of queuing traffic at Ocean Drive intersections.

The maximum right turn queues into the commercial precinct from Ocean Drive extend to approximately 10 vehicles per cycle, however these queues do not extent beyond the lane length as vehicles are unable to access the right turn lane due to the queues from through traffic as shown in Figure 7.5.

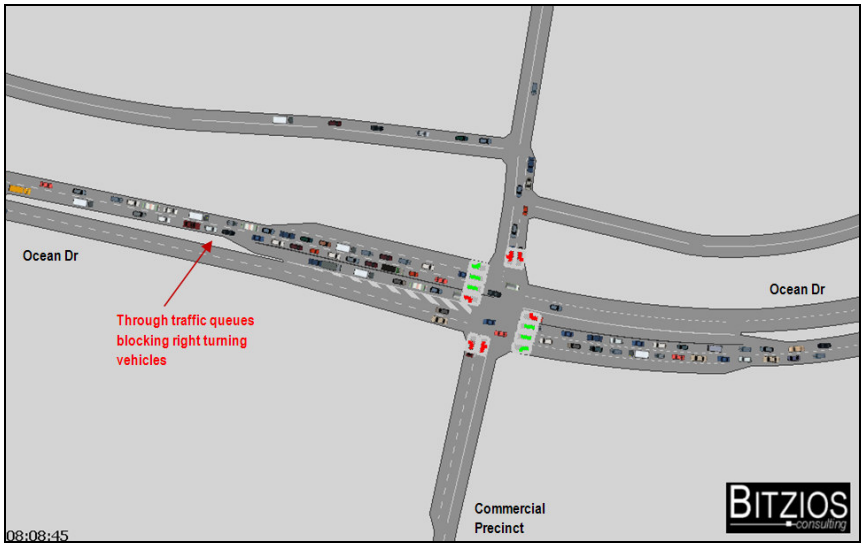


Figure 7.5: Commercial Precinct Intersection – Right Turn Queues Blocked

By extending the length of the right turn lane, through traffic queues would be reduced as right turn vehicles would be able to access the turning lane. Figure 7.6 demonstrated the required improvements to the intersection in addition to demonstrating the performance of the intersection during the AM peak period in 2029.

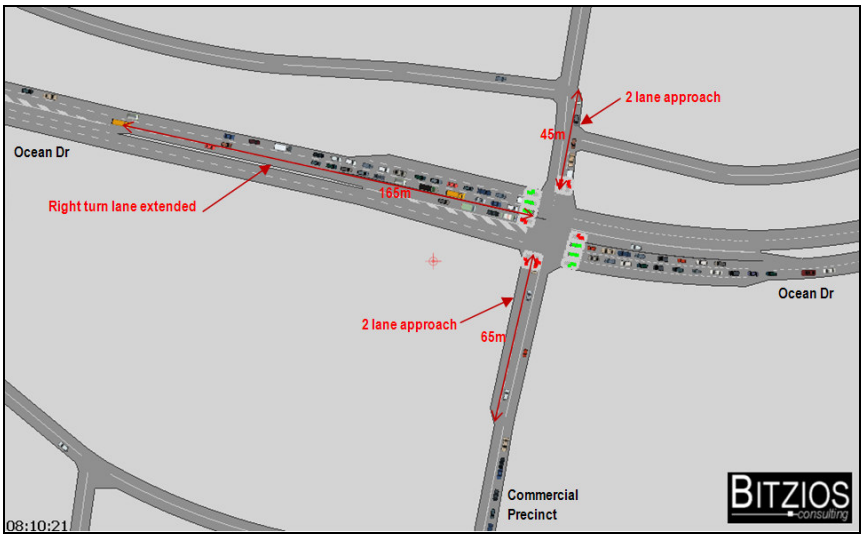


Figure 7.6: Commercial Precinct Intersection Improvements – 2029 AM Peak

7.3.1 Bonny View Drive Intersection

The roundabout intersection at Bonny View Drive continues to perform within capacity at 2029.

7.4 Variation in Peak Demand by 2029

Whilst the recommended intersection configurations perform within capacity at 2029, Ocean Drive continues to show residual queues at the two signalised intersection between 8:00am and 8:15am. This can be attributed to the peak demand profile which has been adopted from the exiting peak hour traffic patterns.

For the previous future year assessment at 2019 it is expected that the through movements along Ocean Drive (AM peak in the northbound direction and PM peak in southbound direction) will continue to be the major movements through the network. Therefore the existing demand profile should be adopted.

However, by 2029 the traffic patterns within the study area are driven more by the surrounding land uses as oppose to the through traffic commuting to Port Macquarie. Therefore the demand profile for the AM peak period is expected to be distributed more evenly across the two hour peak period as shown in Fig 7.7

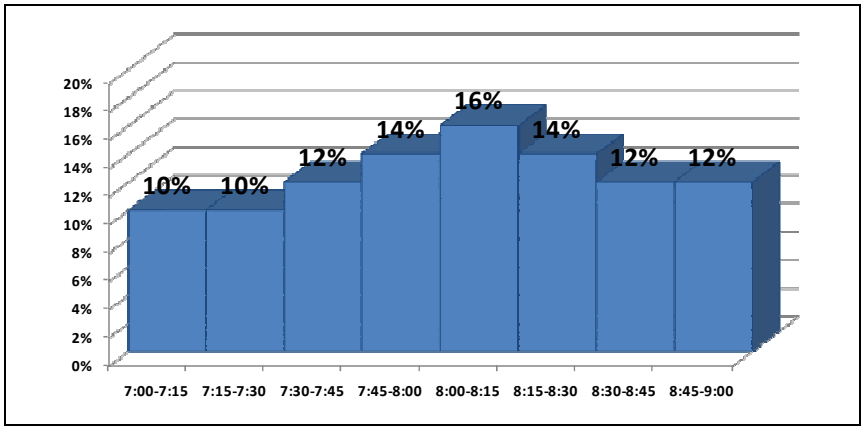


Figure 7.7: Refined AM Peak Demand Profile

Table 7.2 provides the LOS for 2029 Full Development (with Upgrades) Model case.

Intersection	2029 AM	2029 PM
Abel Tasman Dr / Ocean Dr	A	A
Houston Mitchell Dr / Ocean Drive	D	D
Bonny View Dr / Ocean Dr	A	A
New Midblock Intersection	A	A
Commercial Precinct	D	C

Link	2029 AM	2029 PM
Ocean Dr (North of Abel Tasman Dr)	A	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	B	A
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	A	A
Ocean Dr (South of Bonny View Dr)	B	A
Houston Mitchell Dr	A	A

When running the 2029 AM models with the updated demand profile, the concentration of AM peak traffic between 7:45 and 8:15 is reduced and traffic flow is more consistent across the two hour period. This in turn reduces the maximum queues, and subsequent delay for vehicles at the signalised intersections located at Houston Mitchell Drive and the commercial precinct compared to applying the existing peak demand profile.

Figure 7.8 shows the improved performance and reduced queues at Houston Mitchell Drive intersection when applying a refined AM peak demand profile. The queues along Ocean Drive clear with each cycle as traffic volumes are not concentrated at specific times.

Table 7.3 provides the LOS for 2029 Full Development (Updated Profile) Model case.

Intersection	2029 AM
Abel Tasman Dr / Ocean Dr	A
Houston Mitchell Dr / Ocean Drive	D
Bonny View Dr / Ocean Dr	A
New Midblock Intersection	A
Commercial Precinct	C

Link	2029 AM
Ocean Dr (North of Abel Tasman Dr)	A
Ocean Dr (Abel Tasman Dr / Houston Mitchell Dr)	A
Ocean Dr (Houston Mitchell Dr / Bonny View Dr)	A
Ocean Dr (South of Bonny View Dr)	A
Houston Mitchell Dr	A

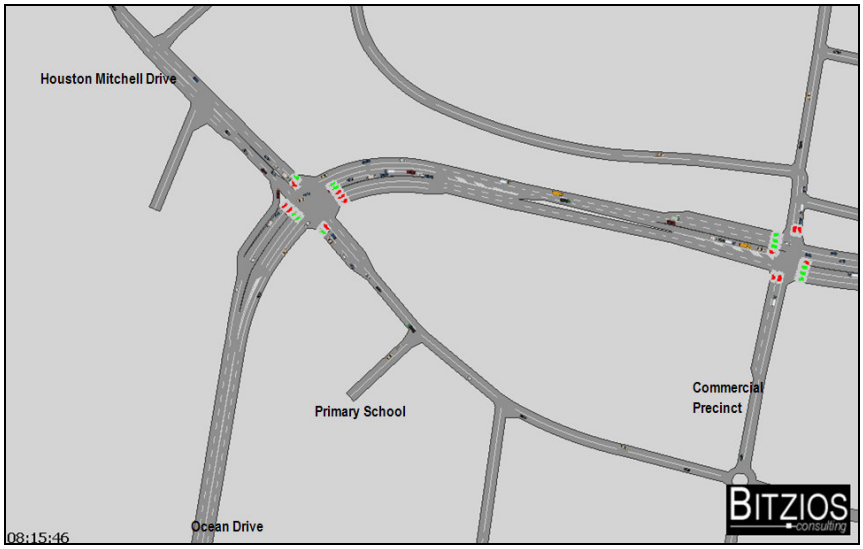


Figure 7.8: Reduced Queues and Congestions with Refined AM Profile

Figure 7.9 provides a summary of the road network and intersection improvements that are required by 2029.

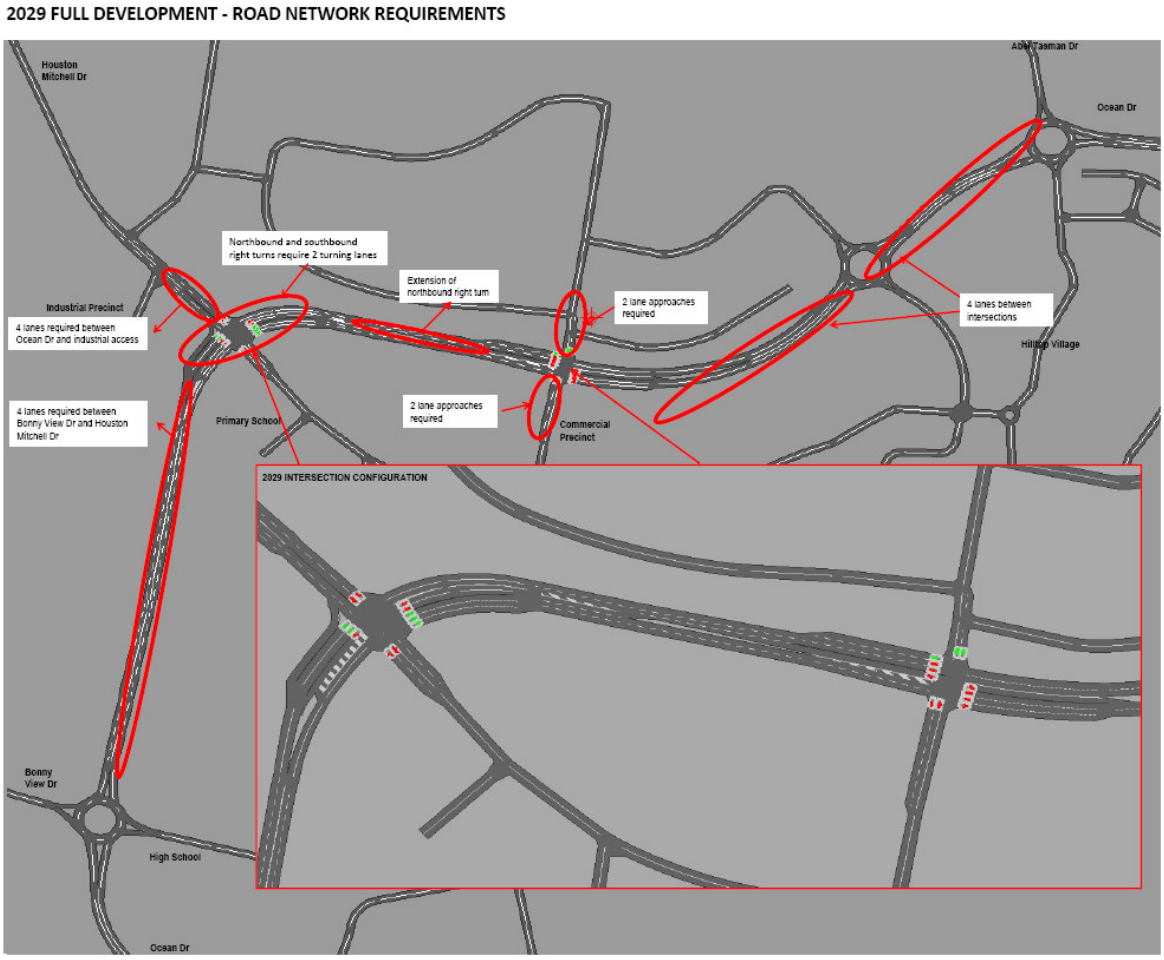


Figure 7.9: Road Network and improvements 2029

7.5 Scenario 2 Performance in 2029

By 2029, residential development traffic as part of Scenario 2 will require the two lanes westbound along Houston Mitchell Drive to be extended past Forest Parkway. Additional turning vehicles at Houston Mitchell Drive and the Commercial Precinct intersection from the north are increased, however no intersection improvements are required. Figure 7.10 shows the performance of the signalised intersections along Ocean Drive with the inclusion of additional residential traffic.

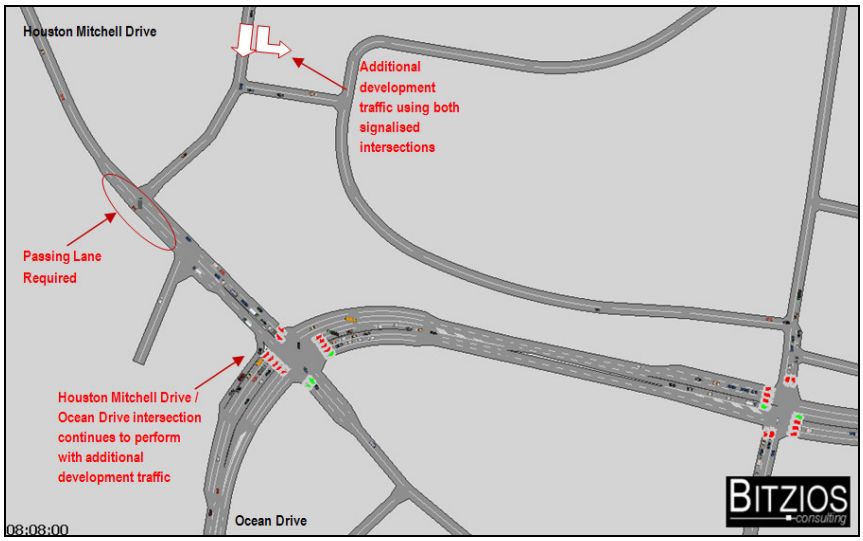


Figure 7.10: Road Network Performance with Addition Development Traffic

The Scenario 2 north-south link road to Kenwood Drive is not expected to attract vehicles from Ocean Drive or Houston Mitchell Drive as long as intersections along Ocean Drive include the recommended configurations. However, it is envisaged that traffic as part of the Scenario 2 residential development will use the connection as to access Lake Cathie and Port Macquarie to the north. In addition, existing traffic from Kenwood Drive and the adjacent areas of North Lake Cathie could also use the proposed north-south link road to access Houston Mitchell Drive towards the Pacific Highway. Therefore, further consideration should be made into using LATM schemes along the proposed link in order to reduce the attractiveness of this route for future through traffic.

8.0 Residential Link to Bonny Hills in 2029

By 2029, LATM schemes along the proposed link road between the commercial precinct and existing residential area at Bonny Hills is essential as to reduce the attractiveness for through traffic shifting from Ocean Drive.

As traffic increases along Ocean Drive and intersection delays become longer, other available routes will become more attractive.

It is important however to allow some usage of the proposed link road as it allow local traffic movements to use the residential access street instead of increasing queues to access and use Ocean Drive.

A concern however is the link road connecting directly into the collector road towards the commercial precinct. This area will be a primary generator of traffic once fully developed. Therefore it is proposed to direct traffic using the proposed link further east of the commercial centre and into the residential road network. This would improve access for residential areas and reduce through traffic along the commercial precinct access.

9.0 Sensitivity Test - Commercial Precinct Access

The initial proposed network distributes traffic to/from the commercial precinct access at Ocean Road via a single intersection. It is envisaged that extensive traffic queues along the commercial precinct 'promenade' would be detrimental to the function of the road and commercial centre success.

Design studies into the physical framework planning of the commercial precinct were undertaken by Design Collaborative in 2008. This report detailed the proposed design option of a north-south road through the commercial precinct which connects Ocean Drive to the residential east-west collector/distributor road. The report also details the option of a possible left in/left out road from Ocean Drive to the east of the commercial precinct and connecting the possible location of an off-street car park.

In order to test the impacts of applying additional access/egress points for commercial traffic, a Paramics model was created which simulates a central car park located to the east of the commercial precinct. The car park was provided with additional access points directly onto Ocean Drive, the commercial precinct promenade and also the residential east-west collector/distributor to the south. Figure 9.1 demonstrates the proposed access configuration.

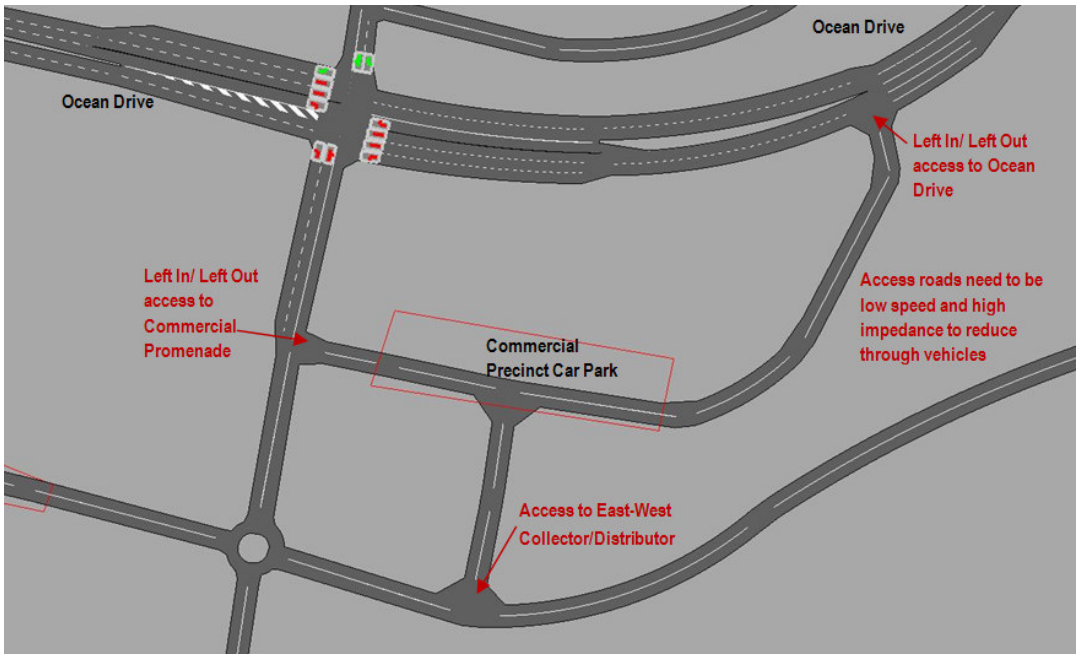
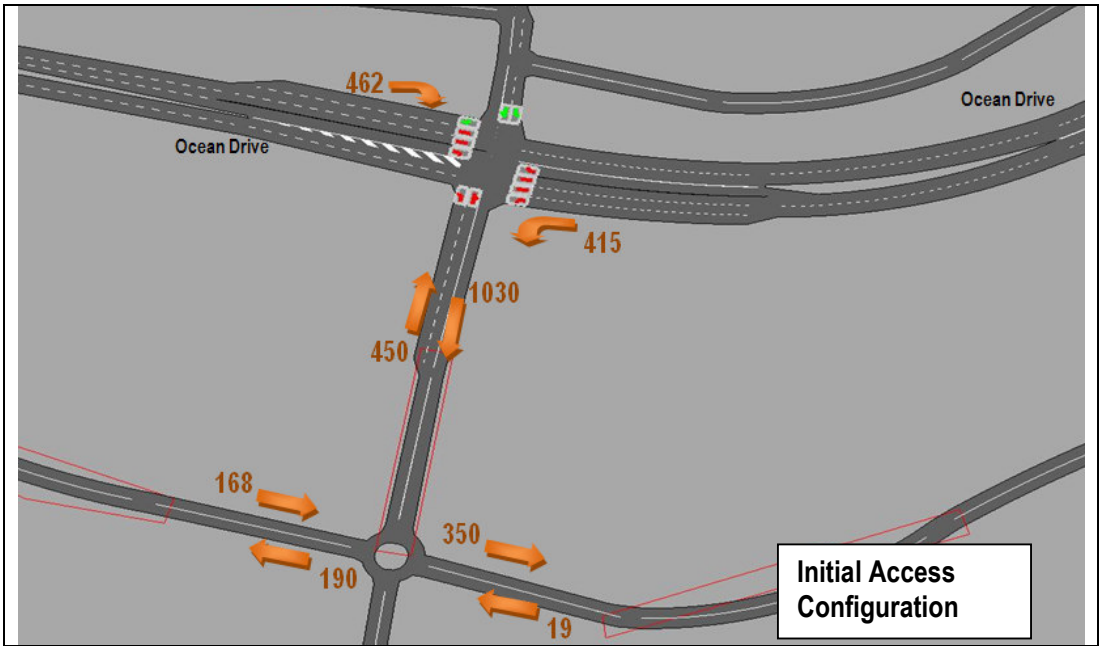


Figure 9.1: 2019 2 Hour Peak Intersection Turn Volumes

A left in/ left out access has been provided from the commercial precinct car park to Ocean Drive southbound and commercial access road southbound only. An additional 'T' intersection has been provided onto the east-west collector/distributor. Figure 9.2 shows the comparison of two hour traffic volumes between a single commercial access and multiple commercial accesses during the AM peak in 2029.



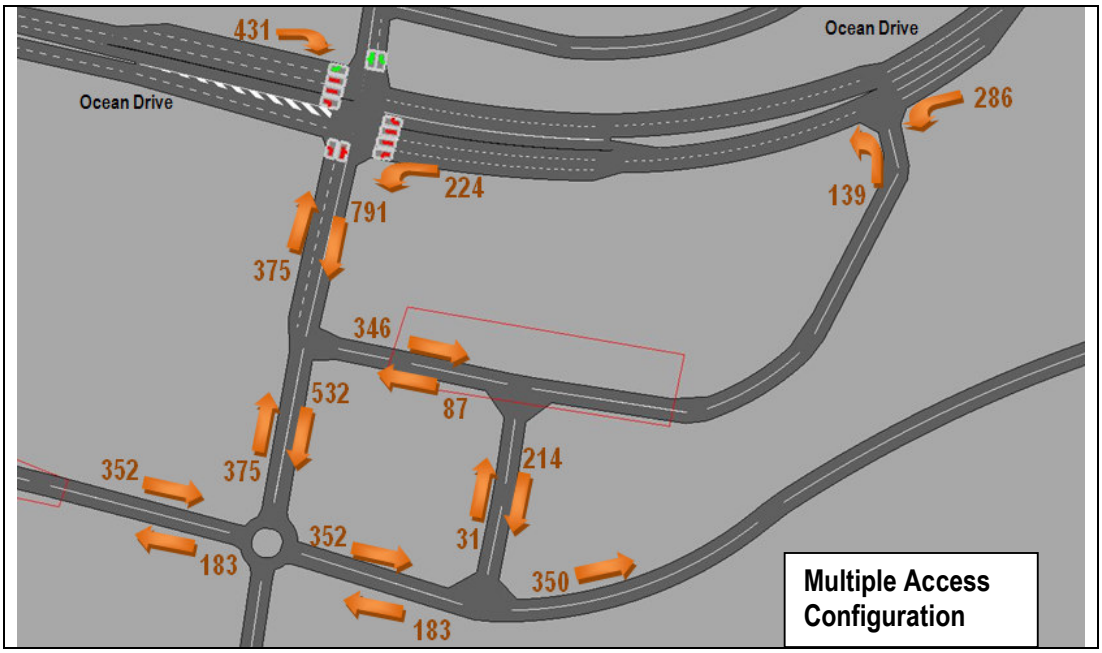


Figure 9.2: Commercial Access Volume Comparison – 2029 AM Peak

The additional points of access/egress for commercial traffic greatly reduce the volumes of vehicles along the commercial precinct access road. This is due to the new links improving the distribution of traffic via Ocean Drive to the north as well as the east-west distributor/collector road to the south. It is important that vehicle impedance is high along these access roads to remove the attractiveness of these linkages as through routes to residential areas.

Figure 9.3 demonstrates the improvements to queues through the commercial precinct as a result of the improved access linkages.

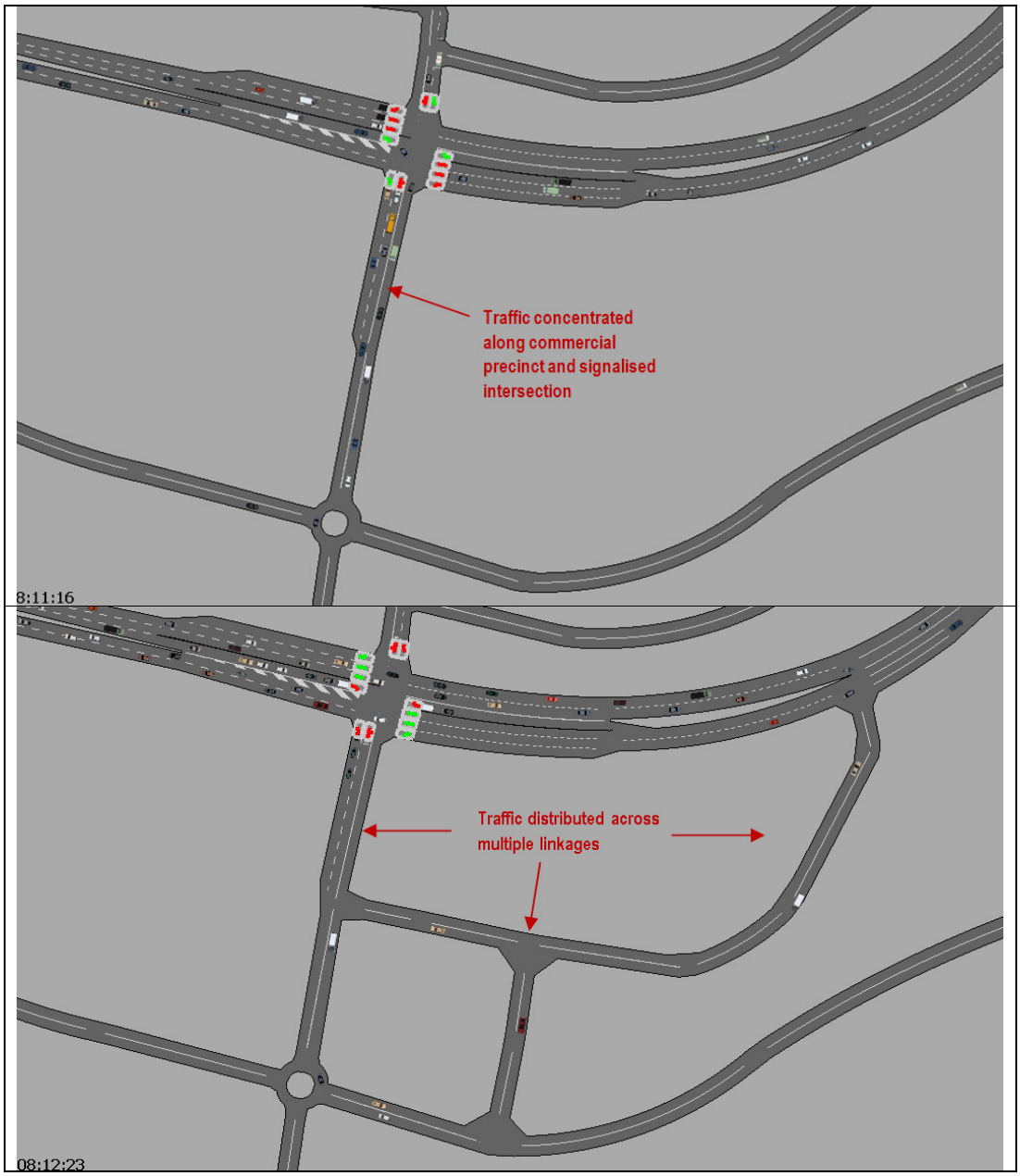


Figure 9.3: Queue improvements due to improved linkages – 2029 AM Peak

10.0 Sensitivity Test – Signals at Abel Tasman Drive

Whilst the roundabout intersection configuration at Abel Tasman Drive is expected to perform well within capacity beyond 2029, Council has identified the need for a pedestrian crossing across Ocean Drive in the vicinity of Abel Tasman Drive. Therefore, a signalised intersection has been modelled to investigate the signalised intersection configuration performance.

Roundabouts generally provide shorter queues than signals as queuing traffic is filtered into the roundabout by gaps generated by conflicting movements. The downside is that the capacity of an approach is reliant on the volumes from the other approaches and priority cannot be given to a specific movement, for example through movements on Ocean Drive.

Signalised intersections however generally produce longer queues but provide designated 'green time' for the movement to clear the intersection. The capacity of the movement through signals is determined by the number of available lanes and multiplied by the percentage of green time compared to the total cycle time. Therefore, capacity for a specific movement can be controlled and refined by the signal operator. Adequate storage area for signals must be taken into account when designing signals and queues should not extend back to influence previous intersections.

Figure 10.1 demonstrates the signalised intersection configuration and performance during the AM Peak in 2029.

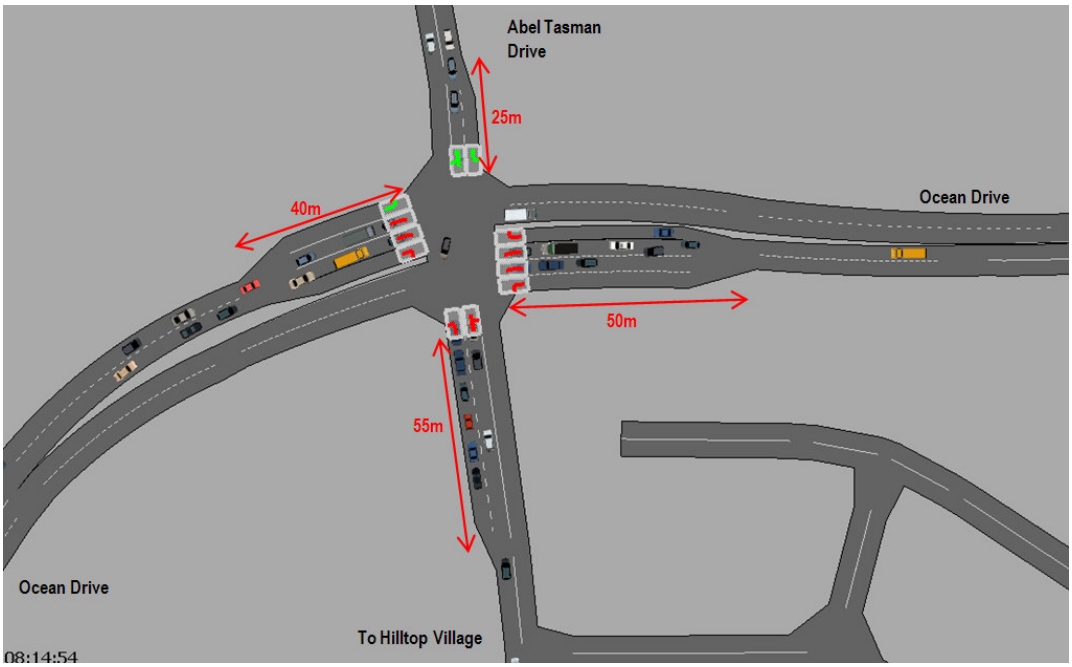


Figure 10.1: Abel Tasman Drive Signalised Intersection Configuration- 2029 AM Peak

The southern approach requires an additional approach lane when compared to the original proposed roundabout configuration.

A major benefit to the intersection is the signal coordination potential with the adjacent signalised intersection to the north. As a result, cycle times can be off-set to enable platooning of traffic to arrive at the next intersection with minimal delay. Figure 10.2 demonstrates the proposed signal phase timing for the intersection.

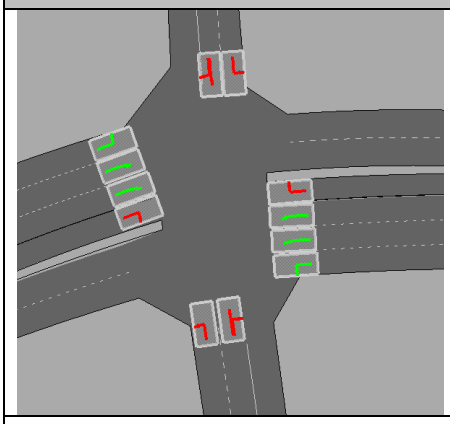
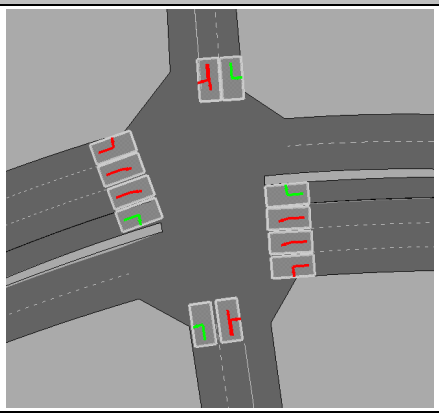
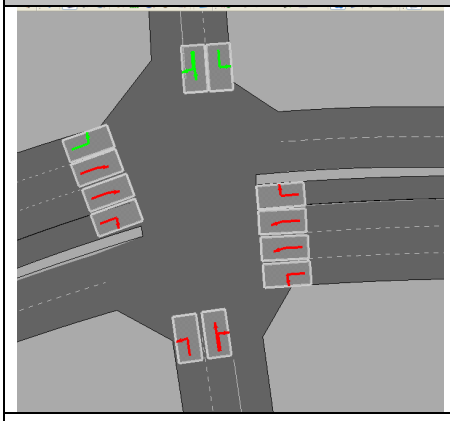
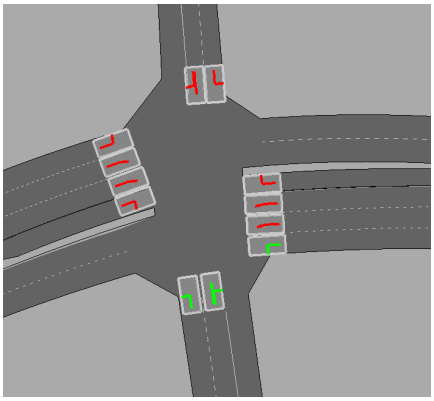
Abel Tasman Drive / Ocean Drive Cycle Time = 100 seconds	
Phase A	Phase B
	
Phase Time = 40 seconds	Phase Time = 12 seconds
Phase C	Phase D
	
Phase Time = 13 seconds	Phase Time = 15 seconds

Figure 10.2: Signal Phase Configuration for Houston Mitchell Drive/Ocean Drive

Similar to Houston Mitchell Drive, pedestrian amenity is required to be provided in the future at Abel Tasman Drive. Pedestrian crossings at side streets will run during phase A, which provide a total crossing time of 43 seconds, including amber times. However, it is recommended to provide a refuge island within the median on both Abel Tasman Drive and the access road to the Hilltop Village for stranded or delayed pedestrians.

Pedestrian crossing across Ocean Drive will run during phases C and D which provide a total of 34 seconds, including amber times. Ocean Drive pedestrian crossings are also recommended to provide a pedestrian refuge within the central medium including a pedestrian button and appropriate guard railing.

11.0 Intersection Footprint Requirements

The intersection configurations and footprints will need to be assessed against the current road reserves along Ocean Drive and adjacent land ownership boundaries. Paramics intersection configurations have been superimposed over the land ownership boundaries to highlight the required land and any associated land acquisition, which will need to be further assessed. It should be noted that widths from Paramics are not to scale and this assessment is only an indication of strategic fit of the proposed intersections. Further analysis involving surveying is required to determine more accurate boundary requirements.

11.1 Houston Mitchell Drive / Ocean Drive Intersection

The required intersection configuration for Houston Mitchell Drive / Ocean Drive intersection (see Figure 11.1) demonstrates that left turn lane from Ocean Drive to Houston Mitchell Drive would encroach outside the current road reserve of Ocean Drive to the west.

It should be noted that there is an additional parcel of land linking Ocean Drive and Houston Mitchell Drive which could be utilised for the left turn. If this land was used for the left turn lane it would reduce pedestrian crossing distances across Ocean Drive. However, this would also reduce the amount of available land for development on the western side of Ocean Drive.

Relocating the left turn would also require the need to provide the access to the industrial precinct further west, as a four-way intersection with Forest Road.

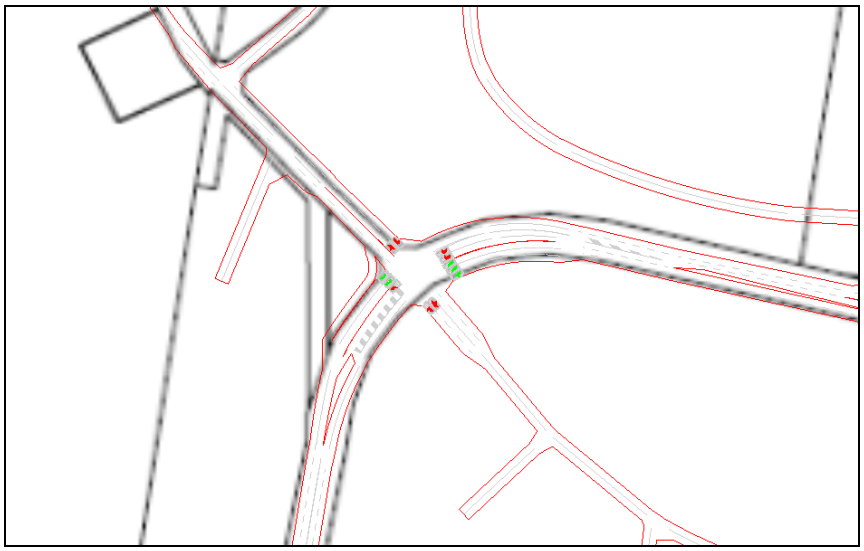


Figure 11.1: Houston Mitchell Drive / Ocean Drive Intersection

11.2 Abel Tasman Drive / Ocean Drive Intersection

Due to existing dwellings on the northern side of the intersection, the proposed roundabout configuration requires the alignment of Ocean Drive to be moved further south in order to allow two circulating lanes on the roundabout as shown in Figure 11.2. The proposed roundabout encroaches approximately 27 metres onto the southern side of Ocean Drive.

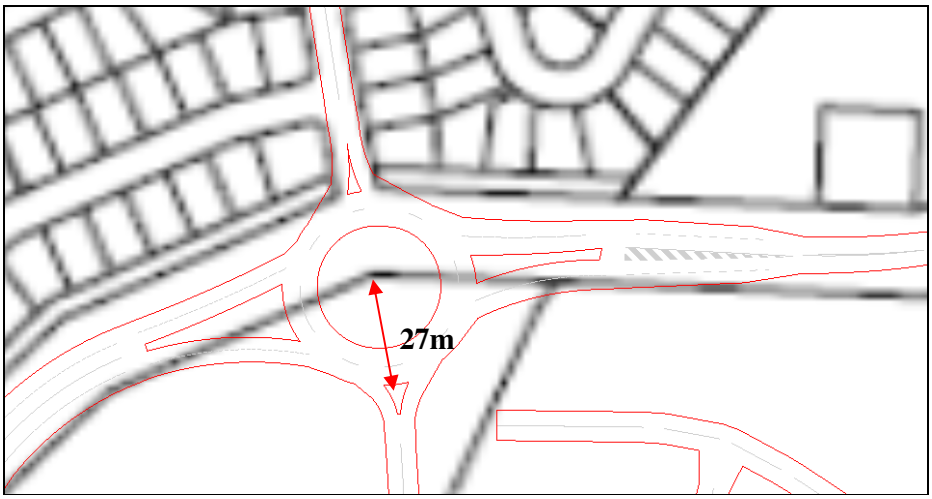


Figure 11.2: Abel Tasman Drive / Ocean Drive Roundabout Intersection

Council has indicated a need to provide pedestrian amenity across Ocean Drive in the vicinity of Abel Tasman Drive. As a result, Abel Tasman Drive / Ocean Drive intersection has been tested with the inclusion of a signalised intersection as shown in Figure 11.3. The benefit of signals at this location is the reduction in land requirements when compared to the initial proposed roundabout intersection.

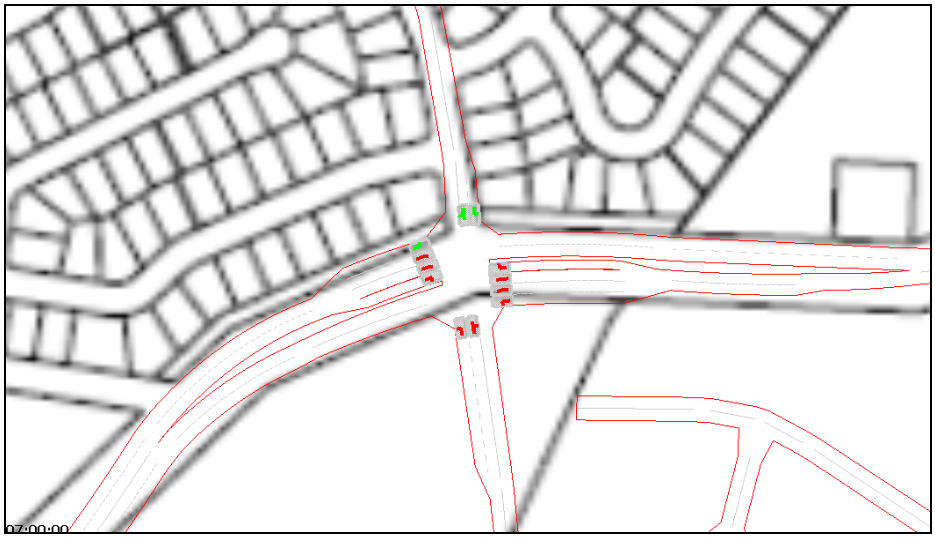


Figure 11.3: Abel Tasman Drive / Ocean Drive Signalised Intersection

The implementation of signals requires more storage capacity for approaches when compared to approaches to roundabouts. As a result, Abel Tasman Drive approach requires two approach lanes for the signalised intersection configuration up to Explorers Way.

The existing configuration comprises of only a single lane in each direction with a central median. The width of the road reserve is 11 metres north of the median, therefore three lanes (two approach lanes and one exit lane) should be able to be provided along Abel Tasman Drive between Ocean Drive and Explorers Way.

11.3 Bonny View Drive / Ocean Drive Intersection

Similar to the roundabout intersection for Abel Tasman Drive, the alignment of Ocean Drive approaching the proposed roundabout at Bonny View Drive is required to shift east in order to reduce the impact on the existing Bonny View Drive approach from the west. Pursuant to this alignment, sections of land on the eastern side of Ocean Drive will still be required with the roundabout intersection configuration (see Figure 11.4). The roundabout intersection requires lane to the east of Ocean Drive to a width of approximately 20metres east.

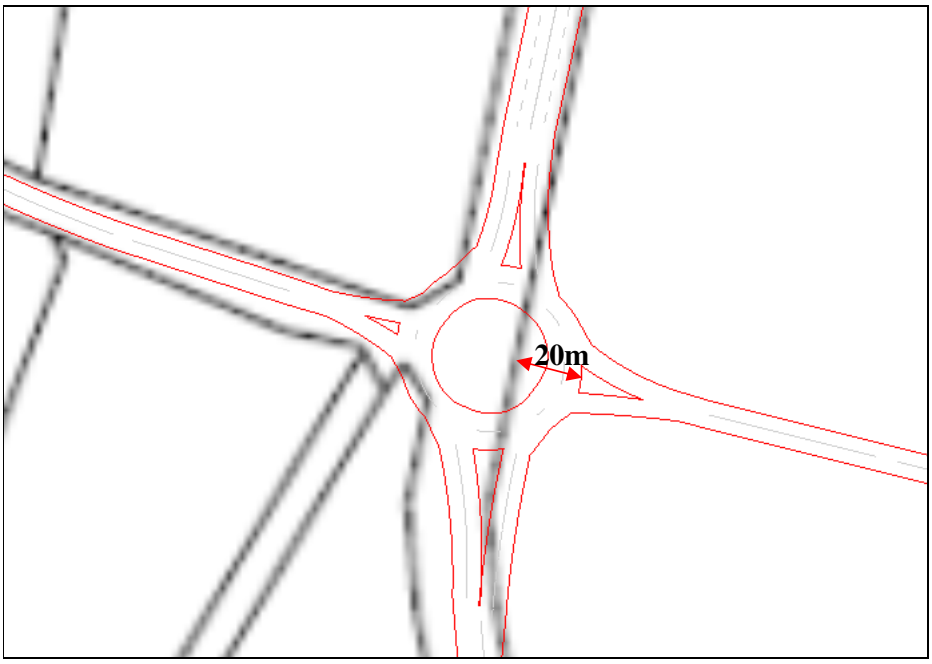


Figure 11.4: Bonny View Drive / Ocean Drive Intersection

12.0 Key Conclusions and Recommendations

Ocean Drive and associated roads within the study area are currently operating well within capacity. However, safety concerns due to speeds through intersections, turning vehicles and poor bus stop and pedestrian facilities will limit the ability if intersections to cater for expected traffic growth in future years.

The proposed development requires additional intersections as well as new approaches into existing intersections along Ocean Drive in order to provide sufficient access to the development sites. By 2019 under a partial development scenario, the following road network improvements are required:

- Ocean Drive requires two lanes northbound between Bonny View Drive and Abel Tasman Drive;
- Houston Mitchell Drive / Ocean Drive requires upgrading to a signalised intersection, which provides two through lanes along Ocean Drive. Pedestrian crossings are recommended across the Houston Mitchell Drive, Primary School Access and the southern approach of Ocean Drive;
- Houston Mitchell Drive requires two lanes eastbound between Forest Parkway and Ocean Drive with a 'clear way' to be line marked at the give way intersection at the Industrial Precinct access;
- a signalised intersection is required on Ocean Drive at the proposed Commercial Precinct which provide two through lanes along Ocean Drive;
- Bonny View Drive / Ocean Drive is required to be upgrade to a roundabout intersection with two lane approaches and circulating lanes;
- Abel Tasman Drive / Ocean Drive intersection is required to be upgraded to a signalised intersection with two lane approaches as it will provide the following benefits:
  - i) requires a smaller intersection footprint compared to a roundabout;
  - ii) provides pedestrian crossing amenity across Ocean Drive;
  - iii) allows signal timing to be optimise depending on the demand flows for both through traffic on Ocean Drive as well as turning movements from the proposed development and Abel Tasman Drive; and
  - iv) provides greater capacity for future traffic growth than a roundabout intersection.
- a new roundabout intersection is required along Ocean Drive between Abel Tasman Drive and the Commercial Precinct. This roundabout requires two lane approaches and circulating lanes; and
- four lanes (two lanes in each direction) are required along Ocean Drive between the Houston Mitchell Drive and the Commercial Precinct.

The inclusion of additional residential development (Scenario 2) and a new north-south link road from Forest Parkway to Kenwood Drive is not expected to require any additional road network improvements. The proposed link road is not expected to change traffic patterns along Ocean Drive as long as recommended improvements are made along Ocean Drive and at associated intersections.

The proposal to include a link road between the existing residential development at Bonny Hills and the proposed residential/commercial area would greatly depend on the design of the proposed link road. In order to limit through traffic using the link road instead of Ocean Drive, it is recommended to include Local Area Traffic Management Schemes (LATM) to reduce the attractiveness of this route. The function and amount of traffic using this proposed road also greatly depends on the intersection configuration and performance along Ocean Drive.

By 2029, the following road network improvements are required:

- Ocean Drive requires four lanes (two lanes in each direction) between Bonny View Drive and Abel Tasman Drive;
- Houston Mitchell Drive / Ocean Drive intersection requires two right turn lanes from Ocean Drive north to Houston Mitchell Drive;
- Houston Mitchell Drive requires four lanes (two lanes in each direction) between Forest Parkway and Ocean Drive;
- The signalised intersection fronting the commercial precinct requires two lane approaches from both the commercial precinct in the south and residential area in the north. The right turn lane from Ocean Drive to the Commercial Precinct requires extension to 165 metres.

By 2029, the traffic patterns within the study area are driven more by the surrounding land uses as opposed to the through traffic commuting to Port Macquarie. Therefore, the demand profile for the AM peak period is expected to be distributed more evenly across the two hour peak period.

By 2029, additional development north of Forest Parkway (Scenario 2) requires the two lanes westbound along Houston Mitchell Drive to be extended past Forest Parkway. Additional turning vehicles at Houston Mitchell Drive and the Commercial Precinct intersection from the north also increase, however no intersection improvements are required.

The Scenario 2 north-south link road to Kenwood Drive is not expected to attract vehicles from Ocean Drive or Houston Mitchell Drive as long as intersections along Ocean Drive include the recommended configurations to provide sufficient through movements. Further assessment is required into the detailed impact of this road to the north along Kenwood Drive and Lake Cathie.

By 2029, LATM schemes along the proposed link road between the commercial precinct and existing residential area at Bonny Hills are essential as to reduce the attractiveness for through traffic shifting from Ocean Drive.

It is recommended to connect the proposed link road further east of the commercial centre and into the residential road network. This would improve access for residential areas and reduce through traffic along the commercial precinct access.

Houston Mitchell Drive is mostly a narrow, hilly and winding road that connects Ocean Drive with the Pacific Highway. Houston Mitchell Drive through to the Pacific Highway will need upgrading to accommodate the additional traffic generated by the proposed development. In addition, consideration of how that traffic would safely enter and exit the Pacific Highway will need to be resolved with the RTA.

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Appendix A
Modelling Review

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Appendix A - Modelling Review

A1.1 Background

The modelling review conducted by Brian Kerwick (Senior Transport Planner) is provided as a result of a telephone enquiry by Port Macquarie Hastings Council's Cliff Toms as to the extent of road works recommended in the draft traffic study. During our discussions I undertook to review the study. Subsequently I received a copy of submissions from two companies (King and Campbell and Tierney Property Services) representing affected landowners. I have also considered the issues raised in those submissions.

I have read the draft traffic report and discussed it with the principal traffic engineer Damien Bitzios and with Roadnet personnel involved in management of the study. I have reviewed the inputs to the model and discussed details of the modelling with the modeller Andrew Eke, including traffic generation factors within the model to ensure that there is no over estimation of traffic. I have also examined the trip tables that distribute traffic on the proposed networks.

Having reviewed the traffic study I am satisfied that the modelling is sound and satisfactorily reflects likely future traffic conditions for the road networks considered.

In regard to your specific comments about the amount of road infrastructure recommended, I would like to further explain the modelling process that we undertook to arrive at a network that can operate effectively in peak hour. As explained in our presentations the Paramics model is progressively developed (additional traffic lanes added) to accommodate increasing traffic demand resulting from proposed development in the study area. In doing this we are always mindful of the costs of providing infrastructure and only add sufficient capacity for the network to operate reasonably in peak hour.

I understand Council's wish to minimise the amount of road works and to desirably retain Ocean Drive as a two lane road if possible. You queried the Level of Service (LOS) adopted for our planning horizons, years 2019 and 2029. At intersections LOS criteria is based on delays and along traffic routes there is a range of criteria relating to the degree of freedom a vehicle has to travel at a desired speed. Generally, the objective is to have no worse than LOS 'C' in year 2029 peak hour for both measures. Desirably, this leaves some spare capacity for growth beyond 2029. In any event, we cannot add half a lane so the increase in capacity when going from two lanes to four lanes is substantial. The final report will contain diagrams and tables showing LOS criteria for intersections and section of road. However, we have found that the best way of representing the performance of a proposed road network is to show the extent of queuing in the Paramics model during the model simulation. In this instance we have prevented the peak hour queue from extending back through other important intersections. This visual appreciation of queuing is the main benefit of the Paramics model. Diagrams extracted from the model included in the report are a snapshot of generally the worst traffic conditions over the AM peak period (which is the highest) and make the degree of congestion clear to any observer.

Both the 2019 and 2029 intersection configurations are primarily based on the existing demand profile. However, for 2029 a 'smoothed' demand profile on Ocean Drive has been included to take account of future surrounding land uses and standard 'bell curves' of peaks. This serves to moderate the maximum queues along Ocean Drive.

As an indication of the Level of Service (LOS) provided by the proposed network configurations in 2019 and 2029, Table 1 below provides the average delay (seconds) and LOS at Houston Mitchell Drive intersection.

Table A1: LOS for Ocean Drive / Houston Mitchell Drive

ROAD	Model Year	Period	Average Delay	Level of Service
	2019	AM	24 secs	LOS C
		PM	27 secs	LOS C
	2029	AM	26 secs	LOS C
		PM	35 secs	LOS D

In both 2019 and 2029 the recommended network will still only provide a Level of Service C during the AM peak period. The PM peak level of service is expected to reach LOS D in 2029. This is a direct result of increased turning movements at the intersection, in particular southbound vehicles from Houston Mitchell Drive conflicting with all other major movements along Ocean Drive and ultimately increasing average delay at the intersection.

In addition, by 2019 a single lane of traffic between Bonny View Drive and Houston Mitchell Drive will be carrying approximately 1600vph northbound during the AM peak. Under the existing configuration (no development and uninterrupted flow northbound), the level of service for the lane would be approaching LOS E. 1600vph northbound would also result in insufficient acceptance gaps for the right turning traffic onto Houston Mitchell Drive westbound. When taking into account the proposed development traffic as well as signalising the intersection at Houston Mitchell Drive, northbound through traffic requires both two stand-up lanes at the intersection as well as two traffic lanes south of Houston Mitchell Drive to provide sufficient carrying and storage capacity.

The notion of retaining two lanes on Ocean Drive has a number of impacts. The modelling indicates that congestion would be approaching an intolerable level in the AM peak hour around year 2019. This means that additional capacity is needed around this time or there would be a restriction on development either imposed by Council or by the market. This would ultimately reduce the attractiveness of any future developments.

The notion of diverting traffic along Houston Mitchell Drive to the Pacific Highway would make little difference to the capacity requirements on Ocean Drive in the study area because almost all traffic will still need to pass through the Ocean Drive / Houston Mitchell Drive intersection. Most traffic will be locally generated and through traffic (traffic that potentially could be diverted) is only a small component. As an indication, a rate of 2.4% is applied to growth in through traffic (a 48% increase over 20 years). This figure has been obtained from the HUGS traffic study. This translates to an increase of approximately 300 vehicles per hour in 2029. Assuming that the Pacific Highway becomes more popular for Laurieton to Port Macquarie trips and the growth rate drops to say 1.4%, this only affects 100 vehicles per hour or 50 each way, or 2 cars each way per cycle of the traffic signals at Houston Mitchell Drive. This is insignificant in the context of the full development of the area.

It is possible that a higher proportion of traffic could be diverted along Houston Mitchell Drive to the Pacific Highway if there are capacity constraints to the north of the study area.

This could have implications for the design of the intersections at both ends of Houston Mitchell Drive, ie Pacific Highway and Ocean Drive.

The Ocean Drive intersection could be realigned to have Ocean Drive south and Houston Mitchell Drive as the continuous road. This could be an option Council may wish to pursue, however it would have further implications including possible upgrades to the Pacific Highway. The Pacific Highway intersection, currently a seagull, would need to be upgraded to an interchange. This may be necessary in any event given the volume of currently predicted traffic but if there is a deliberate strategy to divert traffic to this intersection the RTA may require developer contributions towards its construction. Furthermore, any downgrading of the role of Ocean Drive as a main road (including residential street type intersection designs) may see the Regional Road status of the route questioned. This would have funding implications for Council. Notwithstanding this, Houston Mitchell Drive will need upgrading to safely accommodate projected volumes under either scenario.

A1.2 Reply to Working Group Submissions

The following contains a response to the issues raised in the submissions from King and Campbell and Tierney Property Services.

A1.2.1 King & Campbell

The King and Campbell submission relates comments to page numbers in the Draft Modelling Report. The page numbers are used here as headings for our response.

Page 2 *It is suggested that the Manufactured Home Estate should be included in the Base Road Network for the modelling.*

The Manufactured Homes Estate has been included in the model as part of the 920 residential lots in the locality. There was limited reference within the project brief as well as no indications from Council at the time of modelling that this land contained a different type of development.

The model has applied 0.85 trips per dwelling resulting in 219 peak hour trips. The traffic generation rate from such an estate would be low, say 0.2 trips per dwelling in peak hour. For the 257 dwellings this equates to 52 trips in peak hour.

The changes can be incorporated into the model but would involve creating another zone and amending the report. Alternatively, we could simply decrease the number of normal residential lots proportionally to generate the same traffic volumes.

The comment regarding the staggered T intersection relates to the internal road network. The configuration was obtained off plans provided by Council however this can be readily changed in the model and has little affect on its operation.

The base network has been quantified and validated to reflect what is currently happening. We believe the Base Road Network as developed is appropriate and do not believe the approved subdivision or manufactured estate should be included in the base network. However, this is a matter for Council and changes can be made to the model should other substantial changes also be required.

Page 9 *It is suggested to extend the extremities of the road network further south to Bonny Hills.*

It would be desirable to extend the study area to include possible future development areas that have the potential to come on line within the study period. It is possible that additional urban development, such as another manufactured home estate, could occur without rezoning within the planning period. Consideration of such issues would assist Council determine the ultimate road configuration needed for this locality.

Page 12 *It is suggested that speed limits within the study area be reduced.*

The model was set up on a speed limit of 80kph for both 2019 and 2029. Having said that, the number and type of intersections has the effect of reducing travel speeds on the approach and departure sides of each intersection leaving only short distances of higher speed areas.

It is probable that a 60kph speed environment will be appropriate for year 2029. This does not mean that intersections should have a local street design standard. The designs should be consistent with the main road function of Ocean Drive.

Page 13 *Comment relating to the number of lots proposed.*

The number and type of lots described in the submission is slightly different from the information provided by Council on which we have done the modelling.

If the model is to be updated more recent numbers can be incorporated into the model.

Page 14 *Comment regarding the omission of the northern residential area at the end of Forrester Parkway in stage one of the modelling.*

The northern residential area was included as scenario 2 in the model as requested by Council. Again, this can be changed if the model is to be updated.

Page 18 *Comment querying intersection design standards, in particular the rural road design criteria for Ocean Drive intersections.*

As previously indicated the design criteria for Ocean Drive may change as the area develops. It may be appropriate to stage the designs to transform them ultimately from a single lane for roundabout (80kph) to more of an urban design roundabout (60kph) when required.

Page 21/31 *Comments querying the level of service proposed at the Houston Mitchell Drive and Ocean Drive signalised intersection.*

The design layout of the proposed intersection relates to the amount of traffic that would travel through the intersection and the management of associated queuing.

The Ocean Drive / Houston Mitchell Drive junction has ended up as a substantial intersection because almost all traffic needs to pass through this intersection. The layout has been developed to best manage the 12 traffic movements required.

As stipulated within the draft report recommendations, a single right turn lane is required for 2019 and double right turn for 2029. The two southbound right turn lanes are required in order to provide the following:

1. Minimise the length of southbound queue and required turning lane; and

2. Reduce the amount of green time needed for the movement. This in turn reduces overall cycle time, delays and queue lengths for northbound traffic flow on Ocean Drive.

Page 23 *Comments querying the traffic generation of the manufactured homes estate (MHE) and the configuration of the internal road system.*

The 920 residential dwellings that we have included in our model include the 257 MHE units but do not make the distinction in traffic generation.

Plans now available of the MHE development were not available at the time of modelling and the layouts were not taken into account in detail. The minor change can be made to the model.

We have made provision for access to the proposed commercial centre to the south of Ocean Drive by way of a fourth leg on the roundabout. A signalised intersection was the primary basis for this intersection based on initial design layouts as stipulated within the project brief. We believe that this is a sensible addition to help distribute traffic throughout the network.

As previously indicated the traffic generation for the MHE development would be significantly lower than a residential subdivision. This will be taken into account in any update of the model.

Page 27 *Comment relating to the staging of development at the end of Forest Parkway.*

Refer to comments relating to Page 14.

Page 27 *Comment relating to the residential link road and whether it is economically viable given that there is no development fronting it.*

We believe that the link road is necessary, albeit in a modified form and/or alignment. The link would be desirable to facilitate local access between precincts within the Rainbow Beach residential area and more importantly to provide for the efficient circulation of buses that would service the area.

The modelling contains scenarios with and without this link road. The modelling indicates that there would be a strong desire line along this route because it is shorter (in distance) than the Ocean Drive route. If queues and associated delays were to occur along Ocean Drive, the link road would become a desirable detour. This is why we have suggested a LATM scheme along with adequate capacity on Ocean Drive to reduce the attractiveness of this route for through traffic. An additional recommendation was also included within the report regarding

realigning the link road away from connecting directly towards the Commercial Precinct. This aims to reduce the attractiveness of the link road as a north-south through route.

Assessment of the link road within the draft report can be amended as required by Council.

This route can be included or excluded in any additional modelling that may be required by Council.

Page 29/30 *Further comments relating to the design of the Ocean Drive and Houston Mitchell Drive intersection comparing to other intersections in Port Macquarie.*

The Ocean Drive / Houston Mitchell Drive intersection is the hub of the area through which all traffic must pass. It is the primary route for through traffic on Ocean Drive and for most of the development traffic.

As previously indicated we have designed the intersection to accommodate the traffic movements in the 2019 and 2029 design years based on the following:

- proposed development yields;
- forecast background traffic volumes; and
- existing traffic patterns.

2029 background traffic is based on 2.4% growth between 2009 and 2029, which is in line with available strategic forecast data for Ocean Drive. Peak demand profiles for 2019 and 2029 were based on existing peak traffic patterns along Ocean Drive.

The final report can provide the full network requirement based 'only' on the smoothed profile which 'MAY' provide reduced intersection configurations at some locations. Council is to confirm 2029 assumptions to take forward for final report modelling.

I would like to reiterate that we have not provided unquantified spare capacity as suggested but have incrementally added capacity to various legs of the intersection as to arrive at a tolerable level of operation in peak hour. Lesser configurations performed poorly and resulted in long queues. The final report can provide and compare further information on the impacts of 'not providing' the recommended improvements. This may include screenshots of queues and comparisons of LOS at particular intersections.

In the final report we will provide a table and a plan showing Level of Service for each intersection and section of road. Perusal of such tables may alleviate the concerns regarding potential over design of the intersection. However, individual LOS readings can some times be misleading because intersections and lengths of road are interrelated and rely on adequate capacity of adjoining sections. An example of this is the required inclusion of a double right turn onto Houston Mitchell Drive by 2029. If modelled as a single right turn, queues extended back from the turn lane to influence all southbound traffic as far back as Abel Tasman Drive. This influence on upstream flows restricts traffic actually arriving at the required intersection and subsequently Houston Mitchell Drive intersection records an inaccurate LOS reading compared to if all approaching traffic arrives at the intersection.

(See table of contents for Table numbers for relevant Level of Service [LOS]results for each of the intersections)

The Paramics model combines these factors and sections to give an overall picture of network performance. The model indicates that the road geometry shown in the draft report is required to manage traffic flows for the quantity of development proposed.

Page 31/36 *Further comments relating to be manufactured home estate and the relationship between the use of this facility and school start and finish times.*

We acknowledge these matters and they will be taken into account when the model is updated.

Page 33 S*uggestions regarding the use of the Pacific Highway and Oxley Highway to access Port Macquarie for commuter traffic.*

The trip table developed for the model is based on origin and destination surveys conducted on the existing traffic patterns.

From local knowledge the most direct route to Port Macquarie from the Houston Mitchell Drive/Ocean Drive intersection is via Ocean Drive through Lake Cathie and Lighthouse Beach. It is possible that traffic may take alternative routes to Port Macquarie depending upon capacity restraints to the north of Lake Cathie in the future.

There is no basis to assume that existing traffic patterns would significantly change. As previously discussed should Houston Mitchell Drive become a more attractive route this would have serious implications for the Pacific Highway intersection.

Notwithstanding this, most traffic needs to pass through the Houston Mitchell Drive and Ocean Drive intersection which means that the capacity required on Ocean Drive through the study area will not change substantially with an increased use of Houston Mitchell Drive.

If this scenario were to be further explored the model should be extended to incorporate the Pacific Highway intersection because the impacts are potentially serious.

Page 38 *Comments relating to pedestrian access at Abel Tasman Drive.*

Signals were tested at Abel Tasman Drive following discussions with Council to provide for an existing crossing deficiency for residents west of Ocean Drive, as well as perceived increases in pedestrian movements as a result of the proposed development.

We have made suggestions in the report relating to pedestrian accessibility across Ocean Drive. The matter of pedestrian circulation throughout the study area is beyond the scope of this traffic study.

Page 41 C*omment relating to the diagram that shows closed road near the intersection of Houston Mitchell Drive and Ocean Drive.*

Amalgamation of the subject lots and subsequent removal of the 'closed road' was discussed during meetings and will be amended for the final report.

Page 42 *Further comments relating to design standards to be applied at the intersection at Abel Tasman Drive.*

Modelling shows that a two lane roundabout is needed for storage capacity at Abel Tasman Drive. This requirement would still apply should Houston Mitchell Drive take additional traffic because traffic would still be attracted to the Ocean Drive / Houston Mitchell Drive intersection from the north.

Based on the provided future development and network an assumption, modelling of a single lane roundabout at this location is expected to produce extensive queues along Ocean Drive out to 2029 and beyond. However, should Council choose to further investigate variations in future traffic and development assumptions, the required intersection at Abel Tasman Drive may vary?

The actual size of the roundabout will vary according to the adopted speed limit. The diagrams in the report have been included to indicate the possible extent of land required to provide the facility. The design criteria for the roundabout will be reviewed in the final report (should a roundabout intersection be favoured by Council at this location).

Page 49 C*omment relating to striking a balance between affordability and appropriate level of service.*

The outputs from the modelling indicate that certain level of capacity is needed to carry the predicted traffic based on the provided network assumptions. The intersections have been designed to efficiently manage traffic congestion without having queuing to nearby major intersections during peak hour. We believe that the intersections are not over designed and that infrastructure is required to provide for both expected through traffic and proposed future development traffic.

It is acknowledged that refinements to future proposed development inclusions, land uses and changes in traffic patterns could warrant revised intersection and network configurations. However, these changes to the model inputs would subsequently require additional model runs, along with clear limitations of use and accompanying statements defining any future model assumptions.

Intersection recommendations provided within the study are based primarily on future network capacity. Affordability of intersection requirements has also been included when choosing the type of intersection required for either 2019 or 2029. As stipulated within the report and discussed at meetings, signalised intersections were recommended based on providing traffic capacity, reducing intersection footprint size and providing pedestrian amenity.

It should be kept in mind that there is a ‘doubling’ of capacity when you go from one lane to two lanes, so it could be perceived that some elements of the network may be over designed. I believe we have delivered an appropriate level solution and the network is not over designed. Unfortunately, a single lane solution for Ocean Drive would be significantly under designed and is likely to incur intolerable congestion and extensive queuing.

The extent of the congestion may not be apparent from the Draft Report because we have added capacity to get an acceptable outcome. Unless some additional scenarios are run through the model the impacts of a suggested two lane objective cannot be fully assessed.

A1.2.2 Tierney Property Services

The Tierney Property Services submission on the Draft Modelling Report are in numbered paragraphs. These numbers are referenced as headings for our response.

Point 1 S*uggests the report contains a number of inconsistencies that have been discussed with Council's Vanessa Penfold.*

The Background section within the Draft Report was based on information provided within the brief and by Council.

Council to advise on the inconsistencies and the report will be amended.

Point 2 S*uggested change to be chapter heading for Scenario 2.*

Agree. The report will be amended.

Point 3 *Suggests that the report needs to be changed to identify the northern school site and the southern school site in lieu of high school and primary school. Suggests minor changes to the internal road network.*

Development inputs were provided by Council at the time of the modelling development process. The model needs to distinguish between the high school and the primary school because they generate different volumes of traffic.

It is acknowledged that the Eco Tourism Site is not part of the Hilltop Village. For modelling purposes these sections of the development have been grouped together as traffic to/from the eastern area of the development will be loading into the network at a similar location. Council to advise on details of the internal road network. The model/report will then be amended (if required).

Point 4 Q*ueries the need for a cross intersection at Bonnie View Drive for year 2019.*

Staging of the development components was based on information provided at the time of the modelling development process. If the school is not needed within the planning period, then a T-junction may suffice. Initial estimations without undertaking detail modelling would suggest that at a minimum improvement to linemarking for turn lanes and passing lanes would be required.

Council to advise whether to include the southern school site in the traffic model and in what year.

Point 5 *The need for traffic signals over a roundabout is accepted but the intersection should be staged.*

A signalised cross intersection should be able to be staged. This would be subject to detailed design. Modelling indicates that a single lane right turn lane is required in 2019 and a double right turn lane for southbound traffic in Ocean Drive is required in 2029.

Through traffic lanes can also be staged with northbound lanes requiring 2 through lanes by 2019 and two lanes southbound in 2029.

Point 6 *Queries the need for the new residential access with the intersection for access to the St Vincent's Foundation property.*

The mid-block intersection between Abel Tasman Drive and the Commercial Precinct was included based on network design within the project brief. However, we acknowledge that the draft report does not clearly identify the need/warrant for the inclusion of this intersection. The final report will include further details on the requirement for this intersection and its merits.

Based on the previous modelling, the mid-block intersection does provide relief to surrounding intersections in particular the intersection adjacent to the commercial precinct. Additional modelling was undertaken to elaborate on the benefits of providing additional access/egress locations for the commercial precinct as well as the benefits to both the local road network and Ocean Drive.

Further information can be included within the final report on the mid-block intersection benefits as required by Council.

Point 7 *Coordination is needed for construction of the intersection designed for Abel Tasman Drive.*

Noted.

Point 8 *Queries the need for the residential link road and raises issues regarding LATM.*

The link road would be desirable to facilitate local access between precincts within the Rainbow Beach residential areas and more importantly to provide for the efficient circulation of buses that would service the area. These comments can be clearly defined within the final report.

Impediments to through traffic (LATM) and/or the realignment of the link road away from the commercial precinct are recommended if it was to proceed.

Council to advise whether the link is to be retained or not.

Point 9 Q*ueries the volumes of traffic for the final 2029 scenarios.*

Trip generation tables will be provided within the final report to define the model inputs. This will provide any future variations and refinements to the model assumptions with clear transparency to what the initial recommendations are based on.

The traffic volumes have been calculated in the model using the following traffic generation criteria. These are in line with industry standards. Table 2 shows the rates used.

Table A2: Traffic Generation Rates

Type	Quantity	Peak Hour Rate	Peak Hour Trips
Normal Residential Lot	460+460+833+410 = 2163	0.85/lot	1838
Medium Density	68	0.4/unit	27
Manufactured Homes Estate (To be updated in final models)	257	0.2/home	52 (to be updated in final model)
Residential Apartments	120	0.4/app	48
Commercial Centre	5000m2	12.3/100m^2 GFA	615
Shopping centre	2000m2	12/100m^2 GFA	246
High School	(600 pupils)	20%	123
Primary School	(400 pupils)	25%	180
Additional Lots off Forest Pkwy	338	0.85/lot	287
Total			**3364**

Through traffic is based on 2.4% growth between 2009 and 2029, which is in line with available strategic forecast data for Ocean Drive. Peak demand profiles for 2019 and 2029 were based on existing peak traffic patterns along Ocean Drive. As a result, 2029 traffic queues along Ocean Drive still remained high. However, the draft report stated that peak traffic patterns are expected to 'smooth' compared to existing patterns and as a result, queues along Ocean Drive are not expected to be as extreme as displayed within the initial 2029 model.

Refinements and variations to these inputs are welcome, provided any recommendations are clearly stated alongside the input assumptions.

The design of intersections should be able to be staged subject to detailed design considerations.

Point 10 C*omment on queuing in the commercial access street and the issue of the left in left out scenario.*

The commercial access assessment was an additional modelling task that was included in order to benefit the overall design and ultimate success of the proposed commercial precinct and surrounding residential area.

Agree that this is a detailed design issue.

Point 11 *Comments regarding the footprint requirements for intersections.*

Details of the intersections footprints were included within the draft report upon discussions at the presentations. As previously mentioned Abel Tasman Drive has been tested for both roundabout and signals.

Roundabout size appears to be a sensitive issue at this location. A standardised 'rural' roundabout was the basis of the roundabout design primarily to maintain through and circulating capacity.

However, detailed roundabout design requires additional consideration of pedestrian amenity, median width, staging (one lane initially to two lanes ultimately) and available land.

The final report can detail further information and assessment of a recommended roundabout size requirement as directed by Council.

The diagrams contained in the report as to the land requirements for intersection upgrades are indicative only. The diagrams in the report show the distance from the property boundary to the outside of the roundabout and this is possibly misleading. Abel Tasman Drive requires more land (when compared to Bonny View Drive) to the south-east due to existing properties to the north. We will clarify the roundabout sizes in the final report and that includes staging the development of the intersections from one lane to two lanes.

It is envisaged that the roundabouts would be constructed as a single lane rural facility in the first instance to an 80 kph design speed. They would then be reconfigured as a two lane urban roundabout to 60 kph design speed when required.

Point 12.1 *Bonny View Drive/Ocean Drive intersection.*

Agree that the southern school site development should be considered on its merits at the time of its development. However, the traffic generation from such a facility should be considered in terms of the ultimate configuration of Ocean Drive (up to 2029 and beyond).

This is particularly pertinent given that Council is considering traffic management measures on Ocean Drive that include limiting the number of travel lanes. It would be desirable to consider in the traffic model the traffic generation from such a school along with other potential nearby development.

Modelling can be undertaken without the school in place in 2019 to identify minimum requirement for Bonny View Drive. Council to confirm.

Point 12.2 *Abel Tasman Drive/Ocean Drive intersection. Preference for traffic signals at this intersection.*

Agree and final report to reflect recommendations. To be confirmed by Council.

Point 12.3 *New residential mid-block intersection.*

As previously mentioned, modelling has been developed based on the provided information and the mid-block intersection has been observed to provide relief to surrounding intersections and improve distribution within the network. However, additional assessment can be undertaken on the network without the mid-block intersection under guidance from Council.

Council to advise on whether this facility should remain in the model.

Point 12.4 *Request to withdraw the Link Road.*

Council to advise on whether this facility should remain in the model.

Final Statement *Request that Council determined traffic speeds throughout the study area in regard to the design of future improvements.*

We have made comments regarding speed limits in this review. Desirably, the 80kph speed limit would be applicable until about year 2019. Beyond that date, as the area becomes more urbanised, the speed limit would be reduced to 60kph. Traffic facilities would be staged and designed on this basis.

Council to confirm.

A1.3 Next Steps

Modelling to date has provided a good indication of the type and nature of traffic facilities required for the target years up to 2029. Model inputs were based on provided information at the time of the model development. We believe that we have completed our assignment in accordance with the brief and a final report could be readily completed following standard amendments and refinements to suit Council. However, the draft modelling report has prompted new issues which have been raised in the two submissions and in discussions with you. Other issues have arisen while considering responses to the submissions.

We recognise the development of this future road network (and any) is an iterative process which takes into account various components other than future transport modelling. We also welcome testing of variations in the future development and road network assumptions on order to arrive at an acceptable solution for Council and the community.

Prior to finalising the report we would appreciate Council considering the issues raised in this review and to provide direction as to what, if any additional work is required before completing the traffic study. Standard amendments to the report in line with meeting the project brief will be undertaken for the final report.

Indications are that Council may require additional modelling and/or significant changes to the report. If so, any work outside the initial scope would constitute a variation to the contract.

As a guide you may wish to incorporate the following into the study:

- Update the model to reflect the number and type of lots now proposed within the study area. This includes creating a new zone for the manufactured homes estate and applying a lower generation rate to the 257 sites.

- Retain the internal Link Road to provide for local traffic circulation and buses.

- Retain both schools within the study timeframe because there is a possibility that they may both be required. Suggest the primary school only for 2019 and both for 2029.

- Model a new scenario that directs more traffic along Houston Mitchell Drive and may reduce the amount of proposed road infrastructure.

- Identify the long term future cross section for Ocean Drive and its staged development.

- Expand the model to include the Pacific Highway intersection at Houston Mitchell Drive. The RTA is likely to raise the issue of how the proposed development would impact on this intersection.

- Expand the study to include other potential urban development in the locality, eg at Bonny Hills. This does not necessarily mean including it in the 2029 model but simply acknowledging the possibility of additional traffic being generated onto Ocean Drive in the future and identifying the network needed for that traffic.

- Include general commentary on the implications of the Rainbow Beach development on the wider road network – Pacific Highway / Houston Mitchell Drive intersection, Ocean Drive through Lake Cathie and to the north through to Lighthouse Beach.

Could you please consider the issues raised in this review and advise of any changes to the road network that you would like us to model to address your concerns. The additional cost to update the report in line with the submissions, create new trip tables and re run the model is dependent upon the amount of additional work involved.

I am available and happy to discuss any or all of the issues raised in the submissions and in this response so as to arrive at a satisfactory outcome for Rainbow Beach development.