

Redland Priority Development Area

Toondah Harbour Structure Plan –
Traffic Masterplan Report

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1 Introduction

1.1 Background

On 21 June 2013, Toondah Harbour was declared by the Queensland Government and Redland City Council (RCC) as a Priority Development Area (PDA). The development of the project is being undertaken by RCC in partnership with Economic Development Queensland (EDQ).

The Toondah Harbour PDA covers a total area of 67 hectares, 17.5 hectares of which is on land and 49.5 hectares is within Moreton Bay. Toondah is the main gateway to Stradbroke Island, providing ferry services between the mainland and Stradbroke Island for commuters and tourists. A secondary use of the harbour is for recreational boating.

The vision for the future of Toondah is to bring more economic diversity via the establishment of commercial and residential developments. However, the existing character of the harbour as a recreational and leisure destination is to be retained. Additionally, ensuring that the harbour is well-connected and integrated with the surrounding transport network, with particular respect to active and public transport, is a major consideration.

Working with Redland City Council (RCC), Cardno was appointed to provide specialist traffic engineering and transport advice for the master planning stage of the PDA. Through extensive consultation with Council, a refined structure plan was developed to ensure the future Toondah Harbour will be an accessible and integrated destination.

1.2 Scope of Report

Following the project staging set out by Council, the key scope of the master planning exercise was clearly defined with stages set out as follows:

- > Stage 1: Project inception and mobilisation
- > Stage 2: Technical investigation and analysis, generation of draft options
- > Stage 3: Scenario development, testing and development of preferred scenario
- > Stage 4: Draft development scheme and infrastructure plan
- > Stage 5: Preparation of final development scheme and infrastructure plan
- > Stage 6: Implementation plan.

This report relates to the delivery of Stage 4. The process preceding this report involved an options development and refinement process, involving two workshop events. Tasks undertaken by Cardno leading up to the preparation of the final structure plan relate to Stages 2 and 3. These tasks are outlined in the following sections.

1.2.1 Stage 2: Technical investigation and analysis, generation of draft options

- > Provide a short briefing paper pre-workshop for attendees to gain an appreciation of key strategic issues that should be considered at the workshop
- > Attend the workshop and provide attendees on the day with direction and creative ideas that outwork the ideas to options being considered
- > Assist preparing assessment criteria for assessing the options
- > Assist in an evaluation of the options against the assessment criteria
- > Potentially assist in further refinement of options, by allowing in the study methodology, meetings incorporating community and state feedback.

1.2.2 Stage 3: Scenario development, testing and development of preferred scenario

- > Provide a short briefing paper pre workshop for attendees to gain an appreciation of the options to be considered
- > Workshop to agree on preferred structure plan
- > A report outlining the extent of requirements to be incorporated into the Development Scheme.

The final stage of input from Cardno involves the following tasks, outlined below.

1.2.3 Stage 4: Draft development scheme and infrastructure plan

- > The output from Stage 4 will be the finalised structure plan, including planning study report and associated drawings
- > Input to the development scheme.

1.3 References

- > *Review of Reports on the Master Planning and Redevelopment Options for Toondah Harbour*, GHD, November 2011
- > *Journey Planner and Timetable Information*, TransLink, 2013
- > *Toondah Harbour Priority Development Area Interim Land Use Plan*, Queensland Government, June 2013
- > *Preconstruction Processes Manual (PPM)*, Department of Transport and Main Roads, QLD Government
- > *Guide to Traffic Generating Developments*, Roads and Transport Authority (RTA), NSW Government
- > *Trip Generation Handbook*, Institute of Transportation Engineers (ITE)

1.4 Limitations

It is noted that the majority of the information adopted within the preparation of this report has been sourced from Redland City Council. As such, the accuracy of the findings and recommendations herein are subject to the accuracy of the information supplied.

Cardno have taken due care to ensure all assumptions are as accurate as possible. However, it is acknowledged that any changes in assumptions will ultimately affect the analysis.

2 Existing Situation

2.1 Introduction

The Toondah Harbour PDA covers a total area of 67 hectares, 17.5 hectares of which is on land and 49.5 hectares is within Moreton Bay. The extent of the PDA is indicated on Figure 2-1.

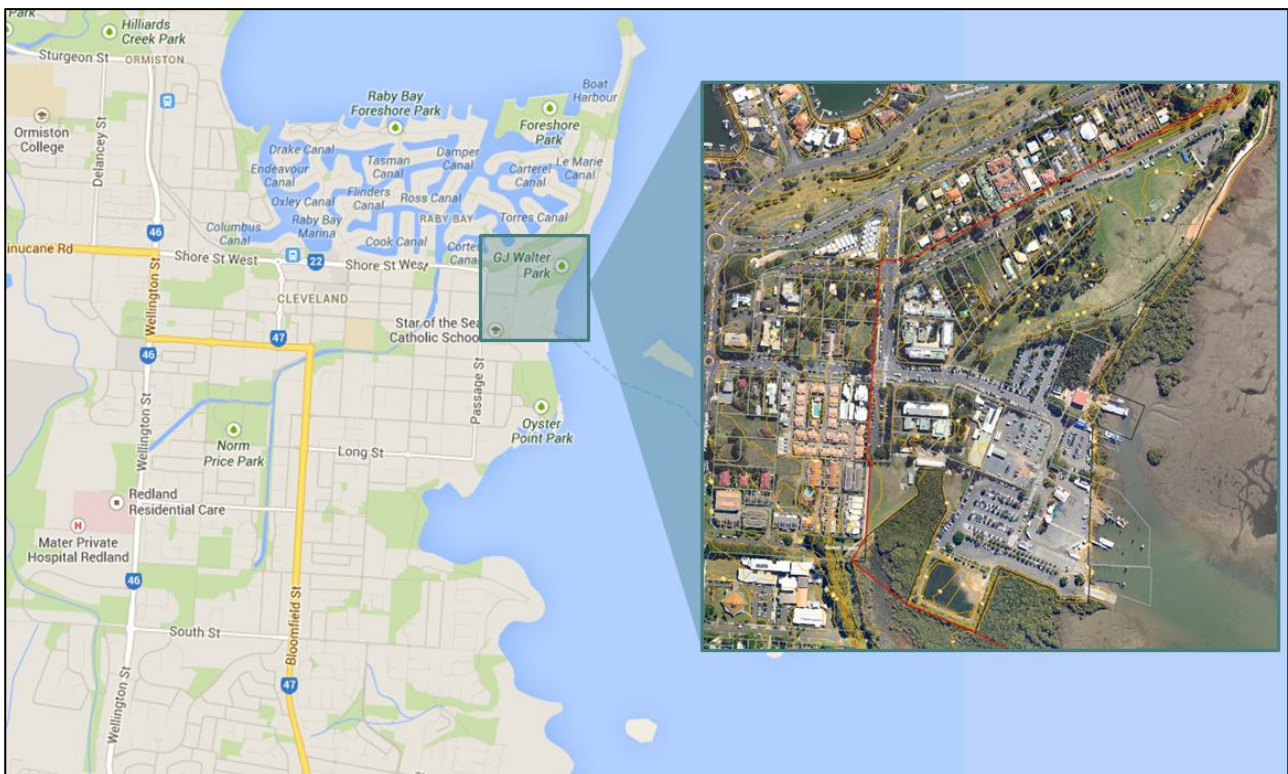
Located approximately 1.6km east of the Cleveland CBD, Toondah is the main gateway to Stradbroke Island, providing ferry services between the mainland and Stradbroke Island for commuters and tourists. Currently, there are three ferry and barge operators:

- > Sea Stradbroke (Big Red Cat) – barge and passenger ferry
- > Stradbroke Ferries – barge and passenger ferry
- > Stradbroke Flyer – passenger ferry

The ferry and barge terminals for all operators are located at Toondah. Parking for passengers is provided, which currently consumes most of the developed site area.

The assessment methodology was based upon mode hierarchy, whereby active transport, public transport and vehicular traffic were assessed separately. This has allowed for a more holistic analysis of the traffic and transport study for the PDA, ensuring all road and path users are considered.

Figure 2-1 Toondah Harbour Priority Development Area



2.1.2 Site Investigation

On Monday 8 July, 2013, a site investigation was conducted by Cardno to gain a clear sense of the use of the study area. Utilisation of parking areas was assessed, in addition to the existing standard of active and public transport facilities.

2.2 Active Transport

2.2.1 Existing Facilities

The current standard of active transport facilities is reasonably satisfactory, particularly with respect to the pedestrian path network. All streets within the study area have footpaths on at least one side of the carriageway, with connections between parking areas and the ferry and barge terminals.

A north-south shared path along Wharf Street extending from North Street south to Oyster Point Park provides good connections for recreational cyclists. However, this connection does require cyclists to pass through a car park with no formal cycling facilities, which raises concerns about safety.

2.2.2 Gaps in Facilities

While the existing standard of facilities is reasonable, there are still opportunities to improve upon the active transport network. Potential improvements to active transport facilities within the PDA are outlined in the following sections.

2.2.2.1 Emmett Drive footpath

Currently, the western footpath on Emmett Drive terminates at the corner with Middle Street. This side of the street caters to pedestrians from the secure parking facility in addition to an inbound bus stop. While the footpath continues on the eastern verge, with kerb ramps installed to formalise the crossing point, the path does not extend to the bus stop or to the parking entrances. It is noted that this particular example may not apply to the redevelopment plans, however the importance of an inter-connected transport network is well highlighted by this point.

2.2.2.2 GJ Walter Park Connections

GJ Walter Park is a large community green space with no formal pedestrian or cycle network. The opportunity to ensure that active travel is maximised through the provision of good connections is presented here. Providing a strong connection with shared paths through the park would enhance the community aspect of the PDA and help to increase sustainable transport modes.

2.2.2.3 Enhanced Facilities on Middle Street

With the vision of Toondah to be a commercial and residential hub, connections to the Cleveland CBD should be enhanced for easier development access. Importantly, this means that Middle Street should cater to all modes of transport. As a result, good quality pedestrian and cycle facilities along Middle Street should be included to ensure sustainable transport is maximised.

2.2.2.4 Improvement to Eddie Santagiuliana Way

Signage for Eddie Santagiuliana Way could be improved in the location of the Wharf Street car park, given that it is currently unclear. To encourage more use of the link by cyclists and pedestrians, both to and from Middle Street, clearer wayfinding signage should be provided to direct path users along the route.

Figure 2-2 Existing Active Transport Network – Provision and Issues



2.2.3 Overview

While the existing level of active transport facilities are reasonable for the current uses of Toondah, the planned redevelopment which includes increased density of land uses, will require stronger and better connections. These include ensuring that the path network connects all major land uses with transport hubs in addition to integrating the connections within the PDA to the external network.

2.3 Public Transport

2.3.1 Existing Services and Facilities

2.3.1.1 Land Based Transport Facilities

Within the PDA study area, there is only one land based public transport service. Translink bus route 258 services the Toondah Harbour ferry terminal via Emmett Drive and Middle Street, acting as a shuttle to Cleveland train station. Outside the study area, on Passage Street approximately 800m from the ferry terminal, two more services operate, connecting to Victoria Point and the Brisbane CBD. Details for these services are summarised in Table 2-1.

Table 2-1 Existing Bus Services

Service	Route	Nearest Bus Stop	Frequency	Hours of Operation
258	Toondah Harbour to Cleveland station	Toondah Harbour ferry terminal	Every hour	6:00am to 7:30pm
274	Victoria Point to Cleveland station	Passage Street	Every hour	7:00am to 9:00pm
275	Thornlands to City via Cleveland station	Passage Street	Every 30 minutes during peak times, AM inbound only and PM outbound only	AM peak – 6:00am to 7:30am PM peak – 5:30pm to 7:00pm

2.3.1.2 Water Based Transport Facilities

The three ferry and barge operators, Stradbroke Ferries, Sea Stradbroke and the Stradbroke Flyer provide relatively frequent services throughout the day. Stradbroke Ferries and Sea Stradbroke share the demand for barge journeys with services staggered between the two providers. The Stradbroke Flyer is a passenger ferry only, and provides hourly services between the mainland and Stradbroke Island. Table 2-2 summarises the details for each operator.

Table 2-2 Existing Ferry Service

Service	Route	Frequency	Hours of Operation
Stradbroke Ferries	Cleveland to Dunwich	Every 2 hours in each direction	5:15am to 7:45pm
Sea Stradbroke	Cleveland to Dunwich	Every 2 hours in each direction	5:15am to 7:45pm
Stradbroke Flyer	Cleveland to One Mile Jetty	Every hour in each direction	4:55am to 7:55pm

2.3.2 Gaps in Facilities

2.3.2.1 Waiting Facilities

Waiting facilities at the ferry terminal are quite poor, with little shelter for waiting passengers. However, it is noted that the bus timetable for route 258 is synchronised with the ferry timetable with waiting times of 5 minutes. Connections with the train at Cleveland station have longer waiting times, up to 20 minutes on average.

2.3.2.2 Service Frequency

Walking distance to the Passage Street bus stops, for routes 274 and 275, is approximately 815m from the ferry terminal, which equates to a 10 minute walk. While peak hour services are more frequent, with approximately 10 minutes to 30 minutes wait time between services to Victoria Point and the Cleveland train station and 30 minutes between services to the Brisbane CBD, the off-peak services are more inconvenient, running every hour. This level of service would not encourage increased public transport use for the planned increase in population and community services at Toondah.

2.3.2.3 Future Growth Considerations

Given the planned densification of the area, better facilities should be integrated to accommodate the increased population and subsequent increased use of public transport facilities. In particular, more frequent bus services to major centres such as the Cleveland and Brisbane CBDs should be considered, with an increase in the number of routes directly accessible from the ferry terminal. Additionally, a higher standard of waiting facilities should be implemented to cater to the expected increase in patronage.

Figure 2-3 Existing Public Transport Network



2.3.3 Overview

The current land based public transport facilities in Toondah are quite poor, with only one bus route servicing the PDA study area. Passenger waiting facilities are not adequate, with little shelter. Although bus-ferry connection times are synchronised for convenience, hourly services are not. Further bus services are located approximately 800m from the ferry terminal on Passage Street, however routes passing this bus stop run every 30 minutes. Given that these facilities serve the existing population, it is integral that improvements are made to cater to the expected population increase and land use densification.

2.4 Road Network

2.4.1 Existing Road Network

The existing road network which was included in the study extended outside the PDA study area. The following roads were assessed:

- > Middle Street
- > Emmett Drive
- > Wharf Street
- > Shore Street East

Middle Street serves as the sole access to the harbour, with connections to the external road network via Passage Street and Wharf Street.

In accordance with the Redland City Planning Scheme, the road hierarchy of these streets were assessed. Table 2-3 highlights the general road characteristics for the relevant road hierarchy system.

Table 2-3 Road Hierarchy Characteristics

Road Classification	AADT	Equivalent Residential Lots	Design Speed	Number of Lanes	Carriageway Width	Minimum Verge Width	Reserve Width
Access Street	1,000	100	30 km/h	2	6m	4m	15m
Local Collector	<3,000	300	40 km/h	2	7m	4m	18m
Trunk Collector	3,000 – 10,000	1,000	50 km/h	2	11 to 14m	4 to 6.5m	19 to 27m
Sub-arterial	15,000 – 20,000	2,000	60 km/h	2 or 4	12 to 20m	4 to 6.5m	20 to 33m

2.4.2 Road Connectivity

The existing road classification and functions of the study roads are highlighted in Table 2-4. Some issues which result from the current network design include:

- > Indirect access for residential areas to the north of the PDA to the ferry terminals in the south
- > Single access along Middle Street to all ferry and barge terminals and parking areas

Figure 2-4 indicates the road hierarchy, as adopted in the Redland City Planning Scheme.

Table 2-4 Existing Road Function

Road Name	Road Classification	Function
Middle Street	Local Collector	Provide main access into Toondah, connecting directly with the external road network (Passage Street, Middle Street west), on-street parking provided
Wharf Street	Access Street	Provide residential access and connection between Middle Street and North Street, on-street parking provided
Emmett Drive	Access Street	Provide access to ferry parking areas and barge loading areas
Shore Street East	Access Street	Provide residential access, on-street parking permitted

Figure 2-4 Existing Road Hierarchy and Traffic Volumes



2.4.3 Overview

The existing road network design essentially splits the PDA site into two areas, the northern section which has mainly been developed as residential and the southern section which comprises the ferry and barge services. The poor integration of the two areas, currently only linked via Wharf Street, segregates the existing site.

Additionally, the function of Middle Street as the sole access into the PDA site means all traffic is funnelled along this link, straining the capacity of the road. With added traffic expected from the densification of the site, this will be an issue that needs resolving.

2.5 Parking

The current layout of Toondah Harbour is dominated by parking areas. Not only are the areas segregated, but they utilise an open air design which takes up large blocks of area and detract from the visual amenity of the harbour. The following parking areas have been identified:

- > Big Red Cat car park – approximately 231 car bays
- > Stradbroke Ferries car park – 52 car parking spaces and 3 motorcycle bays
- > Stradbroke Ferries secure paid car park – approximately 131 spaces
- > Boat Ramp parking – 49 trailer spaces
- > Council parking at GJ Walters Park – approximately 155 spaces
- > Middle Street on-street parking – 122 spaces
- > Wharf Street car park – approximately 104 spaces

It is noted that these parking numbers are approximate estimates only, taken from Nearmap aerial imagery dated 8 September 2013. In total, there are in the order of 847 spaces available for users of Toondah Harbour. On-site observations indicated that generally all parking areas, with the exception of the Stradbroke Ferries secure parking area, had high utilisation rates. The identified parking areas are shown on Figure 2-5.

Figure 2-5 Existing Parking Areas



2.5.1 Overview

Parking at Toondah Harbour is acknowledged to be an issue, with high demand and parking areas already close to or at capacity. The majority of the developed area within the PDA is designated to parking, which detracts from the visual amenity of the harbour, especially as a recreational destination. Finding a way to consolidate the parking areas as well as maintaining efficient operation of the road network will be a major consideration for the finalised plan.

3 Workshop Process

3.1 Introduction

The master planning process undertaken for the Toondah PDA involved the following involvement from Cardno, as defined by the stages set out by RCC in the Consultancy Brief:

- > Preparation of a briefing paper to highlight the existing facilities, deficiencies and resulting issues
- > Participation at Workshop 1 to provide high level input into the development of various development options
- > Review of the developed options with respect to the opportunities and constraints from a traffic and transport perspective
- > Participation at Workshop 2 to narrow the various options to a finalised plan
- > Assessment of the finalised option

3.2 Initial Briefing Paper

Prior to the first workshop, a briefing paper was developed to outline the various traffic and transport considerations of the existing situation at Toondah Harbour. Of particular focus for the paper were the following topics:

- > Active transport facilities, in particular the standard and provision of footpaths and cycle paths
- > Public transport facilities and service frequency
- > Road network operation and intersection capacity
- > Parking provision and demand

3.3 Workshop 1

The first workshop was held on Tuesday 16 July 2013, with all relevant design consultants and stakeholders in attendance. The purpose of the workshop was to develop a number of options for further consideration. Input from all parties was examined with the workshop resulting in three options being established for further assessment.

3.4 Options Review

Reviews of the three developed options were undertaken to assess the various strengths and weaknesses of each. The traffic and transport criteria adopted to evaluate the options included the following:

- > Street efficiency – traffic connectivity
- > Street efficiency – capacity/street design
- > Parking effectiveness
- > Effectiveness of water and land based public transport integration
- > Active transport linkages and facilities

3.5 Workshop 2

On Monday 9 September 2013, the second workshop was held, once again involving all the relevant design consultants and stakeholders. The completion of the workshop resulted in the development of a refined structure plan outlining the finalised road network and development plan.

3.6 Outline of Final Option

This report has been prepared to provide input to the finalised structure plan, in terms of traffic and transport.

4 PDA Structure Plan

4.1 Introduction

A combination of mixed use (commercial and retail) and residential land uses form the heart of the precinct, while ferry services are located to the south and the recreational precinct, comprising a marina and parkland, is located to the north.

The proposed indicative yields, confirmed by RCC, are set out in Table 4-1.

Table 4-1 Land Use Yields – Structure Plan

Land Use	Yield
Commercial	2,500 sq.m
Retail	5,000 sq.m
Community centre	1,050 sq.m
Residential – medium density	480 lots
Residential – high density	1,225 lots
Marine industry	12,000 sq.m
Marina	500 berths

4.2 Road Network Hierarchy

The planned road network involves a number of changes, including extending Middle Street towards the harbour and creating a grid system with a number of key link connections. These new connections include the following:

- > A new loop road extending between the southern end of Emmett Drive and the Wharf Street car park, which will be transformed into a local street
- > A new link between Middle Street and the Shore Street East/Cross Street intersection through the existing GJ Walter parkland area

The function of Middle Street remains as the trunk road, with the other streets serving as part of the local street network. Table 4-2 describes the proposed road function while Table 4-3 summarises the road hierarchy of each of the study roads, while Figure 4-1 graphically illustrates the indicative road hierarchy.

It is noted that while Middle Street is classed as a Sub-arterial road in accordance with the Redlands Planning Scheme, this classification system is rather traditional and it is acknowledged that an updated view of road network planning is more appropriate in this situation. Creating liveable, mixed use streets involves delivering a street character with a good living environment in addition to ensuring commercial and retail needs are met. This entails allowing all road users adequate space while maintaining a vibrant, busy streetscape. Therefore, by designing the road network based upon usage and character rather than capacity, a more active and integrated movement network will be created.

Table 4-2 Proposed Road Function

Road Name	Road Classification	Function
Middle Street	Sub-arterial	Provide main access into Toondah, carrying the majority of Toondah traffic and connecting directly with the external road network (Passage Street, Middle Street west)
Wharf Street	Local Collector	Allow barge and ferry traffic to diverge from the main access street
Emmett Drive	Local Collector	Provide a secondary connection to ferry and barge terminals, improving accessibility
Cross Street	Local Collector	Allow marina and other recreational users to diverge from the main access street
North Street	Trunk Collector	Provide a thoroughfare for existing residential areas and carry traffic for northern sections of the development from the external road network
Shore Street East	Access Street	Provide residential access

Table 4-3 Proposed Road Hierarchy

Characteristic	Middle Street	Wharf Street	Emmett Drive	Cross Street	North Street	Shore Street East
Road Classification	Sub-arterial	Local Collector	Local Collector	Local Collector	Trunk Collector	Access Street
AADT	15,000 – 20,000	<3,000	<3,000	<3,000	3,000 – 10,000	<1,000
Design Speed	60 km/h	40 km/h	40 km/h	40 km/h	50 km/h	30 km/h
Number of Lanes	2-4	2	2	2	2	2
Carriageway Width	12 to 20m	7m	7m	7m	11 to 14m	6m
Minimum Verge Width	4 to 6.5m	4m	4m	4m	4 to 6.5m	4m
Reserve Width	20 to 33m	18m	18m	18m	19 to 27m	15m

Figure 4-1 Proposed Road Hierarchy



4.3 Public Transport

Ensuring that the ferry and bus services are well integrated via connected facilities will be an integral part to creating a sustainable transport network. A public transport hub near the centre of the PDA will be formed with the integration of ferry and bus services at the Middle Street and Emmett Drive corner. With the central location, at the heart of the redevelopment, convenience, and subsequently patronage, will be maximised. Additionally, all paths lead to this location, meaning accessibility for the transport hub is catered for. This will heighten the opportunity for integrated land and water based transport services.

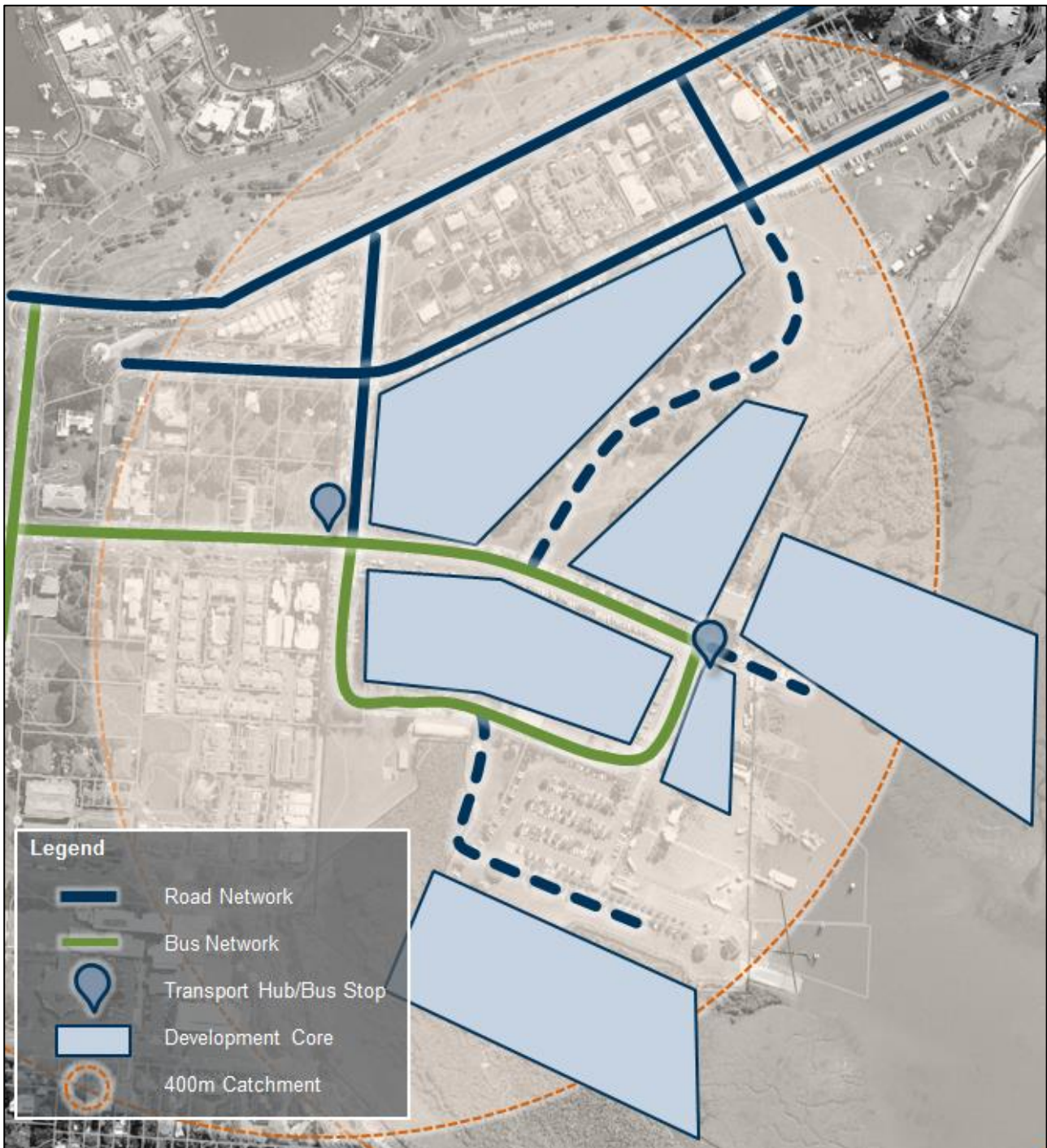
With the extensions of Wharf Street and Emmett Drive, a grid network is created. This facilitates a loop service, which is more efficient than a dead end service. Provision of a second bus stop, in addition to the integrated transport hub, would increase accessibility for both residents and visitors to Toondah. By locating a bus stop further west on Middle Street, both the existing and planned residential areas would be catered for.

Table 4-4 provides a summary of the suitability of bus routes on each of the study roads. Figure 4-2 demonstrates the potential public transport amenity of the structure plan. 400m walkable catchments are shown on the figure, which indicate that close to the entire PDA study area will be covered by the proposed bus stop locations.

Table 4-4 Required Public Transport Facilities

Characteristic	Middle Street	Wharf Street	Emmett Drive	Cross Street	North Street	Shore Street East
Road Classification	Sub-arterial	Local Collector	Local Collector	Local Collector	Trunk Collector	Access Street
Bus Route	Yes	Where appropriate	Where appropriate	Where appropriate	Yes	No

Figure 4-2 Proposed Public Transport Network



The figure indicates the 400m walkable catchments for the two indicative bus stop locations, in line with TMR guidelines. As shown, the two bus stops are located so that all land uses would be within the walkable catchments.

4.4 Active Transport

The structure plan is likely to incorporate extensive lengths of boardwalk, with waterfront paths stretching from the top of the parkland to the bottom of the ferry terminal. Links within the central hub, the mixed use precinct, would be reinforced with a strong path network extending towards all the adjacent land uses.

In line with the classification of Middle Street as a trunk collector road, on-road cycle lanes will be required. This will allow for strong cycle connections between the Cleveland CBD and the waterfront. In addition, the extension of Cross Street to Middle Street has allowed for shared path facilities to extend from the existing north-south shared path to the parkland and marina area in the north.

Table 4-4 summarises the active transport requirements, in accordance with the Redland City Planning Scheme.

Table 4-5 Active Transport Provision

Characteristic	Middle Street	Wharf Street	Emmett Drive	Cross Street	North Street	Shore Street East
Road Classification	Sub-arterial	Local Collector	Local Collector	Local Collector	Trunk Collector	Access Street
Pedestrian Path	N/A	1.5m	1.5m	1.5m	N/A	1.5m
Shared Use Path	2.5 or 3.0m as determined	2.5 or 3.0m as determined	2.5 or 3.0m as determined	2.5 or 3.0m as determined	2.5 or 3.0m as determined	2.5 or 3.0m as determined
On-Road Cycling Facilities	On carriageway and verge, both sides, bicycle lanes 2.0m wide	Not required	Not required	Not required	On carriageway and verge, both sides, exclusive bicycle lanes 1.5m to 2.0m wide	Not required

As shown on Figure 4-3, all streets within the core of the PDA will have footpaths on both sides of the road, in accordance with the Redland City Planning Scheme. On-road cycle lanes will also be required along Middle Street.

Improvements to the active transport network will ensure greater connectivity within and around the PDA and create a more community-minded development.

Figure 4-3 Proposed Active Transport Network



4.5 Parking

One of the objectives for the PDA was to minimise the extent of parking areas, which currently consume the majority of land area at Toondah. This can be achieved reasonably well through a number of approaches, including the following:

- > Locating the parking area for ferry users towards the southern end of the PDA, near the ferry services and behind buildings on Middle Street
- > Using sleaved parking areas nestled between buildings, ensuring that the visual amenity of the PDA is not deteriorated
- > Using on-site parking areas for residential dwellings to maximise public parking space
- > Separating the marina parking from the central hub to improve efficiency
- > Minimising the level of on-street parking, to maintain the character of the PDA.

Based upon the proposed land uses, the level of parking provision has been categorised into short, medium and long term parking areas. Table 4-6 details the proposed parking system and associated indicative parking provision required, in accordance with the Redland City Planning Scheme.

Table 4-6 Parking Provision

Parking Type	Description of User	Location	Parking Rate	Indicative Parking Spaces
Short Term	Customers of the retail and commercial centre (including visitors to the marina/waterfront) of the PDA with allocation for staff	Sleaved parking bordered by the new buildings comprising the central hub	5 spaces per 100sq.m	375 spaces [^]
Medium Term	Marina Parking	To the north of the site, separate from the central hub	0.6 spaces per berth	300 spaces*
Medium Term	Allow for day/overnight parking for users of the ferry who are using their cars to travel to work, visiting Stradbroke Island etc	To the south of the site adjacent to the ferry and barge terminals, positioned behind residential/mixed use buildings to maintain streetscape character	Total of 847 spaces are currently allocated for passenger ferry patrons	At least 847 spaces [†]

[^] Assuming mixed use areas comprise 7,500sq.m GFA

* Assuming 500 berth marina

[†] Total existing passenger ferry spaces provided, to be retained at minimum

Where it is practical, parking will be sleaved, by buildings, to ensure that the parking does not dominate the urban space.

With regards residential parking provision, it is intended that new townhouses would have parking provision within the development lot. In line with Redlands City Planning Scheme, residential parking would be as follows:

- > Townhouses would require a provision of 2 spaces per dwelling; and
- > Unit development would require 1 space per dwelling plus 1 visitor space per every 4 dwelling.

5 Road Network Capacity

5.1 Indicative Traffic Generation

Traffic generation rates have been sourced from multiple engineering publications, including the following:

- > *Preconstruction Processes Manual (PPM)*, Department of Transport and Main Roads, QLD Government
- > *Guide to Traffic Generating Developments*, Roads and Transport Authority (RTA), NSW Government
- > *Trip Generation Handbook*, Institute of Transportation Engineers (ITE)

These sources have been noted in Table 5-1 below, for each land use identified on the structure plan.

Table 5-1 Trip Generation Rates

Land Use	Daily Generation Rate	Peak Hour Generation Rate	Source
Commercial	10 vpd/100sq.m	2 vph/100sq.m	RTA
Retail	121 vpd/100sq.m	16.3 vph/100sq.m	RTA
Community centre	24.6 vpd/100sq.m	2.9 vph/100sq.m	ITE
Residential - medium density	5 vpd/dwelling	0.5 vph/dwelling	RTA
Residential - high density	6 vpd/dwelling	0.29 vph/dwelling	PPM
Maritime Industry	9 vpd/100sq.m	0.9 vph/100sq.m	PPM
Marina - berth	3.2 vpd/berth	0.23 vph/berth	ITE

Given the indicative yields and the generation rates indicated above, the following traffic generation for the Toondah PDA has been estimated.

Table 5-2 Traffic Generation Volumes

Land Use	Indicative Yield	Daily Generation	Peak Hour Generation
Commercial	2,500 sq.m	250 vpd	50 vph
Retail	5,000 sq.m	6,050 vpd	815 vph
Community centre	1,050 sq.m	258 vpd	30 vph
Residential – medium density	480 lots	2,400 cpd	240 vph
Residential – high density	1,225 lots	7,350 vpd	355 vph
Marine industry	12,000 sq.m	1,080 vpd	108 vph
Marina	500 berths	1,600 vpd	115 vph
Total		18,988 vpd	1,713 vph

5.2 Link Capacity

Due to the extensions to the existing road network proposed, the following roads have been assessed in this report. These include:

- > Middle Street, extended east
- > Wharf Street, extended south to meet Emmett Drive
- > Emmett Drive, extended west to meet Wharf Street
- > Cross Street, extended south to meet Middle Street
- > North Street
- > Shore Street East

Table 5-3 Proposed Road Hierarchy

Characteristic	Middle Street	Wharf Street	Emmett Drive	Cross Street	North Street	Shore Street East
Road Classification	Sub-arterial	Local Collector	Local Collector	Local Collector	Trunk Collector	Access Street
AADT (Capacity)	15,000 – 20,000	<3,000	<3,000	<3,000	3,000 – 10,000	<1,000
Daily Volume (vpd)	16,600	1,800	1,800	2,800	5,500	

5.3 Intersection Capacity

5.3.1 Assessment Thresholds

The performance of each study intersection was analysed including and excluding project traffic using SIDRA Intersection 5.1 (SIDRA). SIDRA is an industry recognised analysis tool that estimates the capacity and performance of intersections based on input parameters, including geometry and traffic volumes, and provides estimates of an intersection's Degree of Saturation (DOS), queues and delays. Simplistically, DOS is a measure of the proportion of traffic entering an intersection relative to the intersection's capacity.

Table 5-4 provides the TMR defined DOS thresholds for intersections.

Table 5-4 TMR Thresholds for Intersection Performance

Level of Service Description	DOS Threshold
Signalised intersections	less than or equal to 0.90
Roundabouts	less than or equal to 0.85
Priority controlled intersections	less than or equal to 0.80

Source: TMR *Guidelines for Assessment of Road Impacts of Development*

The guideline notes that a DOS exceeding the values indicated in Table 5-4 indicates that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queuing.

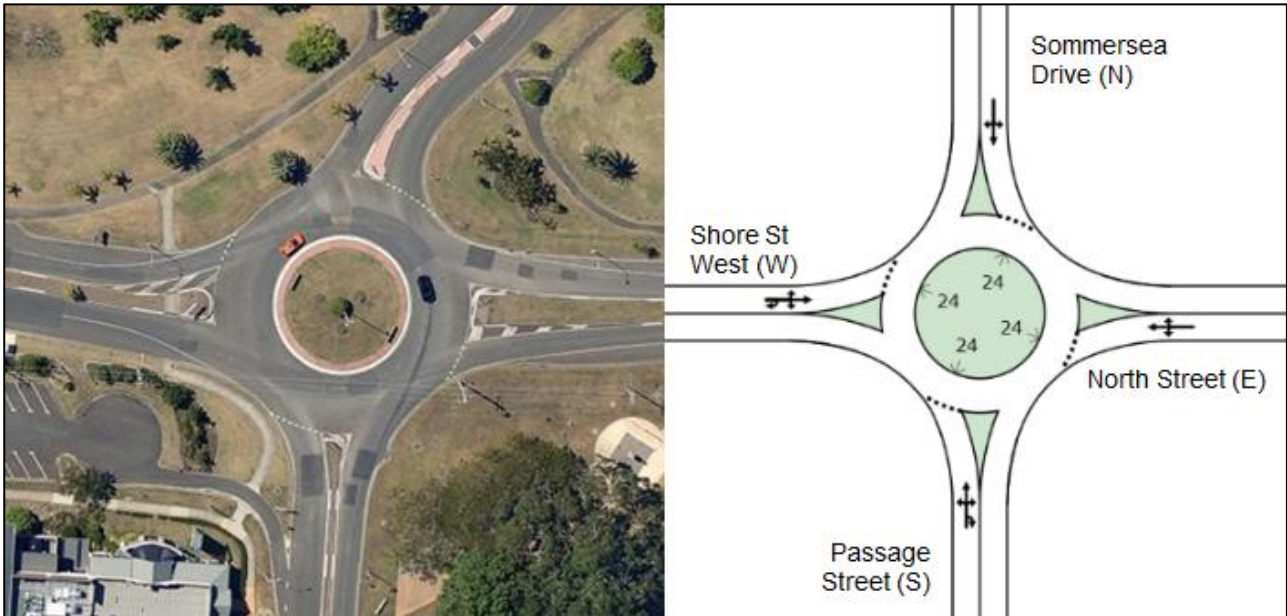
Importantly, it is noted that DOS is not the only performance indicator and that other measures such as critical delay should also be considered when assessing the performance of an intersection. Other authorities such as the NSW Roads and Maritime Services (RMS) recommend the use of the critical movement delay for assessing the performance of priority-controlled intersections.

The following sections provide a brief overview of the analysis findings particularly with respect to any upgrade works required as a result of development. Detailed results from the SIDRA analyses are provided at Appendix A.

5.3.2 Passage Street/Shore St West/North Street

The existing roundabout form for the Passage Street/Shore St West/North Street intersection is illustrated on Figure 5-1. Analysis results indicate that with the ultimate build out of the PDA, the existing form will be adequate in terms of capacity. As such, no upgrades will be required.

Figure 5-1 Passage Street/Shore St West/North Street – Existing Layout

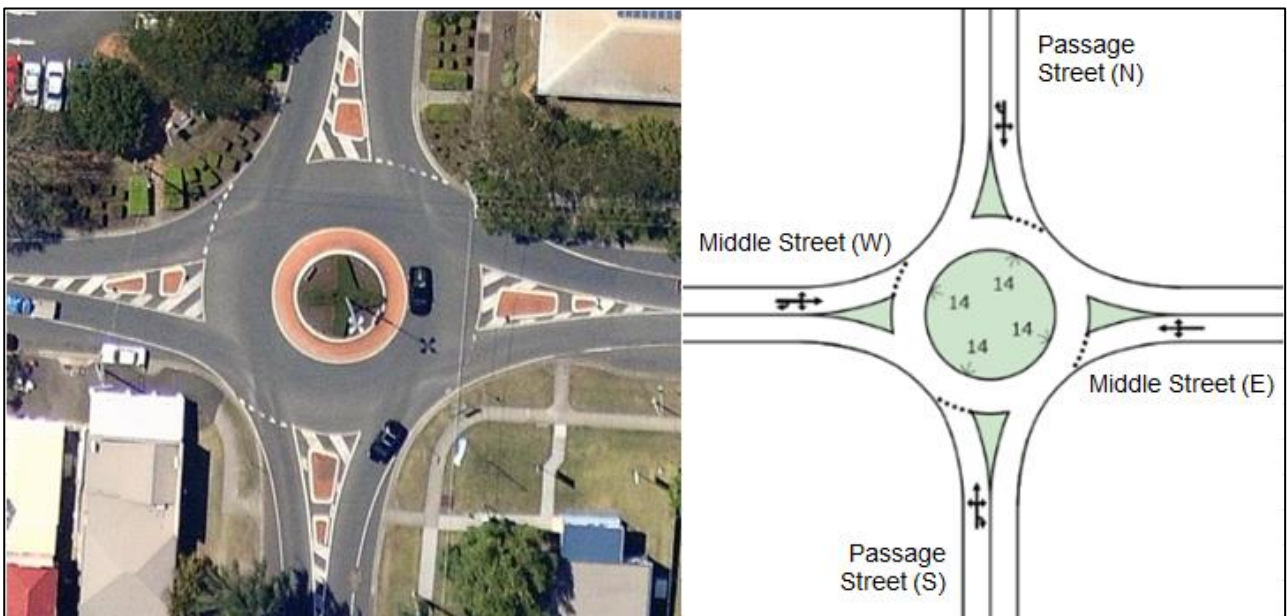


Source: Nearmap, www.nearmap.com

5.3.3 Passage Street/Middle Street

The existing roundabout form for the Passage Street/Middle Street intersection is illustrated on Figure 5-2.

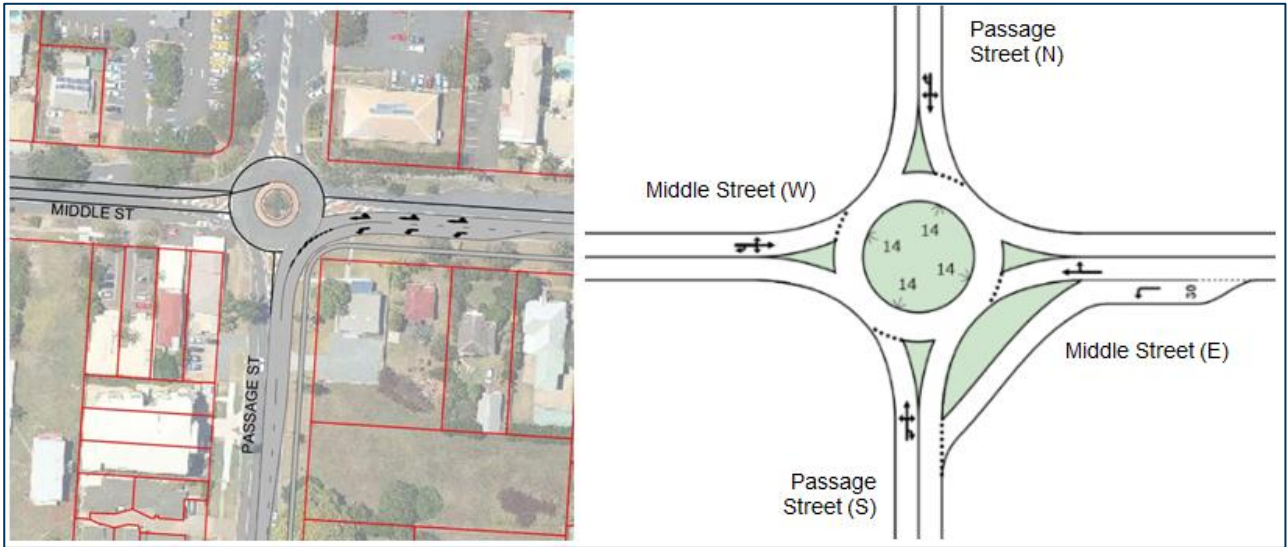
Figure 5-2 Passage Street/Middle Street – Existing Layout



Source: Nearmap, www.nearmap.com

Analysis results indicate that with the ultimate build out of the PDA, the existing form will no longer be adequate in terms of capacity. As such, minor upgrades, involving a left slip lane on the eastern approach, will be required. The proposed upgrade form, as illustrated on Figure 5-3, has been shown to adequately accommodate future traffic demands without exceeding capacity thresholds.

Figure 5-3 Passage Street/Middle Street – Upgrade Layout



5.3.4 North Street/Wharf Street

The existing priority controlled form for the North Street/Wharf Street intersection is illustrated on Figure 5-4. Analysis results indicate that with the ultimate build out of the PDA, the existing form will be adequate in terms of capacity. As such, no upgrades will be required.

Figure 5-4 North Street/Wharf Street – Existing Layout

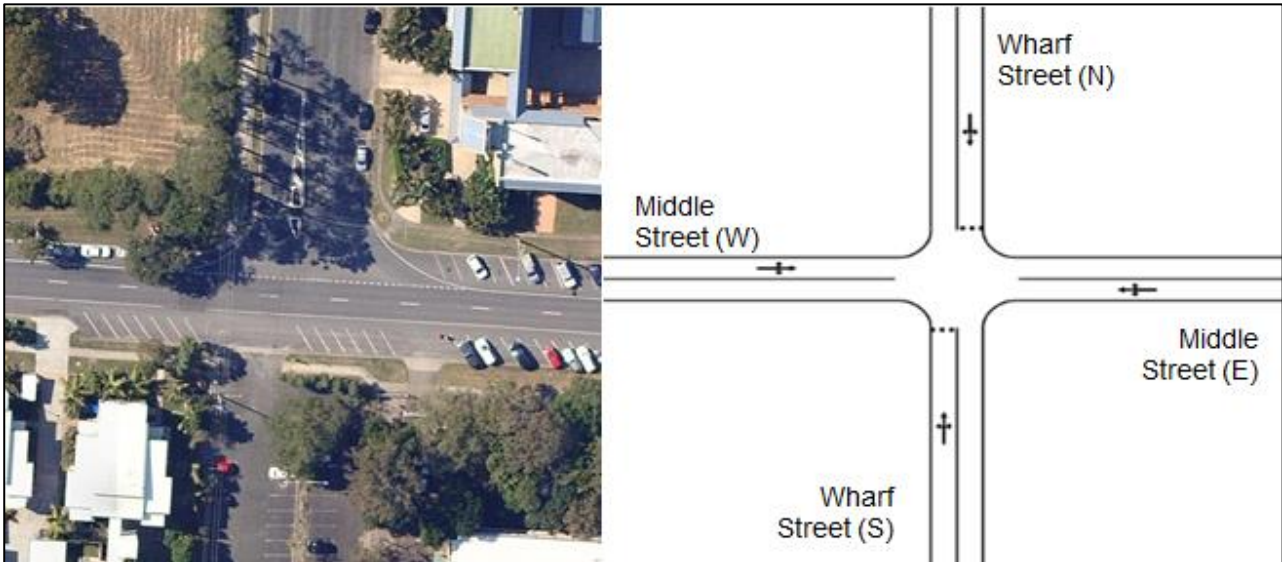


Source: Nearmap, www.nearmap.com

5.3.5 Middle Street/Wharf Street

The existing priority controlled form for the Middle Street/Wharf Street intersection is illustrated on Figure 5-5. Analysis results indicate that with the ultimate build out of the PDA, the existing form will be adequate in terms of capacity.

Figure 5-5 Middle Street/Wharf Street – Existing Layout

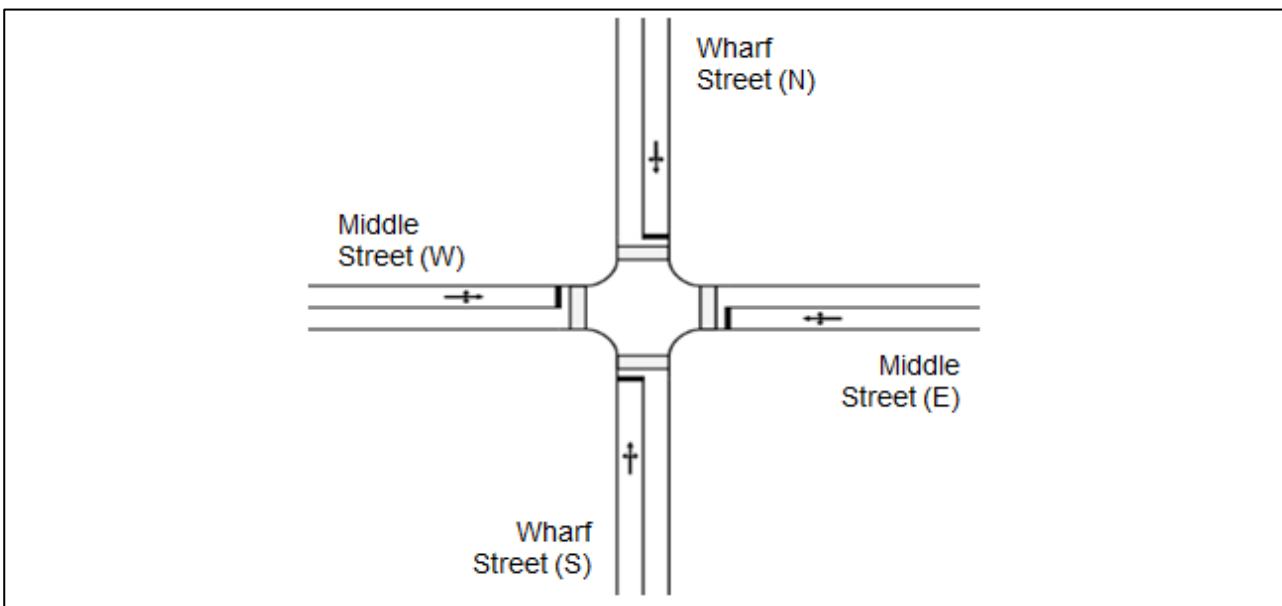


Source: Nearmap, www.nearmap.com

However, given the road network changes resulting from the potential future development, and the formalisation of the southern Wharf Street approach as a local collector, the intersection will be upgraded regardless of capacity considerations. As the intersection is a key crossing point for all users to and from the development, particularly vehicles and pedestrians, it is proposed that a signalised form will be the safest option.

Figure 5-6 illustrates the proposed intersection layout. Analysis results indicate that this form will be able to adequately accommodate the future traffic demands without exceeding capacity thresholds.

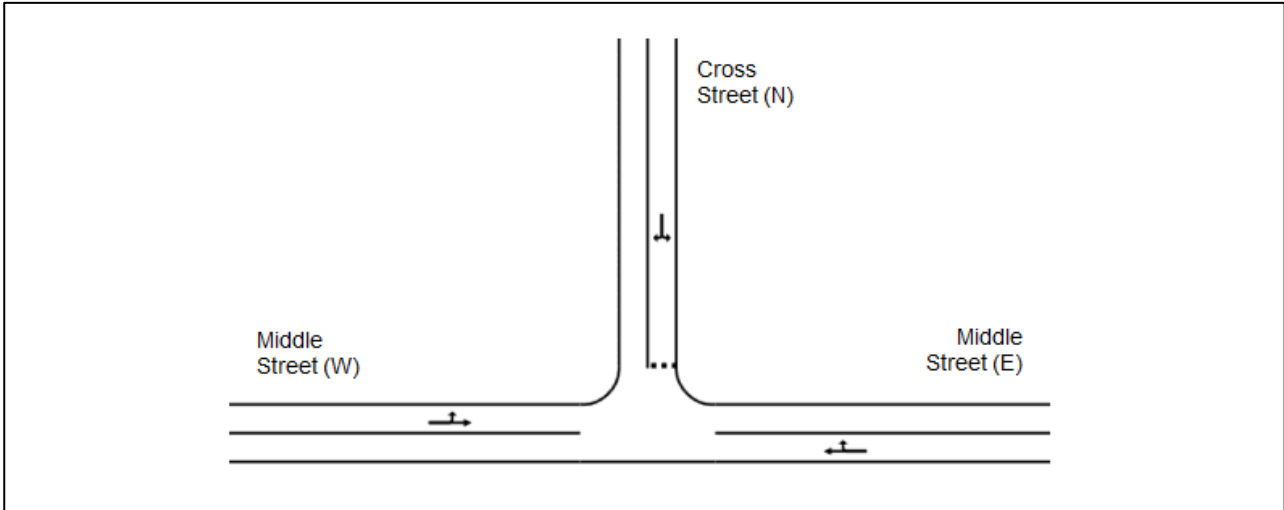
Figure 5-6 Middle Street/Wharf Street – Upgrade Layout



5.3.6 Middle Street/Cross Street

The proposed Middle Street/Cross Street intersection is a result of the new connection from Middle Street to Shore Street East via Cross Street. As Cross Street will provide access to a number of core precincts within the heart of the PDA, and Middle Street will act as the town centre’s main street, the intersection will be a key location. Figure 5-7 shows the proposed intersection form. Analysis results have indicated that the proposed form will be adequate for the anticipated traffic demands of the ultimate PDA.

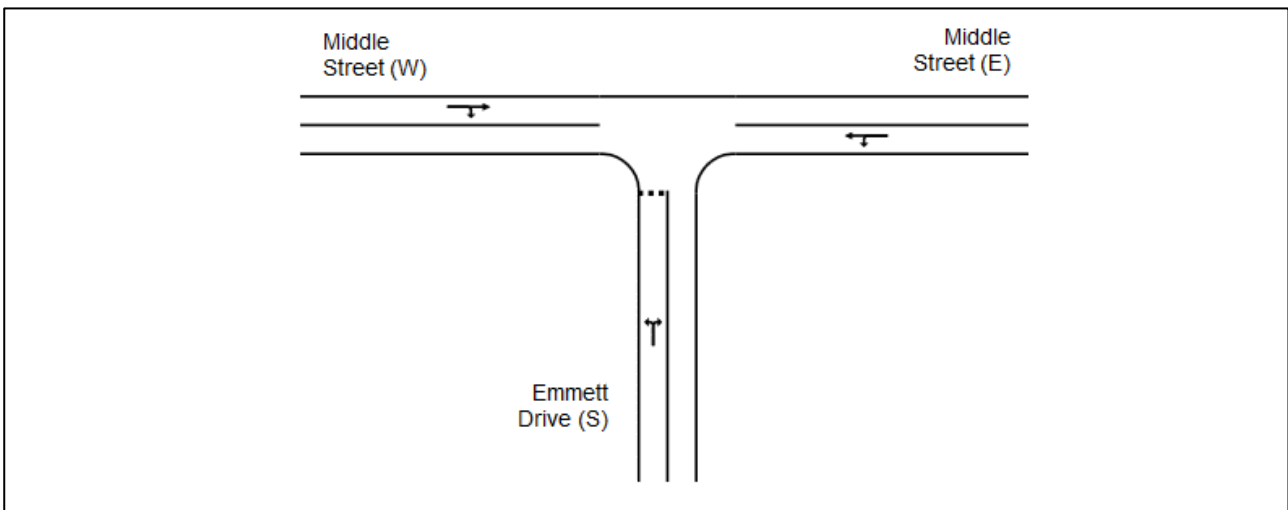
Figure 5-7 Middle Street/Cross Street – Future Layout



5.3.7 Middle Street/Emmett Drive

The proposed Middle Street/Emmett Drive intersection is a result of the extension to Middle Street towards the harbour. As Emmett Drive will provide access to the ferry services and a number of residential and commercial/retail areas, the intersection will be a key location. Figure 5-8 shows the proposed intersection form. Analysis results have indicated that the proposed form will be adequate for the anticipated traffic demands of the ultimate PDA.

Figure 5-8 Middle Street/Emmett Drive – Future Layout



5.4 Summary

The current intersection forms for the five existing intersections were found to not need any upgrade works for the future development scenarios with the exception of the Passage Street/Middle Street intersection which will require minor upgrades. Where new road links have been proposed and subsequently intersections would require upgrades, the proposed modifications were found to adequately accommodate

the assessed traffic scenarios. Analyses for all intersections indicated that capacity thresholds would not be exceeded at the ultimate development scenario.

As for the two new intersections proposed as part of the development structure plan, Middle Street/Cross Street and Middle Street/Emmett Drive, it was found that single lane priority controlled forms would be adequate in terms of traffic capacity for the ultimate development scenarios. Therefore, road cross sections will be able to be designed with spatial efficiency, while maintaining a vibrant, active street character.

6 Summary

6.1 Road Network

The planned road network involves a number of changes, including extending Middle Street towards the harbour and creating a grid system with a number of key link connections. These new connections include the following:

- > A new loop road extending between the southern end of Emmett Drive and the Wharf Street car park, which will be transformed into a local street
- > A new link between Middle Street and the Shore Street East/Cross Street intersection through the existing GJ Walter parkland area

The function of Middle Street remains as the trunk road, with the other streets serving as part of the local street network. While Middle Street is traditionally classed as a sub-arterial road based on traffic capacity, it is recommended that this classification not be relied upon for road design. Instead, ensuring that the street character is appropriate for the PDA is deemed more important. As such, creating a liveable, vibrant streetscape with busy roads and well-used paths is considered a more appropriate basis for the design of Middle Street, as the main street of the PDA.

6.2 Intersections

All existing intersection forms were found to be adequate for future traffic scenarios. Where new road links are proposed as part of the PDA structure plan and subsequent intersection upgrades are required, the minimal standard of upgrades was found to be adequate. Table 6-1 summarises the final forms required for each of the study intersections for the PDA.

Table 6-1 Study Intersections

Intersection	Structure Plan Outcome
Passage Street/Shore Street West/North Street	Existing roundabout form is adequate
Passage Street/Middle Street	Minor upgrades to existing form are required
North Street/Wharf Street	Existing priority controlled form is adequate
Middle Street/Wharf Street	Upgrade to signals with full pedestrian crossings, for safety and efficient operation
Middle Street/Cross Street	Future priority controlled form is adequate
Middle Street/Emmett Drive	Future priority controlled form is adequate

6.3 Parking

One of the objectives for the PDA was to minimise the extent of parking areas, which currently consume the majority of land area at Toondah. This has been achieved reasonably well through a number of approaches, including the following:

- > Locating the parking area for ferry users towards the southern end of the PDA, near the ferry services and behind buildings on Middle Street
- > Using sleaved parking areas nestled between buildings, ensuring that the visual amenity of the PDA is not deteriorated
- > Using on-site parking areas for residential dwellings to maximise public parking space
- > Separating the marina parking from the central hub to improve efficiency
- > Minimising the level of on-street parking, to maintain the character of the PDA.

With the proposed maximum yields for the PDA, it is estimated that approximately 1,522 spaces will be required for ferry users and commercial/retail users. Residential parking is assumed to be contained on site, and has not been included in this parking estimate.

6.4 Public Transport

Ensuring that the ferry and bus services are well integrated via connected facilities will be an integral part to creating a sustainable transport network. A public transport hub near the centre of the PDA will be formed with the integration of ferry and bus services at the Middle Street and Emmett Drive corner. With the central location, at the heart of the redevelopment, convenience, and subsequently patronage, will be maximised. Additionally, all paths lead to this location, meaning accessibility for the transport hub is catered for. This will heighten the opportunity for integrated land and water based transport services.

With the extensions of Wharf Street and Emmett Drive, a grid network is created. This facilitates a loop service, which is more efficient than a turn-around service. Provision of a second bus stop, in addition to the integrated transport hub, would increase accessibility for both residents and visitors to Toondah. By locating a bus stop further west on Middle Street, both the existing and planned residential areas will be catered for.

6.5 Active Transport

It is proposed to incorporate extensive lengths of boardwalk, with waterfront paths stretching from the top of the parkland to the bottom of the ferry terminal. Links within the central hub, the mixed use precinct, are reinforced with a strong path network extending towards all the adjacent land uses.

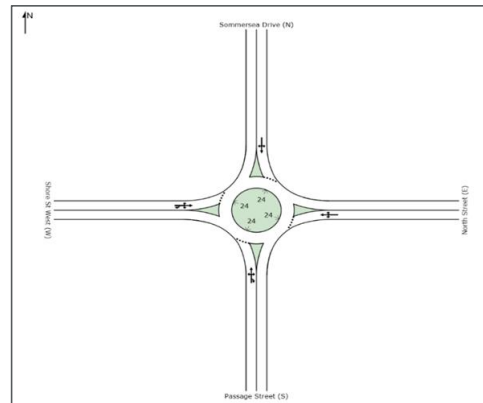
In line with the classification of Middle Street as a trunk collector road, on-road cycle lanes will be required. This will allow for strong cycle connections between the Cleveland CBD and the waterfront. In addition, the extension of Cross Street to Middle Street has allowed for shared path facilities to extend from the existing north-south shared path to the parkland and marina area in the north. Improvements to the active transport network will ensure greater connectivity within and around the PDA and create a more community-minded development.

Toondah Harbour Structure Plan –
Traffic Masterplan Report

APPENDIX A
INTERSECTION ANALYSIS RESULTS

Passage Street/Shore St West/North Street - Existing Layout

SIDRA Layout



Aerial Photography



Scenario	Peak	Passage Street (South)			North Street (East)			Sommersa Drive (North)			Shore St West (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM	0.14	8 sec	5m	0.09	6 sec	3m	0.11	10 sec	4m	0.18	9 sec	8m
	PM	0.15	7 sec	6m	0.13	6 sec	5m	0.06	9 sec	2m	0.23	7 sec	10m
2029 BG	AM	0.16	8 sec	6m	0.09	6 sec	3m	0.11	10 sec	4m	0.20	9 sec	8m
	PM	0.17	7 sec	7m	0.13	6 sec	5m	0.07	9 sec	2m	0.25	8 sec	11m
2039 BG	AM	0.17	8 sec	7m	0.09	6 sec	3m	0.11	10 sec	4m	0.21	9 sec	9m
	PM	0.18	7 sec	7m	0.13	6 sec	5m	0.07	9 sec	2m	0.26	8 sec	11m
2029 BG+Ult Dev	AM	0.56	9 sec	33m	0.31	8 sec	14m	0.16	13 sec	7m	0.49	10 sec	31m
	PM	0.45	8 sec	24m	0.33	8 sec	15m	0.11	14 sec	5m	0.65	9 sec	51m
2039 BG+Ult Dev	AM	0.57	9 sec	35m	0.32	8 sec	15m	0.16	13 sec	7m	0.50	10 sec	32m
	PM	0.47	8 sec	25m	0.33	8 sec	16m	0.12	14 sec	5m	0.66	10 sec	53m

Fig No 6

SIDRA Analysis Results - Passage Street/Shore St West/North Street

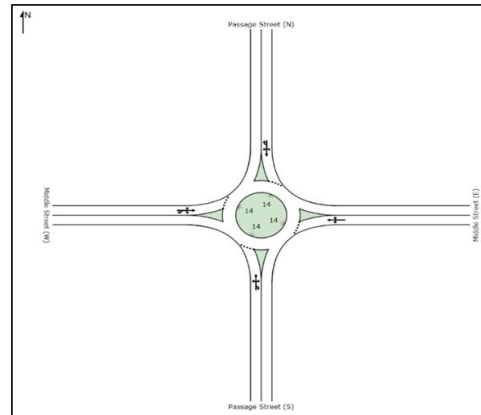
Project: Redlands Weinam and Toondah PDA

Project No.: CEB06456



Passage Street/Middle Street - Existing Layout

SIDRA Layout



Aerial Photography



Scenario	Peak	Passage Street (South)			Middle Street (East)			Passage Street (North)			Middle Street (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM	0.19	8 sec	7m	0.12	7 sec	5m	0.16	8 sec	6m	0.12	9 sec	5m
	PM	0.13	8 sec	5m	0.15	8 sec	6m	0.17	8 sec	6m	0.13	8 sec	5m
2029 BG	AM	0.22	8 sec	9m	0.12	8 sec	5m	0.19	8 sec	7m	0.13	9 sec	5m
	PM	0.15	8 sec	6m	0.15	9 sec	6m	0.19	8 sec	7m	0.14	8 sec	5m
2039 BG	AM	0.23	8 sec	9m	0.12	8 sec	5m	0.20	8 sec	8m	0.14	9 sec	6m
	PM	0.16	8 sec	6m	0.15	9 sec	6m	0.20	8 sec	8m	0.15	8 sec	6m
2029 BG+Ult Dev	AM	0.78	27 sec	71m	0.86	15 sec	119m	0.62	13 sec	43m	0.52	15 sec	32m
	PM	0.56	16 sec	36m	0.72	11 sec	63m	0.82	21 sec	88m	0.53	13 sec	32m
2039 BG+Ult Dev	AM	0.82	29 sec	81m	0.88	17 sec	132m	0.64	13 sec	46m	0.54	16 sec	34m
	PM	0.58	17 sec	38m	0.74	12 sec	68m	0.84	22 sec	97m	0.55	14 sec	34m

Fig No 7A

SIDRA Analysis Results - Passage Street/Middle Street

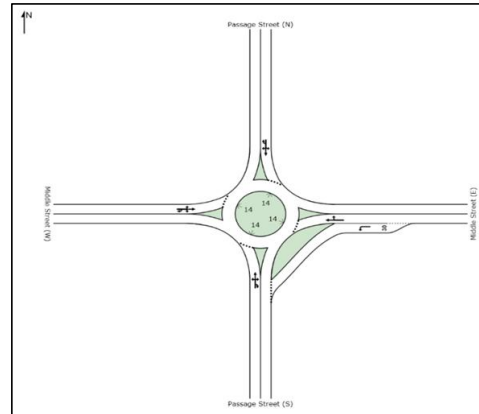
Project: Redlands Weinam and Toondah PDA

Project No.: CEB06456



Passage Street/Middle Street - Upgrade Layout

SIDRA Layout



Aerial Photography

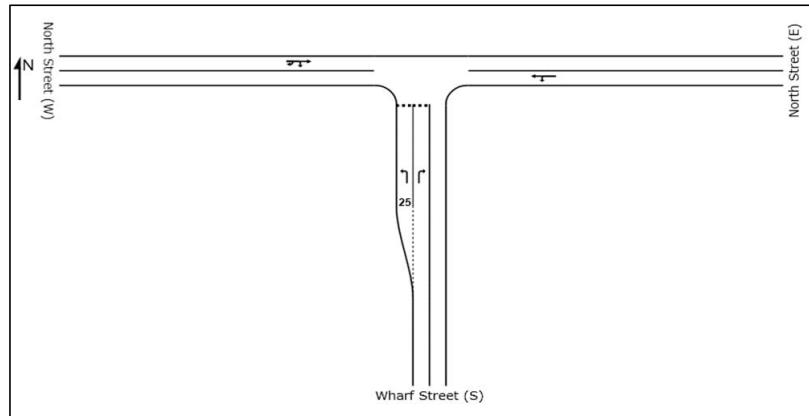


Scenario	Peak	Passage Street (South)			Middle Street (East)			Passage Street (North)			Middle Street (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM												
	PM												
2029 BG	AM												
	PM												
2039 BG	AM												
	PM												
2029 BG+Ult Dev	AM	0.73	24 sec	62m	0.60	9 sec	37m	0.63	13 sec	44m	0.53	15 sec	32m
	PM	0.53	16 sec	32m	0.48	9 sec	26m	0.82	21 sec	88m	0.53	13 sec	32m
2039 BG+Ult Dev	AM	0.73	24 sec	62m	0.60	9 sec	36m	0.64	13 sec	46m	0.52	16 sec	32m
	PM	0.55	16 sec	34m	0.49	9 sec	27m	0.84	22 sec	97m	0.55	14 sec	34m

Note: Background traffic scenarios have not been analysed as the upgraded form will only be utilised by development traffic scenarios

North Street/Wharf Street - Existing Layout

SIDRA Layout



Aerial Photography



Scenario	Peak	Wharf Street (South)			North Street (East)			North Street (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM	0.01	7 sec	0m	0.05	0 sec	0m	0.06	1 sec	2m
	PM	0.01	7 sec	0m	0.07	0 sec	0m	0.08	1 sec	3m
2029 BG	AM	0.01	7 sec	0m	0.05	0 sec	0m	0.06	1 sec	2m
	PM	0.01	7 sec	0m	0.07	0 sec	0m	0.08	1 sec	3m
2039 BG	AM	0.01	7 sec	0m	0.05	0 sec	0m	0.06	1 sec	2m
	PM	0.01	7 sec	0m	0.07	0 sec	0m	0.08	1 sec	3m
2029 BG+Ult Dev	AM	0.08	7 sec	3m	0.07	0 sec	0m	0.13	3 sec	5m
	PM	0.06	7 sec	2m	0.09	0 sec	0m	0.17	4 sec	7m
2039 BG+Ult Dev	AM	0.08	7 sec	3m	0.07	0 sec	0m	0.13	3 sec	5m
	PM	0.06	7 sec	2m	0.09	0 sec	0m	0.17	4 sec	7m

Fig No 8

SIDRA Analysis Results - North Street/Wharf Street

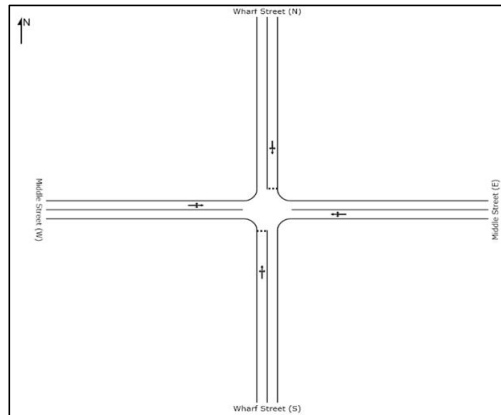
Project: Redlands Weinam and Toondah PDA

Project No.: CEB06456



Middle Street/Wharf Street - Existing Layout

SIDRA Layout



Aerial Photography



Scenario	Peak	Wharf Street (South)			Middle Street (East)			Wharf Street (North)			Middle Street (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM	0.00	8 sec	0m	0.05	1 sec	2m	0.02	7 sec	0m	0.06	2 sec	2m
	PM	0.01	9 sec	0m	0.08	1 sec	3m	0.02	7 sec	0m	0.05	2 sec	2m
2029 BG	AM	0.00	8 sec	0m	0.05	1 sec	2m	0.02	7 sec	0m	0.06	2 sec	2m
	PM	0.01	9 sec	0m	0.08	1 sec	3m	0.02	7 sec	0m	0.05	2 sec	2m
2039 BG	AM	0.00	8 sec	0m	0.05	1 sec	2m	0.02	7 sec	0m	0.06	2 sec	2m
	PM	0.01	9 sec	0m	0.08	1 sec	3m	0.02	7 sec	0m	0.05	2 sec	2m
2029 BG+Ult Dev	AM	0.43	31 sec	11m	0.45	6 sec	49m	0.45	36 sec	10m	0.45	11 sec	56m
	PM	0.52	35 sec	14m	0.38	7 sec	43m	0.46	39 sec	11m	0.52	9 sec	69m
2039 BG+Ult Dev	AM	0.43	31 sec	11m	0.45	6 sec	49m	0.45	36 sec	10m	0.45	11 sec	56m
	PM	0.52	35 sec	14m	0.38	7 sec	43m	0.46	39 sec	11m	0.52	9 sec	69m

Fig No 9A

SIDRA Analysis Results - Middle Street/Wharf Street

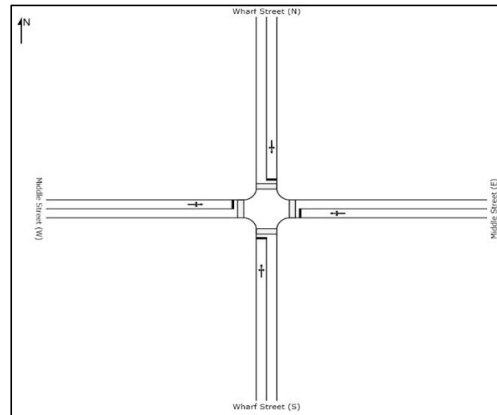
Project: Redlands Weinam and Toondah PDA

Project No.: CEB06456



Middle Street/Wharf Street - Upgrade Layout

SIDRA Layout



Aerial Photography

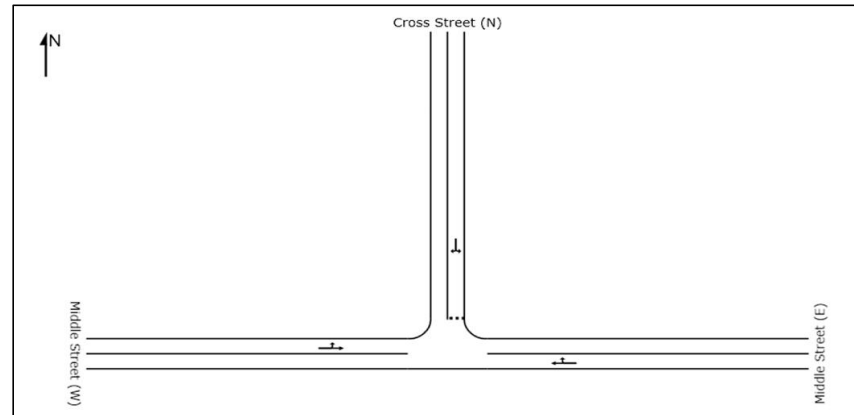


Scenario	Peak	Wharf Street (South)			Middle Street (East)			Wharf Street (North)			Middle Street (West)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM												
	PM												
2029 BG	AM												
	PM												
2039 BG	AM												
	PM												
2029 BG+Ult Dev	AM	0.53	72 sec	41m	0.56	4 sec	133m	0.53	73 sec	34m	0.59	7 sec	142m
	PM	0.61	73 sec	47m	0.50	5 sec	112m	0.51	72 sec	33m	0.65	6 sec	174m
2039 BG+Ult Dev	AM	0.53	72 sec	41m	0.56	4 sec	133m	0.53	73 sec	34m	0.59	7 sec	142m
	PM	0.61	73 sec	47m	0.50	5 sec	112m	0.51	72 sec	33m	0.65	6 sec	174m

Note: Background traffic scenarios have not been analysed as the upgraded form will only be utilised by development traffic scenarios

Middle Street/Cross Street - Future Layout

SIDRA Layout

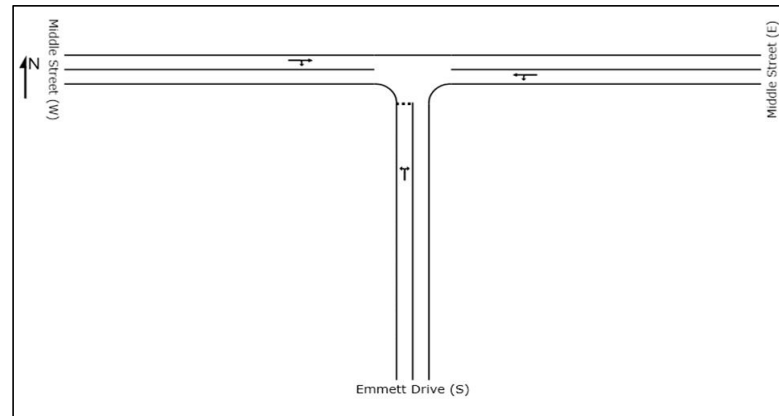


Scenario	Peak	Middle Street (East)			Cross Street (N)			Middle Street (W)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM									
	PM									
2029 BG	AM									
	PM									
2039 BG	AM									
	PM									
2029 BG+Ult Dev	AM	0.33	5 sec	30m	0.27	12 sec	6m	0.32	2 sec	0m
	PM	0.28	7 sec	29m	0.16	12 sec	3m	0.42	2 sec	0m
2039 BG+Ult Dev	AM	0.33	5 sec	30m	0.27	12 sec	6m	0.32	2 sec	0m
	PM	0.28	7 sec	29m	0.16	12 sec	3m	0.42	2 sec	0m

Note: Background traffic scenarios have not been analysed as the upgraded form will only be utilised by development traffic scenarios

Middle Street/Emmett Drive - Future Layout

SIDRA Layout



Scenario	Peak	Middle Street (East)			Cross Street (N)			Middle Street (W)		
		DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue	DOS	Delay	95 th %ile Queue
2013 BG	AM									
	PM									
2029 BG	AM									
	PM									
2039 BG	AM									
	PM									
2029 BG+Ult Dev	AM	0.05	9 sec	2m	0.17	0 sec	0m	0.22	3 sec	9m
	PM	0.07	9 sec	2m	0.15	0 sec	0m	0.21	3 sec	9m
2039 BG+Ult Dev	AM	0.05	9 sec	2m	0.17	0 sec	0m	0.22	3 sec	9m
	PM	0.07	9 sec	2m	0.15	0 sec	0m	0.21	3 sec	9m

Note: Background traffic scenarios have not been analysed as the upgraded form will only be utilised by development traffic scenarios