

DOUBLE BAY TRANSPORT STUDY

Prepared for Woollahra Municipal Council

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Quality Assurance

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Executive Summary

Background and Introduction

SCT Consulting has been engaged by Woollahra Municipal Council (WMC) to undertake a transport study to support a review of existing planning controls for the Double Bay Town Centre. The objectives of the study include a need to:

- Obtain an understanding of the existing parking, traffic and transport conditions within the Double Bay Town Centre;
- Identify the potential parking, traffic and transport implications from additional mixed residential and non-residential development in selective parts of the Double Bay Town Centre;
- Identify what additional development the Double Bay Town Centre can accommodate before key intersections and road network cease to function efficiently;
- Identify if the proposed closure of Knox Street between Bay Street and Goldman Lane will have any adverse impacts on the operation of the surrounding road network.
- Identify strategies, policies and network improvement measures to mitigate those implications – if required; and
- Identify measures to encourage active and public transport usage in association with people living, visiting and working in the Double Bay Town Centre.

Existing Conditions

The Double Bay Town Centre benefits from strong accessibility to the surrounding public transport system. The Double Bay Ferry Wharf is located on the northern extent of the town centre, Edgecliff Station is within walking distance from the town centre and high frequency buses are available along New South Head Road.

There are two ferry services per hour during the AM and PM peak hour periods on the F7 Eastern Suburbs Ferry line, providing access to Circular Quay, Rose Bay and Watsons Bay. Bus and train services provide access to surrounding sub-regional centres and to the City throughout the day. Trains travel to Edgecliff Station with a frequency of more than 16 services per hour on the T4 Eastern Suburbs and Illawarra Line during the AM and PM peak periods. Bus services provide accessibility to the City, Barangaroo, Bondi Junction, Vaucluse, and Watsons Bay. Customer patronage of bus services was gathered for the month of August 2016 and August 2017 for comparative purposes. The results of this analysis indicate an increase in the number of passengers boarding and alighting at Double Bay in 2017 when compared to 2016. During the AM and PM peak hour, a total of six inbound bus services were identified as exceeding seating capacity, however, given the number of services to the area there is spare capacity on the bus network within the town centre.

Bay Street and Cross Street are identified as key bicycle routes on the WMC “Cycling in Waverley and Woollahra cycle map”. These routes are marked as part of the on-road cycle network and traverse the town centre through low traffic volume corridors. Town centre bicycle routes connect to the wider network via New South Head Road to the west, Manning Road and Bellevue Road to the south-east, and via William Street to the north east.

Pedestrian footpaths and facilities are provided through wide paved footpaths on both sides of the carriageway and raised zebra crossings throughout the town centre. On New South Head Road signalised pedestrian crossings are provided at intersections with Manning Road, Knox Street, Kiaora Road and Bellevue Road, providing safe crossing locations and access to the surrounding facilities and public transport network.

Within the town centre, there are low traffic volumes and no notable causes for traffic delay or congestion. On New South Head Road congestion and high traffic volumes were identified during AM and PM peak hour periods in the peak direction of travel. During the AM peak hour, westbound queues and congestion originating at New South Head Road / Ocean Street extend into and impact the operational performance of New South Head Road / Manning Road.

The intersection of New South Head Road / Cross Street / Bellevue Road / Kiaora Road is also identified as a pinch point within the corridor, with queuing of 200m observed along Bellevue Road during the AM peak. During the PM peak, safety and operational efficiency concerns were noted on the dual right turn movement from New South Head Road (W leg) to Kiaora Road (SW leg) and Bellevue Road (S leg).

Potential Growth

As a result of the outcomes of the Double Bay Economic Feasibility Study (July 2015) WMC officers have undertaken a review of the existing planning controls for the Double Bay Town Centre. This review investigated a series of site-specific uplifts to both height and floor space ratio controls to facilitate more viable mixed use development. This uplift would be wholly accommodated in the Cross Street Precinct, an area defined as the southern side of Cross Street between Knox Lane and Bay Street.

WMC staff prepared a hypothetical development scenario based on the proposed amendment to the development controls in the Cross Street Precinct. When compared to the current built form, the proposed amendments could facilitate:

- An uplift of 222 parking spaces and 282 people across a potential expansion of residential, commercial and retail land uses.

Under the above scenario construction would be completed by 2027.

Trip Generation and Traffic Impacts

Overall the potential development supports best practice transit oriented development principles, by providing increased residential and employment density in proximity to existing transport infrastructure.

Internally the proposal encourages sustainable transport use with a permeable layout providing easy access to public transport and existing pedestrian and bicycle facilities. The Cross Street Precinct has access to the public transport system via train, bus and ferry travelling immediately adjacent to the town centre and providing connections to surrounding sub-regional centres and to the City throughout the day. Existing services have sufficient capacity to meet the number of additional public transport trips due to the potential development.

At full development, the potential development uplift could generate up to 59 vehicle trips during the AM peak, 99 vehicle trips during the PM peak and 98 trips during the Saturday peak period. Vehicle access to and from the potential development will be via existing service roads throughout the town centre.

Modelling analysis indicates that under the assessed 2027 forecast demands, which also account for the Knox Street closure network change, all intersections within the network continue to operate at an acceptable level of performance and within capacity under all periods. No major network modifications were identified as being required. This is due to the minor impact the development uplift has on trip generation.

Recommended Traffic and Transport Strategies

Regardless of the low level of impact identified traffic and transport strategies can play a vital role in improving the movement and place outcomes for the Double Bay Town Centre. To enhance the outcomes for the Double Bay Town Centre, the following series of strategies / policies have been identified for consideration:

- Provide additional car share (Go Get) spaces on street within WMC as well as in dedicated parking spaces within new developments and WMC car parks. WMC may also investigate the use of car share schemes in conjunction with certain residences not being eligible for access to residential parking permit schemes;
- Evaluate existing parking controls within the Woollahra Development Control Plan (2015) as well as considering pricing mechanisms to encourage reassignment of mode choice;
- Monitor public transport patronage to determine the needs of residents and evaluate the success of public transport improvements;
- Lobby Transport for NSW for additional services to the Double Bay Ferry Wharf to increase the attractiveness of the mode as a viable alternative to rail and bus connections to the Sydney CBD;
- Introduce a Travel Demand Management Program within Double Bay businesses;
- Consider expanding the current residential parking permit scheme beyond existing limits; and
- Introducing programs like walking groups promoted by the Heart Foundation and walk to school programs to help encourage a modal shift from private vehicles to walking and cycling.

In addition, there are several network improvements options available to WMC to ensure that traffic efficiency is improved within the Town Centre and an increased number of trips by active transport is supported, such as:

- Formalise Line Marking (Knox Street) to improve lane discipline and reduce the occurrence of vehicles queuing in the centre lane and reducing available storage space;

- Removal of two kerbside parking spaces on Knox Street during the AM peak will facilitate greater access to the left turn lane and provide greater efficiency for the operation of the New South Head Road / Knox Street intersection;
- Keep clear pavement markings are proposed at the intersection of Ocean Avenue / Cooper Street to prevent cars from queuing into the intersection footprint and preventing the right turn movement from Ocean Avenue to Cooper Street;
- Developing and delivering active transport projects in line with the WMC Active Transport Plan (2021); and
- Investigate opportunities to improve pedestrian amenity and crossing opportunities along key walking routes.

Conclusion

The Double Bay Transport Study has centred on the assessment of a potential development scenario in the Cross Street Precinct, the closure of Knox Street between Bay Street and Goldman Lane, and the identification of associated impacts for the Double Bay Town Centre. The assessment has found that:

- Existing public transport servicing the Double Bay Town Centre has sufficient capacity to meet increased travel demand associated with the area's potential growth and expansion;
- Existing active transport infrastructure within and around the Double Bay Town Centre is suitable to cater for the increase in population caused by potential growth within the centre, however, further steps can be taken to increase walking and cycling as viable modes. These items are contained within the WMC Active Transport Plan (2021); and
- The Double Bay Town Centre will be able to successfully cater for the proposed expansion and network modifications on Knox Street. Outcomes can be enhanced through the application of various strategies / policies, as noted above.

1.0 Introduction

1.1 Background

As a result of the Double Bay Place Plan being adopted by WMC in December 2014 the following actions were requested:

- Commission an economic study to examine the opportunities for an additional residential population accommodated in Double Bay in smaller apartments with car share
- Report the outcome of that study to WMC and amend planning controls (LEP and DCP) as required to encourage new moderate scale housing.

The outcomes of the Double Bay Economic Feasibility Study (July 2015) have resulted in WMC officers undertaking a review of the existing planning controls for the Double Bay Town Centre. This review investigated a series of precinct specific uplifts to both height and floor space ratio controls to facilitate more viable mixed use development.

The review has been undertaken in alignment with the nine-point liveability framework in the Greater Sydney Commission's Draft Central District Plan (2016). Specific reference in the document is made regarding the need to have healthy, connected communities through the use of public transport, walking and cycling.

Based on the outcome of the above-mentioned documentation the Double Bay Town Centre study area is defined within **Figure 1–1**.

1.2 Objectives

At the completion of the study the following objectives will have been achieved:

- Obtain an understanding of the existing traffic and transport conditions within the Double Bay Town Centre;
- Identify the potential traffic and transport implications from additional mixed residential and non-residential development in selective parts of the Double Bay Town Centre;
- Identify measures to mitigate those implications;
- Identify what additional development the Double Bay Town Centre can accommodate before the intersections and road network cease to function efficiently; and
- Identify measures to encourage increased liveability (connectivity) in association with people living in, visiting and working in the Double Bay Town Centre.

1.3 Report Structure

This report has been structured into the following sections:

- **Section 2** documents the site observations taken of the traffic and transport performance of the study area;
- **Section 3** provides an overview of existing transport demographics within the study area;
- **Section 4** provides an overview of existing intersection operational conditions for the Double Bay Town Centre;
- **Section 5** outlines the hypothetical development yield, trip generation and associated intersection performance results;
- **Section 7** outlines various strategies/policies and mitigation measures to accommodate the potential growth of trips within the study area of the Double Bay Town Centre;

Figure 1-1 Double Bay Transport Study Area



Source: SCT Consulting; 20211

2.0 Site Observations

To gain an understanding of the existing operational conditions, and identify existing issues within the study area, multiple site visits were undertaken on Wednesday 30th August 2017, Thursday 31st August 2017 and Saturday 2nd September 2017. Key observations recorded during this time are noted below with the location of key intersections highlighted in **Figure 1-1**.

2.1 Cross Street / Bay Street

During the AM, PM and Saturday peak periods no notable congestion issues were observed at the intersection of Cross Street / Bay Street. Two wombat crossings and two uncontrolled crossings are available at the intersection with pram ramps located on both sides of the crossing. An illustration of the observed on-site traffic conditions is provided in **Figure 2-1**, **Figure 2-2** and **Figure 2-3**.

Figure 2-1 Cross Street / Bay Street (AM Peak)



Figure 2-2 Cross Street / Bay Street (PM Peak)



Figure 2-3 Cross Street / Bay Street (Saturday Peak)



Source: SCT Consulting; 2021

2.2 William Street / Bay Street

During the AM, PM and Saturday peak periods no notable congestion issues were observed at the intersection of William Street / Bay Street. Two wombat crossings and two uncontrolled crossings are available at the intersection with pram ramps located on both sides of the crossing. An illustration of the observed on-site traffic conditions is provided in **Figure 2-4**, **Figure 2-5** and **Figure 2-6**.

Figure 2-4 William Street / Bay Street (AM Peak)



Figure 2-5 William Street / Bay Street (AM Peak)



Figure 2-6 William Street / Bay Street (AM Peak)



Source: SCT Consulting; 2021

2.3 Ocean Avenue / Greenoaks Avenue

During the AM, PM and Saturday peak periods no notable congestion issues were observed at the intersection of Ocean Avenue / Greenoaks Avenue. However, vehicles turning right from Ocean Avenue to Cooper Street at the nearby Ocean Avenue / Cooper Street intersection were observed to cause occasional delay to the northbound through movement on Ocean Avenue. This is due to southbound vehicles on Ocean Avenue queuing through the intersection of Ocean Avenue / Cooper Street and preventing the abovementioned right turn movement. Pedestrians are given some visibility while crossing Greenoaks Avenue via a pedestrian island as well as north of the intersection along Ocean Avenue where there is also a pedestrian island. Both crossings have a pram ramps located on either side. An illustration of the observed on-site traffic conditions is provided in **Figure 2-7, Figure 2-8 and Figure 2-9.**

Figure 2-7 Ocean Avenue / Greenoaks Avenue (AM Peak)



Figure 2-8 Ocean Avenue / Greenoaks Avenue (PM Peak)



Figure 2-9 Ocean Avenue / Greenoaks Avenue (Sat Peak)



Source: SCT Consulting; 2021

2.4 New South Head Road / Bay Street

During the PM and Saturday peak periods no notable congestion issues were observed at the intersection of New South Head Road / Bay Street. However, during the AM peak period congestion was noted for the westbound (citybound) movement. This is due to the signalised intersection of New South Head Road / Ocean Street which restricts the through movement on New South Head Road due to the available green time. Pedestrians cross Bay Street using an uncontrolled crossing with kerb extensions on either side to give pedestrians more visibility as they cross the road. Pram ramps are provided on both sides of the crossing, Pedestrians cannot cross New South Head Road at this intersection An illustration of the observed on-site traffic conditions is provided in **Figure 2–10, Figure 2–11 and Figure 2–12.**

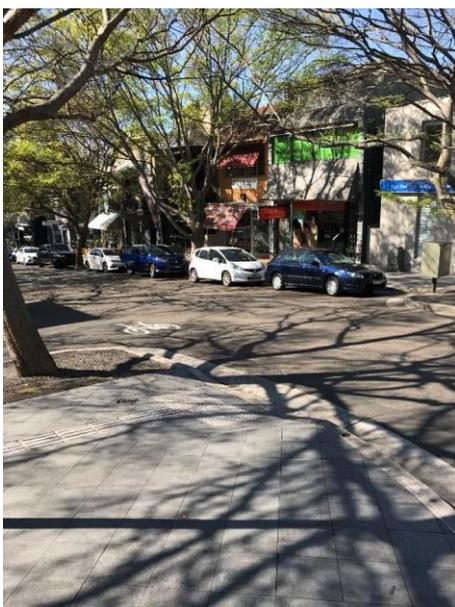
Figure 2–10 NSH Road / Bay Street (AM Peak)



Figure 2–11 NSH Road / Bay Street (PM Peak)



Figure 2–12 NSH Road / Bay Street (Sat Peak)



Source: SCT Consulting; 2021

2.5 New South Head Road / Manning Road

During the PM and Saturday peak periods the queue for the right turn movement from New South Head Road to Manning Road was observed to extend beyond the provided storage bay. This impedes the eastbound through movement on New South Head Road and induces localised congestion, particularly during the PM peak.

During the AM peak period congestion was noted for the westbound (citybound) movement. This is due to the signalised intersection of New South Head Road / Ocean Street which restricts the through movement on New South Head Road due to the available green time. The signalised through movement recorded a minimum of 15 seconds dead green time per cycle based on-site observations and a reduction in free flow capacity. An illustration of the observed on-site traffic conditions is provided in **Figure 2–13, Figure 2–14 and Figure 2–15.**

Manning Road experienced moderate levels of congestion in the AM peak for the left turn movement to New South Head Road (citybound direction of travel). As noted above this is due to the queue which extends from the intersection of New South Head Road / Ocean Street, restricting the capacity of the intersection.

Pedestrians cross Manning Road and New South Head Road using signalised crossings available at all approaches. Pram ramps are provided on both sides of all crossings,

Figure 2–13 NSH Road / Manning Road (AM Peak)

Figure 2–14 NSH Road / Manning Road (PM Peak)



Figure 2–15 NSH Road / Manning Road (Sat Peak)



Source: SCT Consulting; 2021

2.6 New South Head Road / Knox Street

In isolation, the intersection of New South Head Road / Knox Street would experience minimal delays due to the two phase signal operation. However, the intersection is impacted upon by queuing caused due to the reduced throughput at the intersection of New South Head Road / Manning Road. In the AM peak, whilst parking is removed in the kerbside lane, delays are most prominent due to the westbound peak direction of travel.

During the PM peak period queuing was also observed due to the reduction in through lane capacity from three to two. This factor, when combined with the introduction of parking in the kerbside lane, was noted as the reason for the observed delays.

The right turn movement from New South Head Road to Knox Street is currently permitted from the centremost through lane. This was observed, in all peak periods, to result in vehicles stopping and restricting the throughput of vehicles with flow on impacts at the intersection of New South Head Road / Cross Street / Bellevue Road / Kiaora Road. Vehicles were also observed to make late and sudden lane changing manoeuvres upon encountering a stopped vehicle, resulting in an increased risk of a traffic accident.

Lastly, vehicles were unable to access the kerbside lane on Knox Street to turn left onto New South Head Road due to the following two factors:

- Inadequate line marking resulting in vehicles queuing over the centreline and reducing the available lane width
- The queue for right turning vehicles extending beyond the start of parking spaces (AM peak only)

Pedestrians cross Knox Street and New South Head Road using signalised crossings available on all approaches. Pram ramps are provided on both sides of all crossings,

An illustration of the observed on-site traffic conditions is provided in **Figure 2–16**, **Figure 2–17** and **Figure 2–18**.

Figure 2–16 NSH Road / Knox Street (AM Peak)



Figure 2–17 NSH Road / Knox Street (PM Peak)



Figure 2–18 NSH Road / Knox Street (Sat Peak)



Source: SCT Consulting; 2021

2.7 New South Head Road / Cross Street / Bellevue Road / Kiaora Road

The intersection of New South Head Road / Cross Street / Bellevue Road / Kiaora Road is characterised by five approach / departure legs. Site observations, in the AM, PM and Saturday peak periods noted that this impacts upon the operational efficiency of the intersection due to the additional phasing for all movements with associated intergreen delay.

Of all the intersections observed within the study area this location was the poorest performing across the AM, PM and Saturday peak periods.

In the AM peak queuing was observed to extend for over 200m along Bellevue Road for the left turn movement to New South Head Road. The queue blocked the single lane of traffic and prevented vehicles from accessing the centre lane on the approach to the signalised intersection. This resulted in dangerous driving from motorists who were observed to drive on the wrong side of the road to overtake queued vehicles.

In the PM peak safety and operational efficiency concerns were noted due to the dual right turn movement from New South Head Road (W leg) to Kiaora Road (SW leg) and Bellevue Road (S leg). This impacts the intersection as follows:

- Vehicles turning right in Kiaora Road are delayed due to the spacing from the New South Head Road (E leg) stop line. Note that in the PM peak these vehicles were observed to turn right through queued vehicles and, on one occasion, a near miss occurred with a vehicle travelling in the kerbside lane was unable to see the turning vehicle.
- No dedicated right turn movement is provided to vehicles turning right to Bellevue Road (S leg). This results in vehicles only achieving this movement during the phase intergreen. In the event that a vehicle is turning right in to Kiaora Road (SE leg) this movement is unable to occur and the vehicle must wait until the intergreen at the end of the next cycle.

Pedestrians cross Kiaora Road, Cross Street, Bellevue Road and New South Head Road using signalised crossings available on all approaches. Pram ramps are provided on both sides of all crossings.

An illustration of the observed on-site traffic conditions is provided in **Figure 2–19, Figure 2–20 and Figure 2–21.**

Figure 2-19 NSH Road / Cross Street / Bellevue Road / Kiaora Road (AM Peak)



Figure 2-20 NSH Road / Cross Street / Bellevue Road / Kiaora Road (PM Peak)



Figure 2-21 NSH Road / Cross Street / Bellevue Road / Kiaora Road (Sat Peak)



Source: SCT Consulting; 2021

3.0 Existing Transport Demographics

Section 3 provides an overview of existing transport demographics, excluding road network performance, which is discussed in **Section 4**.

3.1 Journey to Work Data

Analysis of Journey to Work Data (Travel Zones 535, 536, 537 and 541) from the 2011 Census¹ is provided in **Table 3-1**. The data indicates that the Double Bay Town Centre contains a high proportion (54 per cent) of individuals who utilise public and active transport to access their place of employment. The highest percentage of mode share is based on the Vehicle (Driver) category which accounts for 37 per cent of total trips.

Contrastingly, only 30 per cent of people utilise public transport to commute to the Double Bay Town Centre. Vehicle (Driver) as a proportion of overall mode share increases to 63 per cent. This statistic is noteworthy when compared against the geographic location of employees (**Table 3-2**) which shows that 54 per cent of people who work in the Double Bay Town Centre live in proximity within the Eastern Suburbs.

A total of 78 per cent of Double Bay Town Centre residents journey to work trips are to the inner city of Sydney or Eastern Suburbs (North) areas. This concentration of residential and employment land uses encourages a higher proportion of walking trips as a mode, reported as 12 per cent. Should these trends continue, or be enhanced in the future, greater focus and investment on active transport as a key travel mode could be realised. An increased proportion of individuals working from home also has the potential to disrupt traditional travel patterns.

Table 3-1 Journey to Work Mode Data – Double Bay Town Centre

| Mode | From Double Bay Town Centre | | To Double Bay Town Centre | |
|---------------------|-----------------------------|-------------|---------------------------|-------------|
| | Value | Percentage | Value | Percentage |
| Vehicle (Driver) | 604 | 37% | 1,737 | 63% |
| Vehicle (Passenger) | 67 | 4% | 108 | 4% |
| Train | 552 | 34% | 435 | 16% |
| Bus | 68 | 4% | 110 | 4% |
| Walked only | 192 | 12% | 262 | 10% |
| Ferry / Tram | 67 | 4% | - | - |
| Other | 50 | 3% | 53 | 2% |
| Mode not stated | 26 | 2% | 31 | 1% |
| Total | 1,881 | 100% | 3,142 | 100% |

Source: <http://visual.bts.nsw.gov.au/itwdynamic/>; 2017, modified by SCT Consulting; 2021

¹ 2016 data not available at time of publication

Table 3-2 Journey to Work Origin / Destination Data (Top 5) – Double Bay Town Centre

| Origin / Destination | From Double Bay Town Centre (Destination) | | To Double Bay Town Centre (Origin) | |
|----------------------------------|---|------------|------------------------------------|------------|
| | Value | Percentage | Value | Percentage |
| Sydney (Inner City) | 953 | 51% | 309 | 10% |
| Eastern Suburbs (North) | 513 | 27% | 1,341 | 43% |
| North Sydney – Mosman | 99 | 5% | - | - |
| Eastern Suburbs (South) | 40 | 2% | 342 | 11% |
| Chatswood – Lane Cove | 40 | 2% | - | - |
| Kogarah – Rockdale | - | - | 87 | 3% |
| Strathfield – Burwood - Ashfield | - | - | 86 | 3% |
| Total | 1,645 | 87% | 2,165 | 70% |

Source: <http://visual.bts.nsw.gov.au/itwdynamic/>; 2017, modified by SCT Consulting; 2021

3.2 Household Travel Survey

Double Bay Town Centre sits within the statistical area “Eastern Suburbs (North)” as defined by the Australian Bureau of Statistics within the 2015/2016 Household Travel Survey.

For the purpose of analysis, it has been assumed that Journey to Work data provides a suitable reflection of the travel characteristics during AM and PM peak hour periods, due to the high proportion of trips during this timeframe associated with journey to work trips.

Analysis of the 2015/2016 Household Travel Survey, which is reflective of travel characteristics of residents throughout an average weekday, indicates that over 50 per cent of trips made by residents of statistical area “Eastern Suburbs (North)” are likely to be associated with shopping, personal, business and social and recreational activities. Trips of this nature are likely to account for a high proportion of trips that are made on a Saturday peak.

On this basis, the Household Travel Survey for “Eastern Suburbs (North)” is considered reflective of the trips likely to be made in Double Bay during the Saturday peak period and reflect typical travel characteristic and mode choice associated with these trips.

Table 3-3 and **Table 3-4** provides a summary of the purpose of travel and overall mode choice by residents of Eastern Suburbs (North) associated with these trip purposes compared against the Sydney average and the districts of Manly, Parramatta and Penrith.

There is a relatively consistent comparison regarding trip purpose between Eastern Suburbs (North) and Sydney. The main differences are within the social / recreation trip purpose which is higher in the Eastern Suburbs (North) area, compared to Sydney, with an overall percentage of total trips of 26 versus 22. The Eastern Suburbs (North) area also makes fewer education trips, five per cent, compared to Sydney at eight per cent.

When compared to the Manly, Parramatta and Penrith districts the primary differences noted are that the Eastern Suburbs (North) district has a greater percentage of social / recreational trips and a reduction in trips which are to serve a passenger.

Regarding mode share the Eastern Suburbs (North) area has a higher proportion of walk trips, 30 per cent, compared to Sydney with 17 per cent. This is attributable to the higher density of the eastern suburbs and associated urban design outcomes and is also reflected in the lower proportion of trips recorded in the Eastern Suburbs for the Vehicle (Driver) and Vehicle (Passenger) categories. This is also evidenced when comparing mode share within Manly, Parramatta and Penrith. The greater the density, as shown with Manly and Parramatta, the greater the proportion of walking trips and trips by public transport.

Table 3-3 Household Travel Survey – Residents within Eastern Suburbs (North) and Sydney: Trip purpose

| Travel by purpose | Eastern Suburbs (North) | Sydney | Manly | Parramatta | Penrith |
|-----------------------|-------------------------|-------------|-------------|-------------|-------------|
| Commute | 11% | 11% | 12% | 13% | 14% |
| Work related business | 9% | 8% | 5% | 5% | 13% |
| Education / childcare | 5% | 8% | 6% | 9% | 10% |
| Shopping | 13% | 14% | 13% | 13% | 11% |
| Personal business | 3% | 4% | 5% | 3% | 4% |
| Change mode of travel | 14% | 14% | 15% | 17% | 8% |
| Social / recreation | 26% | 22% | 23% | 17% | 18% |
| Serve passenger | 14% | 17% | 18% | 19% | 19% |
| Other | 5% | 3% | 3% | 4% | 2% |
| Total | 100% | 100% | 100% | 100% | 100% |

Source: <https://www.transport.nsw.gov.au/performance-and-analytics/passenger-travel/surveys/household-travel-survey/statistical-area-level-3>, accessed 30/10/2018

Table 3-4 Household Travel Survey – Residents within Eastern Suburbs (North) and Sydney: Mode Choice

| Mode | Eastern Suburbs (North) | Sydney | Manly | Parramatta | Penrith |
|---------------------|-------------------------|-------------|-------------|-------------|-------------|
| Vehicle (Driver) | 41% | 48% | 39% | 42% | 57% |
| Vehicle (Passenger) | 13% | 21% | 20% | 20% | 24% |
| Train | 6% | 6% | 3% | 7% | 3% |
| Bus | 5% | 6% | 6% | 7% | 5% |
| Walk only | 30% | 17% | 25% | 23% | 9% |
| Other | 4% | 2% | 8% | 1% | 1% |
| Total | 100% | 100% | 100% | 100% | 100% |

Source: <https://www.transport.nsw.gov.au/performance-and-analytics/passenger-travel/surveys/household-travel-survey/statistical-area-level-3>, accessed 30/10/2018

3.3 Public Transport²

3.3.1 Ferry

3.3.1.1 Services

The Double Bay Ferry Wharf is located on the northern extent of the study area and on the F7 Eastern Suburbs Ferry line. A summary of services to and from the wharf is provided in **Table 3-5**. The current peak hour frequency of two services per hour is challenging to attract significant patronage increases due to the competing high frequency modes of bus and rail. A greater number of services has the potential to increase demand as customers will be able to use the ferry on a 'turn up and go' basis as opposed to using a timetable or high frequency bus services on New South Head Road.

Table 3-5 Double Bay Ferry Wharf Services (Monday to Friday)

| Time Period | Inbound (To Circular Quay) | Outbound (From Circular Quay) |
|-------------|--------------------------------------|--|
| Before 7AM | 6:48AM | - |
| 7AM – 9AM | 7:18AM 7:48AM 8:18AM 8:48AM | 7:14AM 7:44AM 8:14AM 8:44AM |
| 9AM – 4PM | 9:51AM 10:51AM 11:21AM 11:51AM | 9:32AM 3:22PM |
| 4-6PM | 5:49PM | 4:19PM 4:51PM 5:46PM |
| After 6PM | 6:19PM 6:49PM 7:19PM | 6:16PM 6:46PM 7:16PM 8:06PM 9:06PM 10:06PM [^] 11:06PM [^] |

[^] Friday only

Source: Transport for NSW; 2018

3.3.1.2 Patronage

Customer patronage of ferry services utilising the Double Bay Ferry Wharf was gathered for the month of August 2016 and August 2017 for comparative purposes. The results of this analysis, provided for Tuesday, Wednesday and Thursdays only, is provided in **Table 3-6**. Overall, trips originating from the Double Bay Ferry Wharf were observed to increase for the month of August, across the 12 month period, by a total of 117. For destination trips to Double Bay a total of 161 fewer people was recorded. These results should be considered in line with the additional ferry services that were provided across this time period. Further, the change in timetables on 26 November 2017 which alters the stopping pattern of ferries accessing the Double Bay wharf is not reflected in the below dataset. It is recommended that this information be reviewed again in August 2018 to determine the impact of these changes.

Table 3-6 Double Bay Ferry Wharf Patronage (August 2016 vs August 2017)

| Time Period | Inbound (To Circular Quay) | | | Outbound (From Circular Quay) | | |
|-------------|----------------------------|-------------|------------|-------------------------------|-------------|------------|
| | August 2016 | August 2017 | Difference | August 2016 | August 2017 | Difference |
| 6 - 6:59 | 136 | 143 | 7 | - | - | - |
| 7 - 7:59 | 807 | 752 | -55 | 50 | 28 | -22 |
| 8 - 8:59 | 918 | 918 | 0 | 32 | 57 | 25 |
| 9 - 9:59 | 115 | 165 | 50 | 42 | 39 | -3 |
| 10 - 10:59 | 111 | 101 | -10 | 21 | 18 | -3 |
| 11 - 11:59 | 201 | 181 | -20 | 67 | 58 | -9 |
| 12 - 12:59 | 5 | 4 | -1 | 1 | 1 | 0 |

² Service, patronage and capacity figures are reflective of timetable prior to revision on 26 November 2017

| Time Period | Inbound (To Circular Quay) | | | Outbound (From Circular Quay) | | |
|--------------|----------------------------|--------------|------------|-------------------------------|--------------|-------------|
| | August 2016 | August 2017 | Difference | August 2016 | August 2017 | Difference |
| 13 - 13:59 | 69 | 40 | -29 | 111 | 92 | -19 |
| 14 - 14:59 | 30 | 34 | 4 | 79 | 79 | 0 |
| 15 - 15:59 | 28 | 36 | 8 | 103 | 157 | 54 |
| 16 - 16:59 | 36 | 72 | 36 | 315 | 255 | -60 |
| 17 - 17:59 | 104 | 65 | -39 | 333 | 333 | 0 |
| 18 - 18:59 | 52 | 45 | -7 | 600 | 511 | -89 |
| 19 - 19:59 | 19 | 14 | -5 | 167 | 144 | -23 |
| 20 - 20:59 | 3 | 6 | 3 | 79 | 69 | -10 |
| 21 - 21:59 | 1 | 1 | 0 | 47 | 45 | -2 |
| Total | 2,635 | 2,752 | 117 | 2,047 | 1,886 | -161 |

Source: Transport for NSW; 2017

3.3.1.3 Capacity

Capacity figures for ferries operating to and from Double Bay were unable to be obtained for the purposes of this study.

3.3.2 Bus

3.3.2.1 Services

The Double Bay Transport study area contains four bus stops, as shown in **Figure 1-1** and **Table 3-7** which provides a summary of bus stops and associated services.

Table 3-7 Double Bay Town Centre: Bus Stops and Services

| Stop ID | Location | Services |
|---------|--|---|
| 202819 | New South Head Road (EB), near Knox Street | <ul style="list-style-type: none"> Route 323: City <> Dover Heights Route 324: City <> Watsons Bay Route 325: City <> Watsons Bay Route 326: City <> Bondi Junction |
| 202833 | New South Head Road (WB), opposite Knox Street | <ul style="list-style-type: none"> Route 323: City <> Dover Heights Route 324: City <> Watsons Bay Route 325: City <> Watsons Bay Route 326: City <> Bondi Junction |
| 202812 | Manning Road (NB), near New South Head Road | <ul style="list-style-type: none"> Route 327: City <> Bondi Junction |
| 202813 | Manning Road (SB), near New South Head Road | <ul style="list-style-type: none"> Route 327: City <> Bondi Junction |

Source: SCT Consulting; 2021

During peak hour periods, bus stops adjacent to the town centre are offered a high frequency of services with Double Bay being well connected to surrounding areas and Edgecliff Station.

During the AM peak period, there are approximately 15 and 11 services travelling to and from Edgecliff, respectively. During the PM peak, 11 services travel towards Edgecliff whilst 13 services travel in the eastbound direction. There has been minimal change in the number of bus services to the area between 2016 and 2017, with only one additional service offered in the outbound direction during the day.

The number of buses per hour that service the bus stops adjacent to the Double Bay Town Centre are summarised in **Table 3-8**.

Table 3-8 Bus Services per hour (1st week of August 2016 vs 1st week of August 2017)

| Time Period | Inbound (To Edgecliff) | | Outbound (From Edgecliff) | |
|-------------|------------------------|------|---------------------------|------|
| | 2016 | 2017 | 2016 | 2017 |
| Before 7AM | 3 | 3 | 4 | 4 |
| 7AM – 9AM | 15 | 15 | 11 | 11 |
| 9AM – 3PM | 6 | 6 | 6 | 7 |
| 3-7PM | 11 | 11 | 13 | 13 |
| After 7PM | 4 | 4 | 4 | 4 |

Source: Transport for NSW; 2017, modified by SCT Consulting; 2021

3.3.2.2 Patronage

Analysis of Opal Data indicates that there was an increase in the number of passengers boarding and alighting at Double Bay in 2017, when compared to 2016. In 2017, a total of 161 additional passengers boarded, equivalent to a seven per cent increase to 2016 passengers. There was a 15 per cent increase in the number of passengers alighting in 2017, equivalent to 187 passengers.

A comparison of 2016 and 2016 bus patronage is summarised in **Table 3-9**.

Table 3-9 Bus Service Patronage (1st week of August 2016 vs 1st week of August 2017)

| Stop ID | Tap On | | | Tap Off | | |
|---------------|--------|------|------------|---------|------|------------|
| | 2016 | 2017 | Difference | 2016 | 2017 | Difference |
| 202812 | | | | | | |
| All day | 33 | 29 | -4 | 69 | 86 | 17 |
| 7-8AM | 4 | 2 | -2 | 11 | 9 | -2 |
| 8-9AM | 3 | 10 | 7 | 9 | 25 | 16 |
| 4-5PM | 6 | 2 | -4 | 7 | 2 | -5 |
| 5-6PM | 7 | 1 | -6 | 2 | 12 | 10 |
| 202813 | | | | | | |
| All day | 70 | 100 | 30 | 16 | 34 | 18 |
| 7-8AM | - | 1 | 1 | 1 | - | -1 |
| 8-9AM | 4 | 5 | 1 | 1 | 10 | 9 |
| 4-5PM | 13 | 15 | 2 | - | 4 | 4 |
| 5-6PM | 16 | 26 | 10 | 8 | 2 | -6 |
| 202819 | | | | | | |
| All day | 393 | 430 | 37 | 827 | 937 | 90 |

| Stop ID | Tap On | | | Tap Off | | |
|---------------|--------------|--------------|------------|--------------|--------------|------------|
| | 2016 | 2017 | Difference | 2016 | 2017 | Difference |
| 7-8AM | 15 | 19 | 4 | 85 | 108 | 23 |
| 8-9AM | 11 | 11 | - | 84 | 137 | 53 |
| 4-5PM | 47 | 61 | 14 | 52 | 63 | 11 |
| 5-6PM | 40 | 45 | 5 | 94 | 105 | 11 |
| 202833 | | | | | | |
| All day | 1,712 | 1,810 | 98 | 355 | 377 | 22 |
| 7-8AM | 126 | 125 | -1 | 10 | 20 | 10 |
| 8-9AM | 235 | 219 | -16 | 46 | 47 | 1 |
| 4-5PM | 114 | 156 | 42 | 20 | 26 | 6 |
| 5-6PM | 193 | 183 | -10 | 23 | 28 | 5 |
| Total | 2,208 | 2,369 | 161 | 1,247 | 1,434 | 187 |

Source: Transport for NSW; 2017

3.3.2.3 Capacity

Opal Data information (tap on / tap off) provided by Transport for NSW for the 2nd week of August 2016 and August 2017, indicates that during peak periods, a total of six inbound bus services per hour exceed seating capacity (45 seats), with two of these also exceeding standing capacity (59 passengers). This trend was evident in both 2016 and 2017. The number of service exceeding seating and standing capacity is summarised in **Table 3-10**. Compared against the number of services per hour to the area (**Table 3-8**), the analysis indicates that the majority of services are not over capacity and there is spare capacity on the network at this location. This is evidenced within **Table 3-11** which highlights the average spare capacity on services throughout a standard weekday in both 2016 and 2017.

Table 3-10 Number of services over seating (and standing) capacity per period per day (August 2016 vs August 2017)

| Time Period | Inbound (To Edgecliff) | | Outbound (From Edgecliff) | |
|-------------|------------------------|-------|---------------------------|-------|
| | 2016 | 2017 | 2016 | 2017 |
| Before 7AM | 0 | 0 | 2 (1) | 3 (1) |
| 7AM – 9AM | 6 (2) | 6 (2) | 1 | 2 |
| 9AM – 3PM | 1 | 4 (4) | 2 (1) | 0 |
| 3-7PM | 6 (1) | 7 (1) | 1 | 3 (1) |
| After 7PM | 1 | 1 | 0 | 0 |

Source: Transport for NSW; 2017

Table 3-11 Average Spare Capacity (August 2016 vs August 2017)

| Time Period | Inbound (To Edgecliff) | | Outbound (From Edgecliff) | |
|-------------|------------------------|------|---------------------------|------|
| | 2016 | 2017 | 2016 | 2017 |
| Before 7AM | 48 | 48 | 39 | 37 |
| 7AM – 9AM | 36 | 35 | 39 | 37 |
| 9AM – 3PM | 40 | 37 | 45 | 45 |
| 3-7PM | 38 | 37 | 45 | 43 |
| After 7PM | 47 | 46 | 48 | 47 |

Source: Transport for NSW; 2017

3.3.2.4 Average Speed

In relation to bus service performance the average bus speed through the Double Bay Town Centre is summarised in **Table 3-12**. The data indicates that there has been an increase in the average bus travel speed in 2017, when compared against equivalent time periods in 2016. This increase could be representative of an improvement in the prevailing road network conditions and / or greater passenger uptake of Opal which results in a reduction in bus dwell times. The attractiveness of public transport as a mode is therefore improved and, if communicated to travellers accessing/egressing Double Bay, can support further attitudinal changes towards public transport.

The most significant improvement is observed between 6am and 8am for the inbound (westbound) direction, with an average increase of 4km/h in travel speed for trips toward Edgecliff. In the eastbound (outbound) direction, the average bus speed increased by 5km/h in 2017 between 3pm and 4pm, when compared against 2016 bus speeds for the same time period.

Table 3-12 Average Speed (August 2016 vs August 2017)

| Time Period | Inbound (To Edgecliff) | | | Outbound (From Edgecliff) | | |
|----------------|------------------------|------|------------|---------------------------|------|------------|
| | 2016 | 2017 | Difference | 2016 | 2017 | Difference |
| 06:00 to 07:00 | 18 | 22 | 4 | 21 | 24 | 3 |
| 07:00 to 08:00 | 15 | 19 | 4 | 18 | 20 | 2 |
| 08:00 to 09:00 | 13 | 15 | 2 | 18 | 19 | 1 |
| 09:00 to 10:00 | 12 | 15 | 3 | 19 | 19 | 0 |
| 15:00 to 16:00 | 10 | 12 | 2 | 14 | 19 | 5 |
| 16:00 to 17:00 | 9 | 12 | 3 | 16 | 18 | 2 |
| 17:00 to 18:00 | 12 | 13 | 1 | 15 | 18 | 3 |
| 18:00 to 19:00 | 15 | 15 | 0 | 16 | 20 | 4 |

Source: Transport for NSW; 2017

3.3.3 Train

3.3.3.1 Services

Edgecliff Station is located to the south-west of the study area, approximately 400m and five minutes walking distance from the town centre. Edgecliff Station is on the T4 Eastern Suburbs and Illawarra Line and on the South Coast Line, these train lines provide direct access to Bondi Junction, the City, Sutherland and to Wollongong, whilst also interconnecting to the wider Sydney Train network.

Trains travel to/from this station with a frequency of 18 services, in each direction of travel, during the AM peak hour period. Sixteen outbound (to Bondi Junction) trains and 17 inbound (to Central) trains service the station in the PM peak hour. There are approximately seven train services per hour on Saturdays.

3.3.3.2 Patronage

Patronage figures for the current rail line have not been provided to inform this study however, an overall summation of patronage, regarding the maximum capacity of the line is discussed below in **Section 3.3.3.3**.

3.3.3.3 Capacity

Capacity, assessed in the form of peak loading, has been obtained from Transport for NSW for the time period of March 2016 on the T4 - Eastern Suburbs and Illawarra Line in the peak direction of travel. Capacity is assessed against the following two measures:

- 100% load: A seat is available for each passenger
- 135% load: The benchmark beyond which passengers experience crowding and dwell times that can impact on on-time running.

During the AM peak the peak direction of travel is from Waterfall, Hurstville and Cronulla towards the city. Of the 30 trains that operate between 7-9AM, based on their arrive time at Central Station, only one train exceeds the 135 per cent threshold and five trains exceed the 100 per cent threshold as measured at Kings Cross Station. This indicates a large degree of spare capacity to operate future growth for individuals travelling to Edgecliff Station.

In the PM peak, peak load measurements were undertaken at Martin Place Station for the T4 line. During the 4-6PM time period a total of 31 trains were recorded, based on the departure time from Central Station within this time period. Only one train was recorded as exceeding the 100 per cent threshold with no trains exceeding the 135 per cent threshold. As was noted in the AM peak this provides sufficient capacity to cater for potential growth in the Double Bay Town Centre.

3.4 Cycling Usage

An overview of key cycling routes, as well as dedicated walking paths, within and around the study area is provided in **Figure 3-1**.

Figure 3-1 Key Cycling routes



Source: WMC; 2007, modified by SCT Consulting; 2021

Bay Street and Cross Street are identified as key bicycle routes on the WMC ‘Cycling in Waverley and Woollahra Cycle Map’. These routes are marked as part of the on-road cycle network and traverse the town centre through low traffic volume corridors. Town centre bicycle routes connect to the wider network via New South Head Road to the west, Manning Road and Bellevue Road to the south-east and via William Street to the north east. No dedicated cycle routes are shown along New South Head Road within the Double Bay Town Centre, as identified in the Woollahra Bicycle Strategy (2009).

3.4.1.1 Existing Cycling Conditions

Cycling to and from Double Bay is currently observed to be difficult and potentially unsafe due to a lack of dedicated cycling infrastructure and topographical constraints. Multiple roads with steep grades make it difficult for cyclists to ride uphill with limited protection for cyclists.

Ocean Avenue between Cooper Street and New South Head Road and William Street between Sherbrooke Avenue and New South Head Road in particular, have very steep gradients making them a challenging environment for cyclists.

Sydney’s Cycling Future released by TfNSW in 2013 classified Sydney’s cycleway network into six and grouped them into three customer preference categories (shown in **Figure 3–2**).

Figure 3–2 Sydney’s Cycling future – facilities classification

| Facility Type | Preference |
|--|---|
|  Off road separated bicycle path (separated from pedestrians) |  |
|  On road separated bicycle path (physically separated from vehicles/ pedestrians) |  |
|  Mixed traffic lane on quiet local street |  |
|  Road shoulder |  |
|  Bicycle logo beside a parked car |  |
|  Mixed traffic lane on busy street |  |

| Facility Type Preference Ranking | |
|---|---|
|  | >75% feel quite or very safe and comfortable |
|  | As many feel safe and comfortable as unsafe and uncomfortable |
|  | >75% feel quite or very unsafe and uncomfortable |

Source: TfNSW, 2013, modified by SCT Consulting; 2021

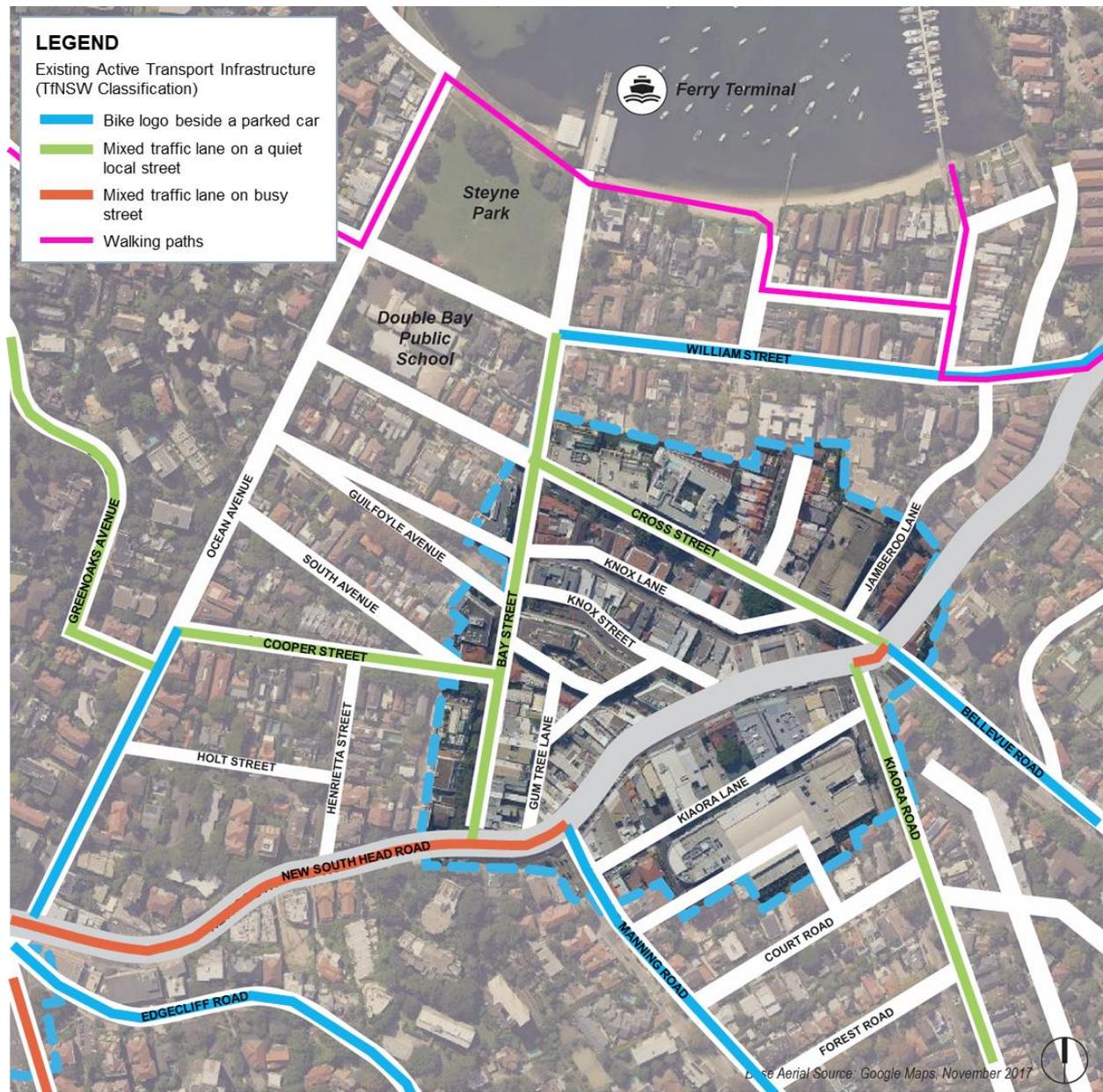
The Double Bay study area comprises of three cycleway classifications:

- “Mixed traffic lane on busy street” where the designated cycleway is located on a major arterial road such as New South Head Road;
- “Bicycle logo beside a parked car” where the designated cycleway is located on a major council road such as Ocean Avenue or where painted cycleways are located next to a parked car such as Bellevue Road; and
- “Mixed traffic lane on a quiet local street” where the designated cycleway is located on a minor council road such as Cooper Street.

There are currently no cycleways within the Double Bay study area where “>75% feel quite or very safe and comfortable”.

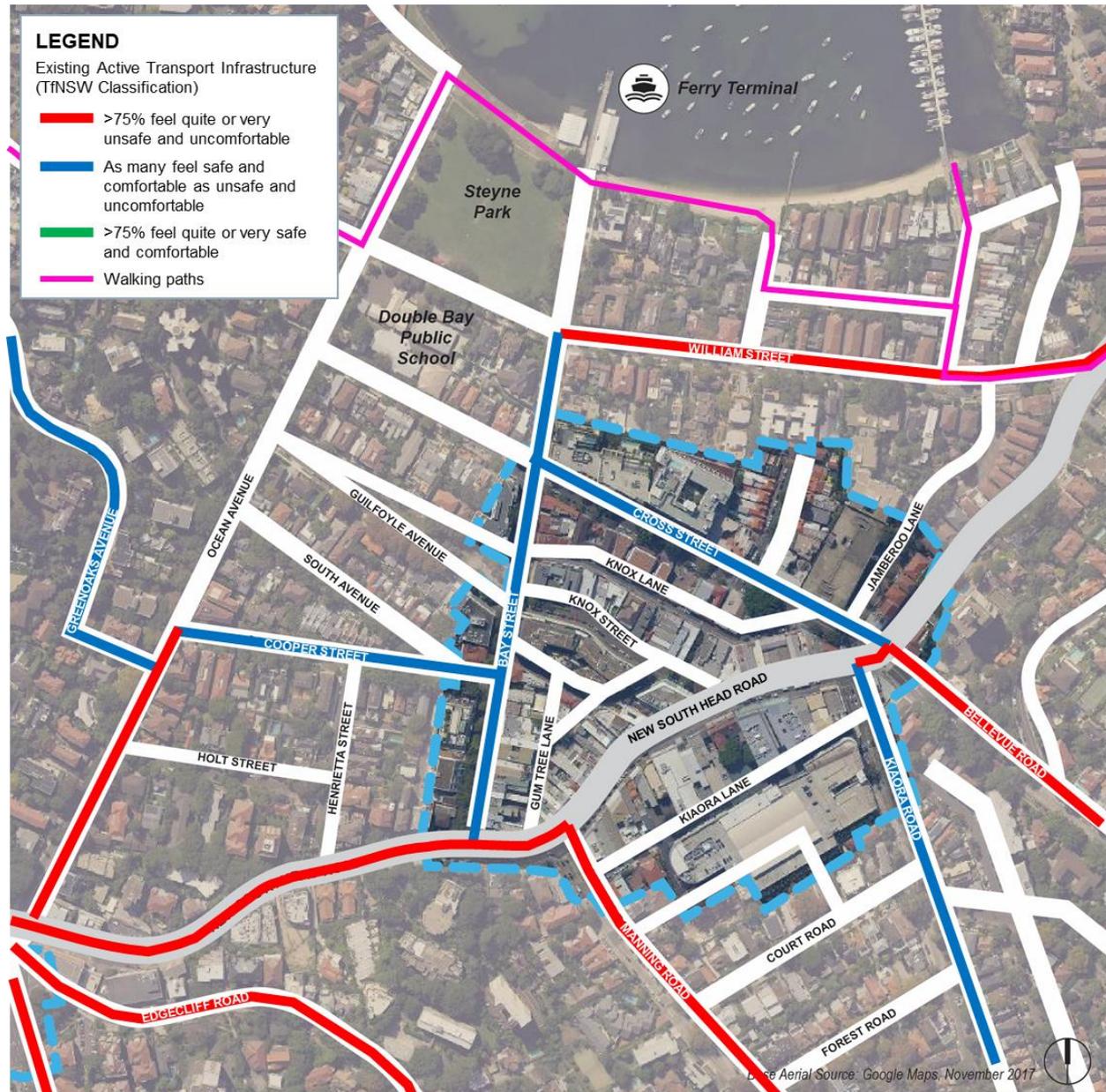
A summary of active transport facilities in the Double Bay and their preference rankings are shown in **Figure 3–3** and **Figure 3–4** respectively.

Figure 3–3 Existing active transport facility types using TfNSW Classifications



Source: WMC; 2007, modified by SCT Consulting; 2021

Figure 3-4 Existing active transport facility type preference ranking using TfNSW Classifications



Source: WMC; 2007, modified by SCT Consulting; 2021

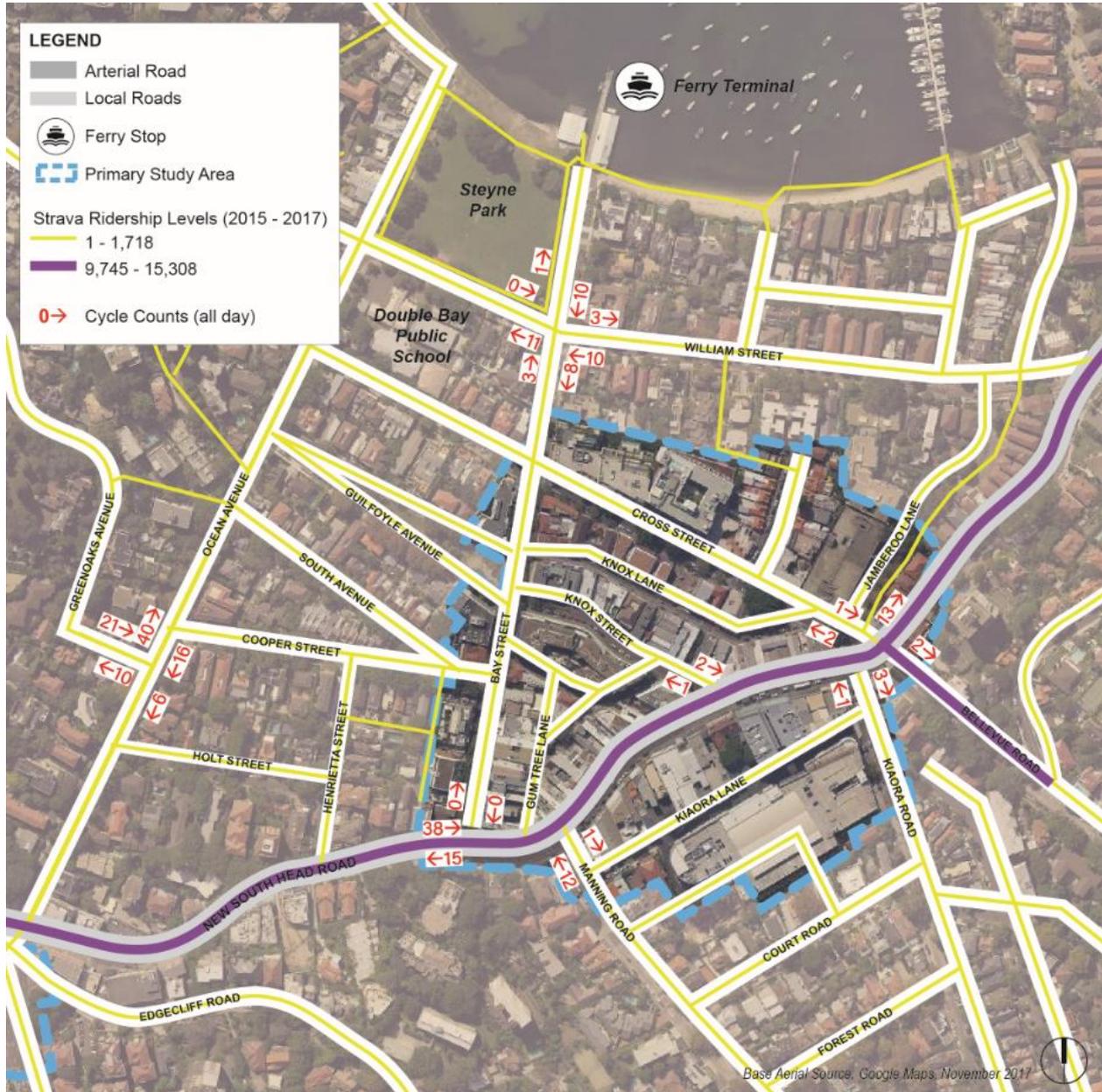
3.4.1.2 Cyclist volumes

To provide an estimate of current ridership volumes within the Double Bay Town Centre data was obtained from Strava for the time period July 2015 to June 2017. Whilst only representing a subset of the cycling population the series profile that is provided across the multiple routes within the study area highlights a key travel pattern of this subset of cyclists. **Figure 3-5**, which highlights the utilised routes visually, indicates that New South Head Road is the most frequently used route for cyclists within the Double Bay Town Centre for this subset. All remaining roads within the study area recorded a low patronage range total of between 1 and 1,718 cyclists over the two year period.

Cyclist counts at key intersections within the Double Bay area (surveyed in August 2017) indicated that New South Head Road, Ocean Avenue and William Street were the most frequently used roads for cyclists within the Double Bay Area as shown in **Figure 3-5**. Cyclist counts at the intersection of Ocean Avenue and Greenoaks Avenue indicated a northbound desire line from Ocean Avenue to William Street were the highest instead of WMC’s route designation of Bay Street to William Street.

Additionally, cycle counts showed that cyclists were more willing to cycle downhill in the Double Bay area where the volume of cyclists travelling downhill along New South Head Road, Ocean Avenue and William Street were significantly higher when compared to the cyclist volumes of those travelling uphill.

Figure 3-5 Cycle counts



Source: Strava; 2017, modified by SCT Consulting; 2021

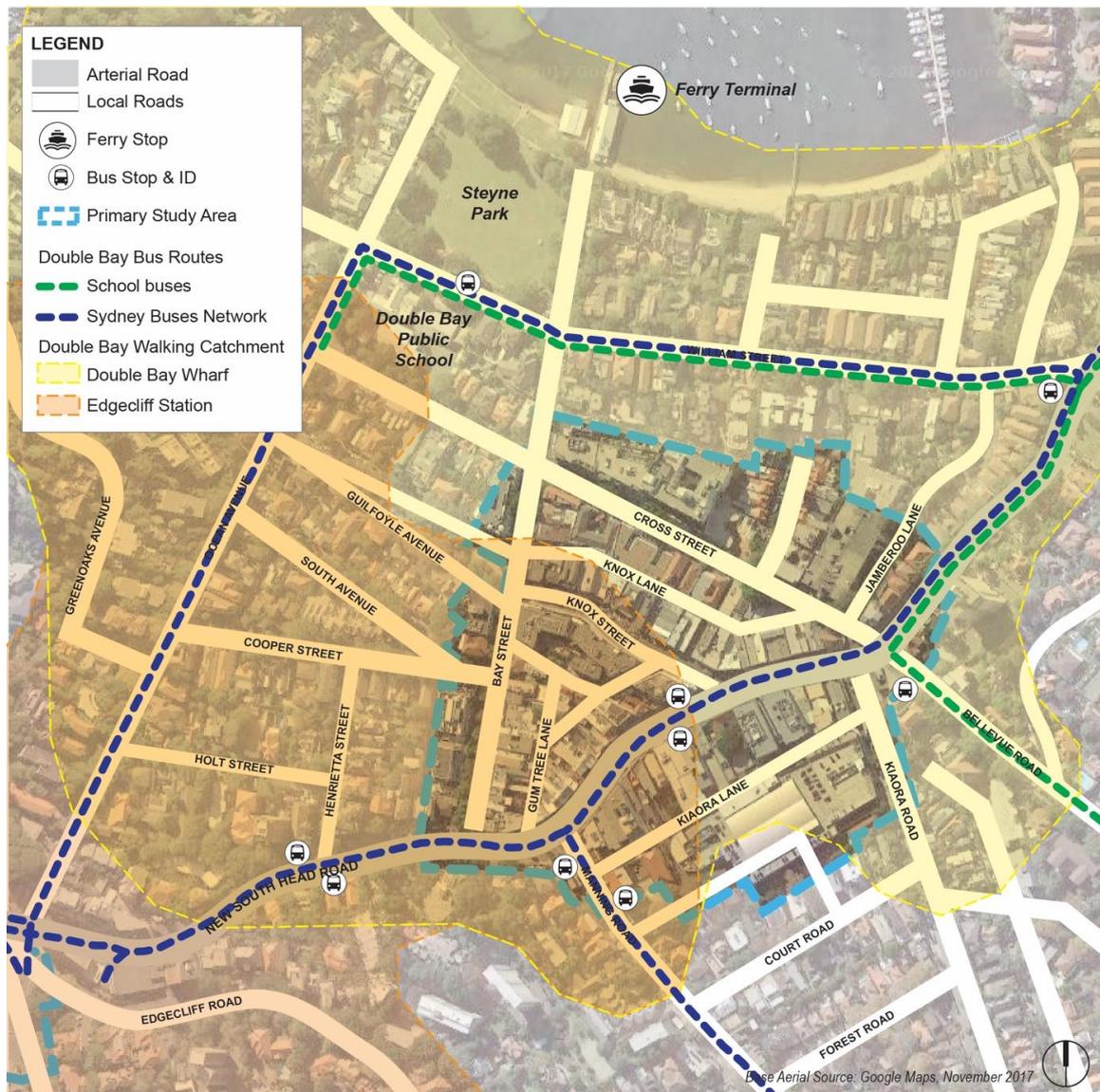
3.5 Walking

Walking is a very accessible travel model for residents living in the Double Bay study area. The Department of Infrastructure and Transport notes that generally people are prepared to walk approximately 800m to a high frequency, direct public transport service such as trains and ferries. For indirect or local services such as buses, people are willing to walk about 400m³.

In relation to the Double Bay study area, almost all residents live within an 800m walking catchment to either Edgecliff Train Station or Double Bay Ferry Wharf as shown in **Figure 3-6**. For buses, most residents live within a 400m walking catchment to at least one bus stop located along New South Head Road, the primary road for buses travelling into Sydney CBD. Similarly, key destinations (as shown in **Figure 3-7**) such as Double Bay Town Centre and Double Bay Primary School are accessible within an 800m catchment for all residents living within the Double Bay study area.

Double Bay Town Centre is an attractive destination with high pedestrian activity along streets like Cross Street, Knox Street and Transvaal Avenue. It's appeal as a local destination combined with Double Bay's high quality walking environment makes it easy to encourage residents to walk instead of drive.

Figure 3-6 Walking Catchment to Edgecliff Station and Double Bay Ferry Wharf



Source: SCT Consulting; 2021

³ Walking, Riding and Access to Public Transport, Department of Infrastructure and Transport

Figure 3–7 Points of interest in Double Bay



Source: SCT Consulting; 2021

3.5.1.1 Existing Walking Conditions

Walking conditions within the Double Bay area are generally pleasant with wide footpaths on either side of almost all local roads and large street trees providing pedestrians with protection from the weather.

All crossing opportunities identified as a key walking route in Double Bay (refer to **Figure 3–8**) have kerb ramps installed on both sides of crossing opportunities.

In relation to topography, the Double Bay area is mostly flat where the profile of the area varies between 0 to 14 meters above sea level (see **Figure 3–9**). The area outside Double Bay however is quite high with profiles ranging from 14 to 104 meters above sea level. This difference in height between Double Bay and its surrounding areas creates steep roads and footpaths making it difficult for surrounding residents to access Double Bay Town Centre by walking.

Figure 3–8 Key Walking Routes in Double Bay



Source: SCT Consulting; 2021

Figure 3–9 Double Bay Topography



Source: SCT Consulting; 2021

3.6 Car Share Usage

Within the overall Double Bay Transport Study area, shown in **Figure 1–1**, there are a total of five locations (six vehicles) where residents have access to GoGet car share vehicles, shown in **Table 3-13**. A total of 440 GoGet members currently are within 250m of at least one of these locations.

Data was obtained for the month of March 2016 and 2017 to determine underlying trends in car share usage within the precinct. Results indicated that car share usage has declined within the Double Bay Town Centre precinct over the past 12 months across overall bookings, hours booked and average trip hour metrics. This dataset is not considered large enough to form a representative sample and draw conclusions relating to car share usage in Double Bay. Further, the Holt Street pod is considered an outlier given the significant difference in usage between 2016 and 2017 as well as when compared to other pods locations.

Table 3-13 Go Get Car Share Usage (March 2016 vs March 2017)

| Bay Location | Number of bookings | | Hours Booked | | Average Trip Hours | |
|-----------------------|--------------------|------------|---------------|--------------|--------------------|-------------|
| | March 2016 | March 2017 | March 2016 | March 2017 | March 2016 | March 2017 |
| Cross Street Car Park | 31 | 42 | 502.5 | 190 | 16.2 | 4.5 |
| Holt Street | 29 | 25 | 189.5 | 108.5 | 6.5 | 4.3 |
| Ocean Avenue | 27 | 15 | 138.5 | 128.5 | 5.1 | 8.6 |
| South Avenue | 29 | 27 | 130 | 178 | 4.5 | 6.6 |
| William Street | 25 | 21 | 192 | 73.5 | 7.7 | 3.5 |
| Total | 165 | 138 | 1253.5 | 719.5 | 44.2 | 32.6 |

Source: GoGet Car Share; 2017

3.6.1 Benefits of Car Share

Benefits realisation of car share schemes, with respect to the City of Sydney Local Government Area, is documented within the Committee for Sydney document 'Carsharing: Sydney Snapshot' as follows:

- Each car share vehicle removes 10 private vehicles from the road network. Within the Double Bay area research indicates that approximately 70 per cent of these vehicles would be parked on street. These factors can be considered in the application of ratios for car spaces within new dwellings.
- A reduction in vehicle kilometres travelled by approximately 2,000km per year for each user with corresponding increases in walking, riding a bicycle or using public transport. This has flow on impacts to the health of residents.
- Each car space in a multi-storey car park can cost between \$30,000 - \$70,000 to construct with apartment prices increasing in cost by \$50,000 - \$140,000 when a car space is provided. These cost savings are passed on to developers and unit owners alike.
- The current benefit that each car share vehicle provides is estimated at \$59,673. This takes into consideration factors such as congestion, environmental factors such as emissions, opportunity cost of not owning a car space, management fees and community value of space.

These statistics support the notion of using car share schemes, such as Go Get, to achieve reductions in private vehicle ownership. They also allow for action to be taken regarding parking provision and a review of existing parking controls.

3.7 Future Growth Patterns

Future patterns of growth are not possible to accurately predict based on the increasing emergence of technology in aiding workplace productivity and the ability of staff to work remotely and the unknown workplace location of these individuals. However, factors such as attitudinal changes to public transport, increased public transport frequencies during peak times, and future employment growth within the WMC local area all have the potential to further improve the public and active transport mix for journey to work trips. This would reduce the impact of private vehicles on the local road network relative to existing usage rates.

Furthermore, the changing pattern of car ownership in future years has the potential to change both people's travel behaviour and the need for parking within residential buildings, commercial dwellings. Research indicates that as many as 200,000 Australians are currently using car share schemes with this potentially increasing to 1.5m in the next 10 years.

4.0 Existing Intersection Operational Conditions

4.1 Geometric Layout and Operational Performance

Section 4 provides a detailed overview of the existing geometrical and operational performance characteristics of the following key intersections within the study area:

- Cross Street / Bay Street
- William Street / Bay Street
- Ocean Avenue / Greenoaks Avenue
- New South Head Road / Bay Street
- New South Head Road / Manning Road Street
- New South Head Road / Knox Street
- New South Head Road / Cross Street / Bellevue Road / Kiaora Road

The following time periods were identified as the peak hour within the surveyed AM, PM and Saturday data sets:

- AM peak (7:45AM – 8:45AM)
- PM peak (5:30PM – 6:30PM)
- Saturday peak (11:45AM – 12:45PM)

Operational performance is typically measured through an assessment of the throughput of vehicles across a traffic network, with average delay per vehicle used to assess the performance of an individual intersection. This is consistent with Roads and Maritime Service best practice and is industry standard for the assessment of intersection performance. The average delay per vehicle measure is linked to a Level of Service (LoS) index which characterises the intersection's operational performance. **Table 4-1** provides a summary of the LoS performance bands.

Table 4-1 Level of Service Index

| Level of Service | Average Delay per Vehicles (sec/h) | Traffic Signals / Roundabout | Give Way / Stop Signs |
|------------------|------------------------------------|--|--|
| A | Less than 14.5 | Good operation | Good operation |
| B | 14.5 to 28.4 | Good with acceptable delays and spare capacity | Acceptable delays and spare capacity |
| C | 28.5 to 42.4 | Satisfactory | Satisfactory, but incident study required |
| D | 42.5 to 56.4 | Operating near capacity | Near capacity and incident study required |
| E | 56.5 to 70.4 | At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method. | At capacity, requires other control method |
| F | 70.5 or greater | At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method. | At capacity, requires other control method |

Source: Guide to Traffic Generating Developments; Roads and Maritime Services; 2002

Degree of saturation is used to measure the capacity of an intersection. This is determined from the ratio of the volume of vehicles which pass through an intersection against the capacity provided by green time, if applicable, and number of traffic lanes available. i.e. $\text{vehicle} / \text{capacity} = \text{DoS}$. DoS has been used as the measure to define network capacity for this study and to determine whether the road network can cater for any potential development.

All sites assessed as part of the Double Bay Transport Study have been modelled in the software package SIDRA 7.

4.1.1 4.1.1 Cross Street / Bay Street

4.1.1.1 Geometric Layout

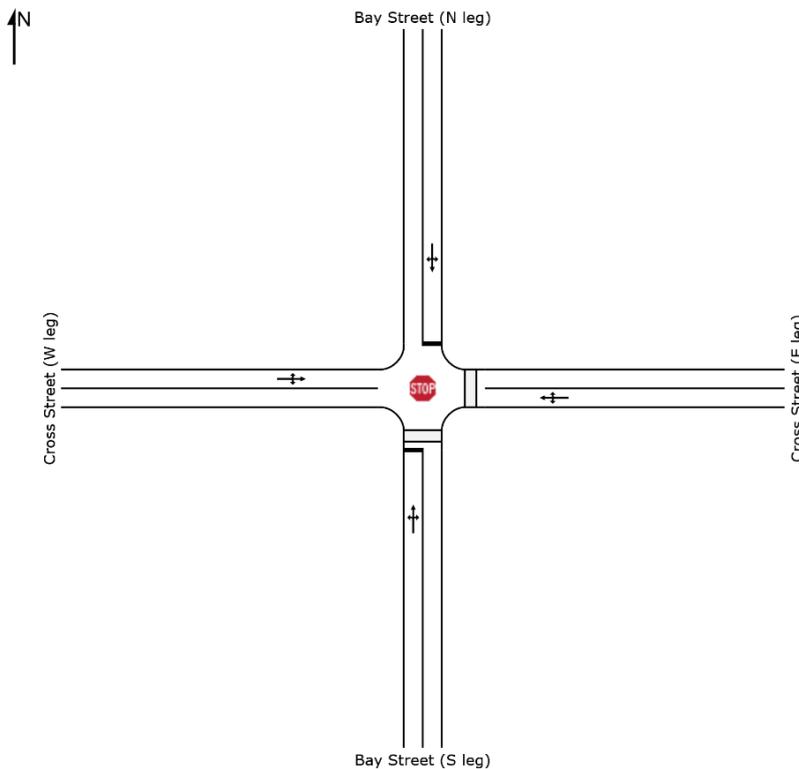
Cross Street / Bay Street is a priority controlled intersection, located at the northern extent of the Double Bay Town Centre, characterised by single lanes on approach and departure. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-2** and **Figure 4-1**.

Table 4-2 Cross Street / Bay Street: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|----------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| Bay Street (S leg) | 50 | - | - | - |
| Cross Street (E leg) | 50 | - | - | - |
| Bay Street (N leg) | 50 | - | - | - |
| Cross Street (W leg) | 50 | - | - | - |

Source: SCT Consulting; 2021

Figure 4-1 Cross Street / Bay Street: Geometric Layout



Source: SCT Consulting; 2021

4.1.1.2 Intersection Performance

A summary of the existing operational performance of the Cross Street / Bay Street intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-3**. Modelling results indicate that the intersection operates with a large degree of spare capacity in both the AM, PM and Saturday peak hour periods, recording LoS A at all times. The largest DoS recorded in any period was 0.18 (Saturday peak hour period).

Table 4-3 Cross Street / Bay Street: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 813 | 0.17 | 9.2 | A | 4 |
| PM Peak Hour Period | 718 | 0.17 | 8.5 | A | 4 |
| Saturday Peak Hour Period | 745 | 0.18 | 8.7 | A | 4 |

Source: SCT Consulting; 2021

4.1.2 William Street / Bay Street

4.1.2.1 Geometric Layout

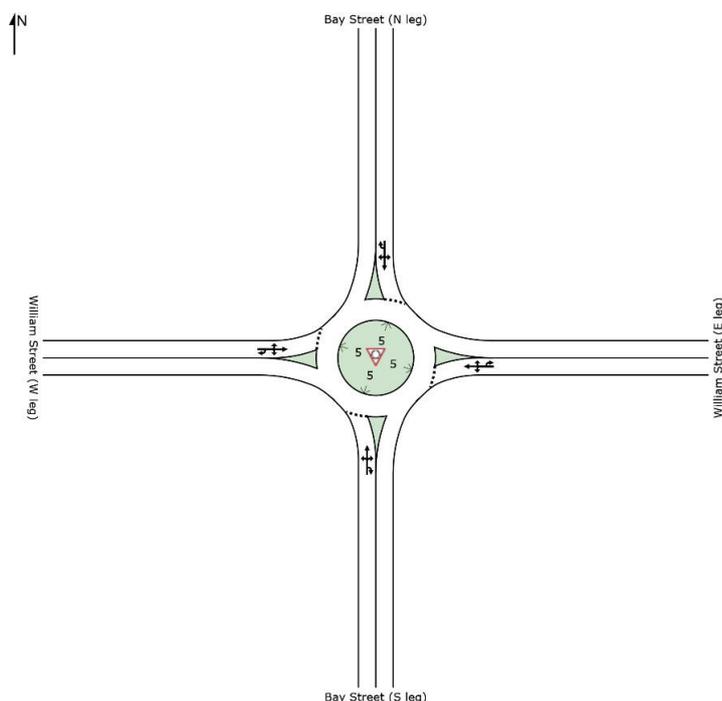
William Street / Bay Street is a roundabout priority controlled intersection, located at the northern extent of the Double Bay Town Centre. The site borders Steyne Park to the north and is characterised by single lanes on approach and departure. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-4** and **Figure 4-2**.

Table 4-4 William Street / Bay Street: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|------------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| Bay Street (S leg) | 50 | - | - | - |
| William Street (E leg) | 50 | - | - | - |
| Bay Street (N leg) | 50 | - | - | - |
| William Street (W leg) | 50 | - | - | - |

Source: SCT Consulting; 2021

Figure 4–2 William Street / Bay Street: Geometric Layout



Source: SCT Consulting; 2021

4.1.2.2 Intersection Performance

A summary of the existing operational performance of the William Street / Bay Street intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-5**. Modelling results indicate that the intersection operates with a large degree of spare capacity in both the AM, PM and Saturday peak hour periods, recording LoS A at all times. The largest DoS recorded in any period was 0.35. This was noted in the AM and Saturday peak hour periods.

Table 4-5 William Street / Bay Street: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 1,026 | 0.35 | 7.7 | A | 17 |
| PM Peak Hour Period | 779 | 0.34 | 7.9 | A | 16 |
| Saturday Peak Hour Period | 883 | 0.35 | 8.1 | A | 16 |

Source: SCT Consulting; 2021

4.1.3 Ocean Avenue / Greenoaks Avenue

4.1.3.1 Geometric Layout

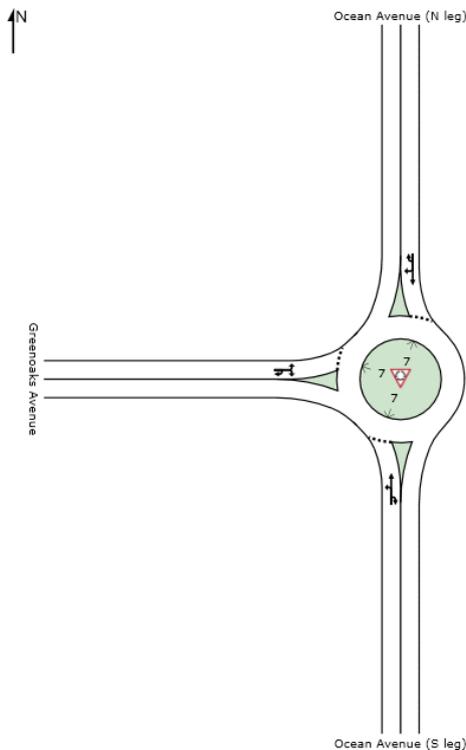
Ocean Avenue / Greenoaks Avenue is a roundabout priority controlled intersection, located at the western extent of the Double Bay Town Centre. The site is characterised by single lanes on approach and departure. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-6** and **Figure 4–3**.

Table 4-6 Ocean Avenue / Greenoaks Avenue: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|--------------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| Ocean Avenue (S leg) | 50 | - | - | - |
| Ocean Avenue (N leg) | 50 | - | - | - |
| Greenoaks Avenue (W leg) | 50 | - | - | - |

Source: SCT Consulting; 2021

Figure 4-3 Ocean Avenue / Greenoaks Avenue: Geometric Layout



Source: SCT Consulting; 2021

4.1.3.2 Intersection Performance

A summary of the existing operational performance of the Ocean Avenue / Greenoaks Avenue intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-7**. Modelling results indicate that the intersection operates with a large degree of spare capacity in both the AM, PM and Saturday peak hour periods, recording LoS A at all times. The largest DoS recorded in any period was 0.67. This was noted in the AM peak hour period.

Table 4-7 Ocean Avenue / Greenoaks Avenue: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 1,804 | 0.67 | 12.3 | A | 52 |
| PM Peak Hour Period | 1,334 | 0.50 | 8.0 | A | 27 |
| Saturday Peak Hour Period | 1,484 | 0.57 | 7.4 | A | 33 |

Source: SCT Consulting; 2021

4.1.4 New South Head Road / Bay Street

4.1.4.1 Geometric Layout

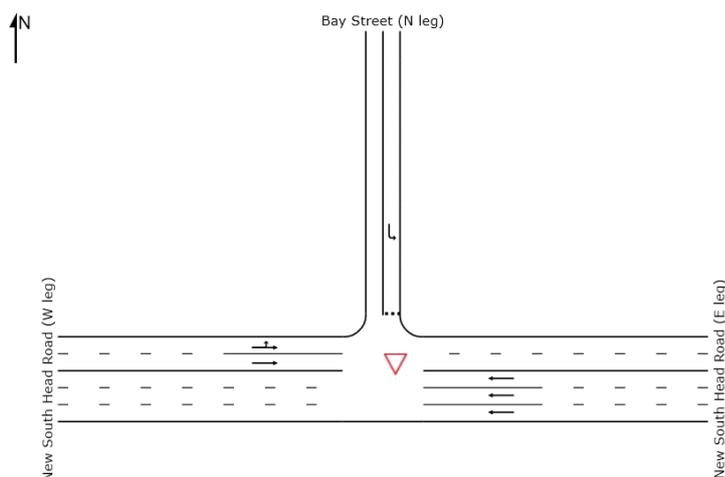
New South Head Road / Bay Street is a signalised intersection, located at the southern extent of the Double Bay Town Centre. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-8** and **Table 4-4**.

Table 4-8 New South Head Road / Bay Street: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|-----------------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| New South Head Road (E leg) | 60 | Right | - | - |
| Bay Street (N leg) | 50 | Right | - | - |
| New South Head Road (W leg) | 60 | - | - | - |

Source: SCT Consulting; 2021

Figure 4-4 New South Head Road | Bay Street: Geometric Layout



Source: SCT Consulting; 2021

4.1.4.2 Intersection Performance

A summary of the existing operational performance of the New South Head Road / Bay Road intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-9**. Modelling results indicate that the intersection operates with a large degree of spare capacity in both the AM, PM and Saturday peak hour periods, recording LoS A at all times. The largest DoS recorded in any period was 0.55. This was noted in the Saturday peak hour period.

Table 4-9 New South Head Road / Bay Street: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 3,280 | 0.38 | 6.3 | A | 2 |
| PM Peak Hour Period | 3,198 | 0.44 | 0.4 | A | 9.3 |
| Saturday Peak Hour Period | 3,509 | 0.55 | 13.5 | A | 17.0 |

Source: SCT Consulting; 2021

4.1.5 New South Head Road / Manning Road

4.1.5.1 Geometric Layout

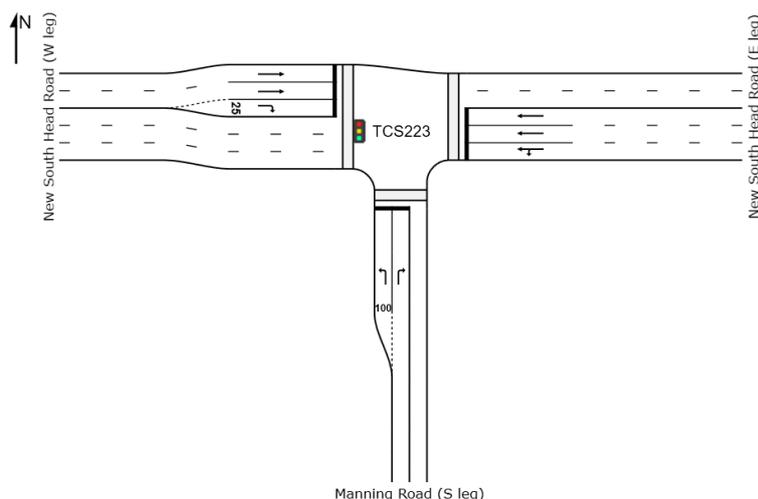
New South Head Road / Manning Road is a signalised intersection, located at the southern extent of the Double Bay Town Centre. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-10** and **Figure 4-5**.

Table 4-10 New South Head Road / Manning Road: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|-----------------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| Manning Road (S leg) | 50 | - | Left | 100 |
| New South Head Road (E leg) | 60 | - | - | - |
| New South Head Road (W leg) | 60 | - | Right | 25 |

Source: SCT Consulting; 2021

Figure 4-5 New South Head Road / Manning Road: Geometric Layout



Source: SCT Consulting; 2021

4.1.5.2 Intersection Performance

A summary of the existing operational performance of the New South Head Road / Manning Road intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-11**. Modelling results indicate that the intersection operates with at least 10 and 20 per cent spare capacity in the AM and PM peak hour periods respectively. The intersection operates at LoS A at all times. The largest DoS recorded in any period was 0.88. This was noted in the AM peak hour period.

Table 4-11 New South Head Road / Manning Road: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 3,383 | 0.88 | 35.4 | C | 229 |
| PM Peak Hour Period | 3,316 | 0.81 | 12.7 | A | 106 |
| Saturday Peak Hour Period | 3,144 | 0.74 | 11.7 | A | 106 |

Source: SCT Consulting; 2021

4.1.6 New South Head Road / Knox Street

4.1.6.1 Geometric Layout

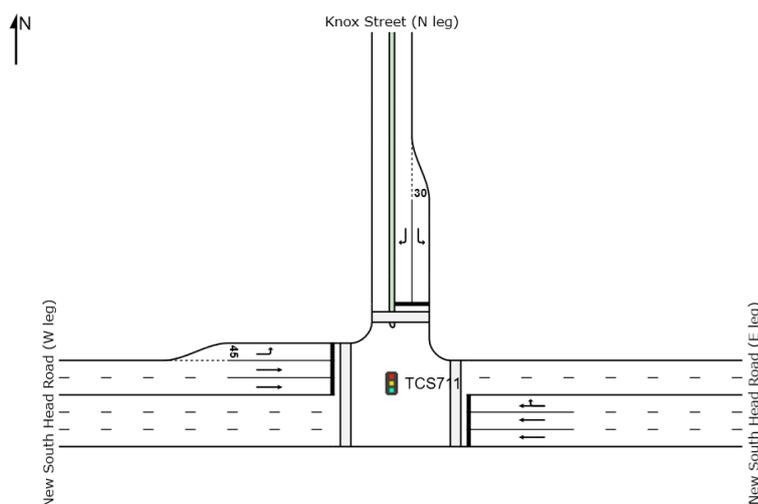
New South Head Road / Knox Street is a signalised intersection, located at the eastern extent of the Double Bay Town Centre. The site is characterised as the intersect of arterial and local road networks. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-12** and **Figure 4-6**.

Table 4-12 New South Head Road / Knox Street: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|-----------------------------|-------------|------------------|----------|--------|
| | | | Movement | Length |
| New South Head Road (E leg) | 60 | - | - | - |
| Knox Street (N leg) | 50 | - | Left | 30 |
| New South Head Road (W leg) | 60 | - | Left | 45 |

Source: SCT Consulting; 2021

Figure 4-6 New South Head Road / Knox Street: Geometric Layout



Source: SCT Consulting; 2021

4.1.6.2 Intersection Performance

A summary of the existing operational performance of the New South Head Road / Knox Street intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-13**. Modelling results indicate that the intersection operates at practical capacity during the AM peak period, with DoS 0.92 and LoS B. There is a large degree of spare capacity in the PM and Saturday peak hour periods, recording LoS A.

Table 4-13 New South Head Road / Knox Street: Intersection Performance

| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 2,924 | 0.92 | 15.3 | B | 111 |
| PM Peak Hour Period | 2,853 | 0.77 | 5.3 | A | 45 |
| Saturday Peak Hour Period | 2,404 | 0.41 | 5.4 | A | 43 |

Source: SCT Consulting; 2021

4.1.7 New South Head Road / Cross Street / Bellevue Road / Kiaora Road

4.1.7.1 Geometric Layout

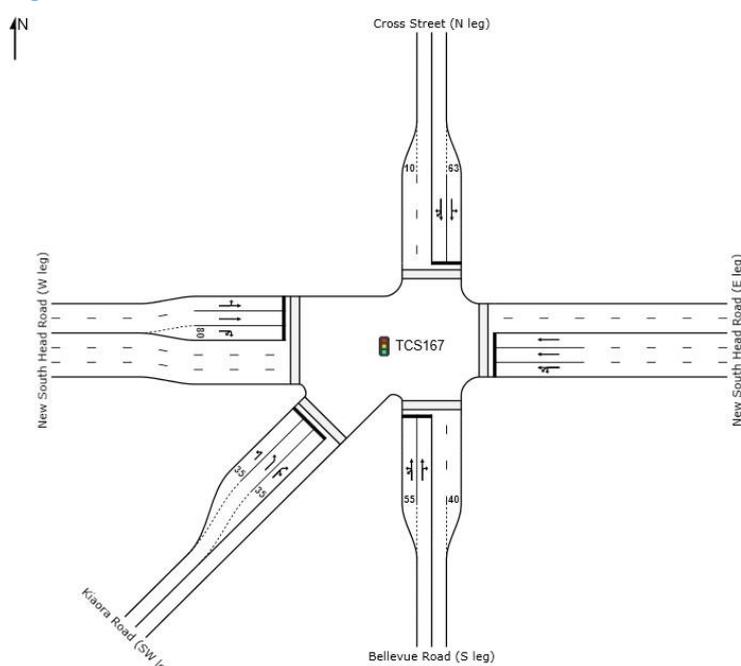
New South Head Road / Cross Street / Bellevue Road / Kiaora Road is a signalised intersection to the, located at the eastern extent of the Double Bay Town Centre. The site is characterised by five approaches which restrict the overall operating capacity of the intersection. An overview of the geometric layout and characteristics of the intersection is provided in **Table 4-14** and **Figure 4-7**.

Table 4-14 Ocean Avenue / Greenoaks Avenue: Geometric Layout Key Features

| Approach | Speed Limit | Banned Movements | Turn Bay | |
|-----------------------------|-------------|------------------|--------------|---------|
| | | | Movement | Length |
| Bellevue Road (S leg) | 50 | - | Left | 55 |
| New South Head Road (E leg) | 60 | Right | - | - |
| Cross Street (N leg) | 50 | - | Left | 63 |
| New South Head Road (W leg) | 60 | - | Right | 80 |
| Kiaora Road (SW leg) | 50 | - | Left Right | 35 35 |

Source: SCT Consulting; 2021

Figure 4-7 New South Head Road / Cross Street / Bellevue Road / Kiaora Road: Geometric Layout



Source: SCT Consulting; 2021

4.1.7.2 Intersection Performance

A summary of the existing operational performance of the New South Head Road / Cross Street / Bellevue Road / Kiaora Road intersection, for the AM, PM and Saturday peak periods, is provided in **Table 4-15**. Modelling results indicate that the intersection operates with acceptable overall performance, with LoS C during all periods. During the AM peak the highest DoS occurs on Bellevue Road at 0.99, and is associated with the left turn movement. During the PM and Saturday peak the most saturated movement is the right turn movement on New South Head Road (W leg), operating at DoS 0.98 and 0.96 respectively.

Table 4-15 New South Head Road / Cross Street / Bellevue Road / Kiaora Road: Intersection Performance

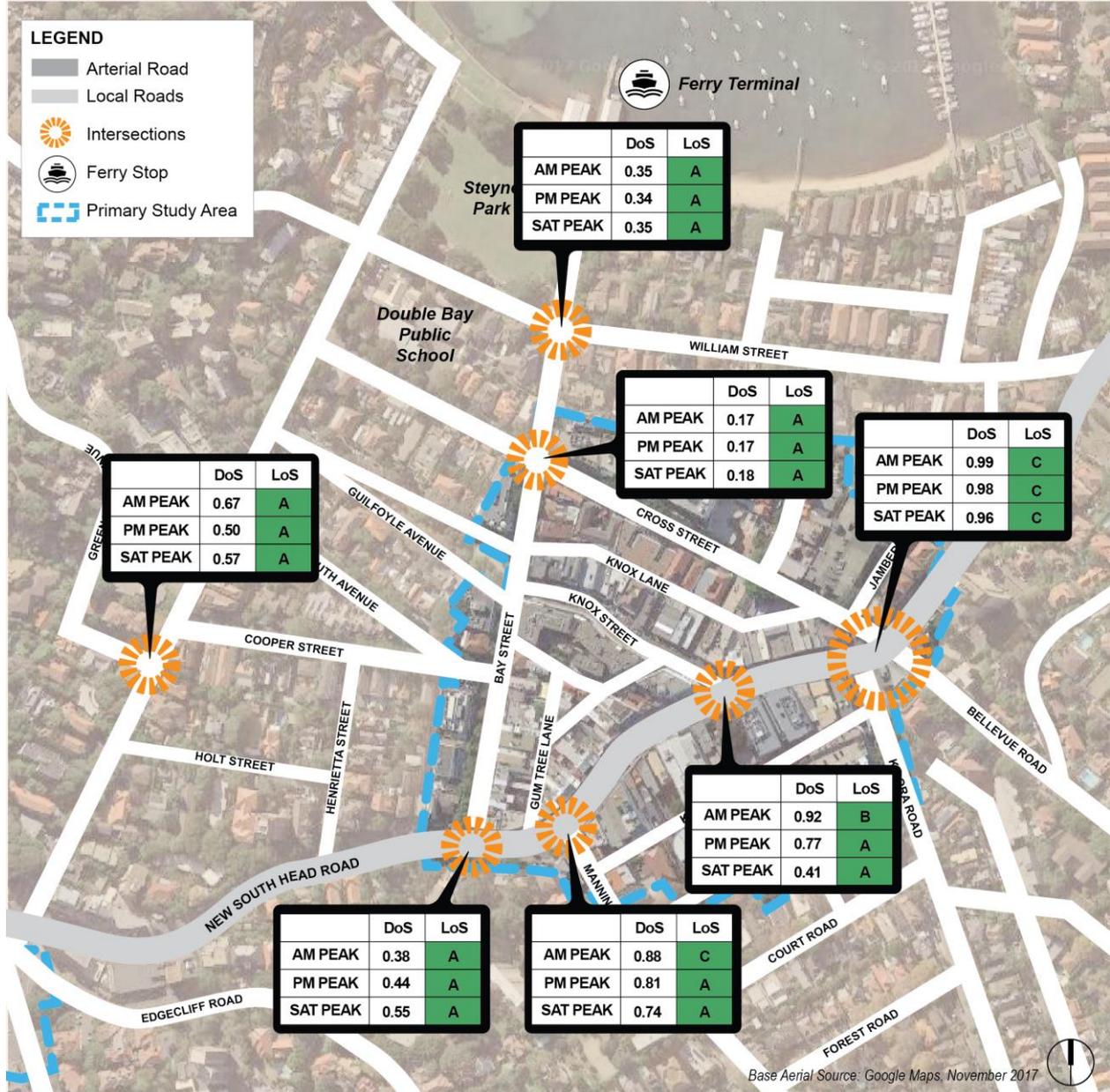
| Peak Period / Approach | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|---------------------------|----------|------|---------------------|-----|---|
| AM Peak Hour Period | 3,771 | 0.99 | 38.4 | C | 195 |
| PM Peak Hour Period | 3,475 | 0.98 | 32.2 | C | 137 |
| Saturday Peak Hour Period | 3,523 | 0.96 | 33.9 | C | 201 |

Source: SCT Consulting; 2021

4.2 Existing Intersection Performance Summary

A summary of DoS and LoS across the Double Bay Transport Study area is provided in **Figure 4–8**.

Figure 4–8 Existing Intersection Performance Summary



Source: SCT Consulting; 2021

5.0 Potential Development

5.1 Assessment Scenario

In order to ascertain the impact of the potential additional development yield in the Cross Street Precinct on the Double Bay Town Centre the following scenario was assessed:

- Scenario 1
 - 10 year plan which centred on the assessment of the following peak periods:
 - AM peak hour
 - PM peak hour
 - Saturday peak hour

The scenario includes consideration of the pedestrianisation of Knox Street which incorporates the following:

- Closure of Knox Street to vehicles between Bay Street and Goldman Lane.
- Alteration of Knox Street between Goldman Lane and New South Head Road to one way only. i.e. no westbound traffic; and
- Removal of the left and right turn movements from New South Head Road to Knox Street.

5.2 Development Yield

Figure 5–1 and **Table 5-1** provide an overview of the hypothetical development scenario for the redevelopment of the Cross Street Precinct and includes yield, car parking provision, and associated population growth associated with the residential, commercial and retail land uses. At completion, the potential expansion of the Cross Street Precinct could result in an uplift of 222 parking spaces and 282 people across all three land uses.

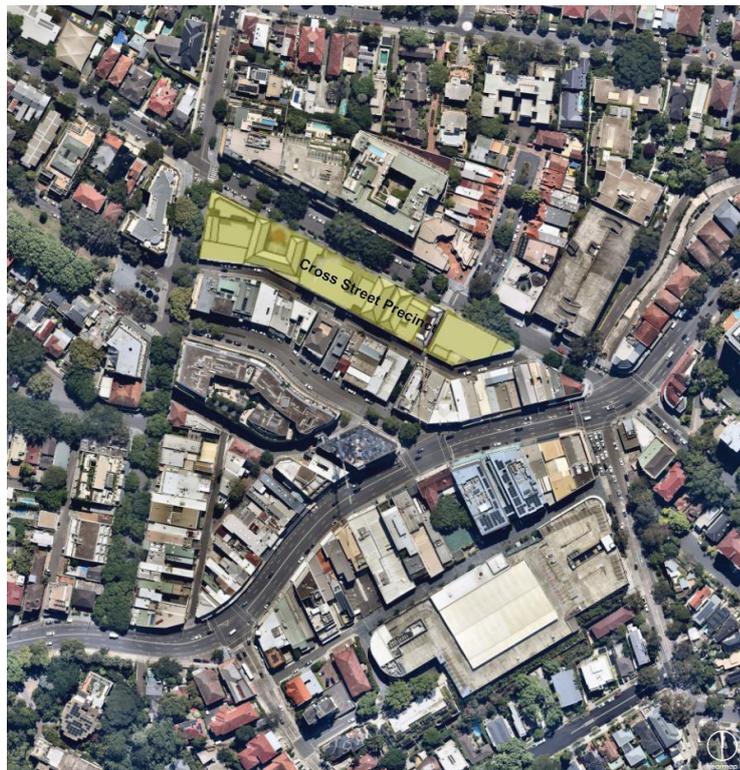
The development potential is based on the total future development compared to the existing development as a baseline.

Table 5-1 Double Bay Town Centre Potential Development Yield

| Site / Land Use | | Residential | | Commercial | | Retail | |
|-----------------------|-----------------------|-------------|--------|------------|--------|--------|--------|
| | | Future | Uplift | Future | Uplift | Future | Uplift |
| Cross Street Precinct | GFA (m ²) | 10,037 | 10,037 | 4,589 | 1,121 | 4,589 | 756 |
| | People | 201 | 201 | 229 | 56 | 153 | 25 |
| | Parking | 82 | 82 | 69 | 59 | 91 | 81 |

Source: WMC; 2017

Figure 5–1 Double Bay Town Centre Potential Development Schematic



Source: SCT Consulting; 2021

5.3 Background traffic

Analysis of the Woollahra Local Government Area (LGA) Journey to Work data between 2006 and 2011 indicates that there was an increase in approximately 0.7 per cent in vehicle trips (Car (Driver)) over the five year period. This is equivalent to approximately 0.15 per cent growth in vehicle trips per annum.

A background growth rate of 0.15 per cent per annum has been adopted for vehicle trips along New South Head Road, as per historical trends indicated from the Journey to Work data for the Woollahra LGA. A summary of key Journey to Work trips is provided in **Table 5–2**.

Table 5-2 Woollahra LGA Journey to Work Analysis (2006-2011)

| Main Method of Travel | 2011 | | | 2006 | | | Change ('06 to '11) | |
|-----------------------|--------|------|----------|--------|------|----------|---------------------|--------------|
| | Number | % | Sydney % | Number | % | Sydney % | trips | % per annum |
| Train | 3,829 | 14.6 | 13.8 | 3,156 | 12.7 | 12.3 | +673 | 3.94% |
| Bus | 2,466 | 9.4 | 5.8 | 2,221 | 8.9 | 5.4 | +245 | 2.11% |
| Tram or Ferry | 597 | 2.3 | 0.4 | 571 | 2.3 | 0.4 | +26 | 0.89% |
| Taxi | 293 | 1.1 | 0.3 | 370 | 1.5 | 0.3 | -77 | -4.56% |
| Car (Driver) | 10,434 | 39.7 | 53.8 | 10,358 | 41.6 | 53.7 | +76 | 0.15% |
| Car (Passenger) | 1,042 | 4.0 | 4.5 | 1,127 | 4.5 | 5.3 | -85 | -1.56% |
| Truck | 56 | 0.2 | 1.1 | 48 | 0.2 | 1.3 | +8 | 3.13% |
| Motorbike | 302 | 1.1 | 0.6 | 177 | 0.7 | 0.5 | +125 | 11.28% |
| Bicycle | 332 | 1.3 | 0.8 | 167 | 0.7 | 0.6 | +165 | 14.73% |
| Walked only | 2,266 | 8.6 | 4.1 | 2,123 | 8.5 | 4.2 | +143 | 1.31% |

Source: <http://profile.id.com.au/>; 2017, modified by SCT Consulting 2021

5.4 Development Trip Generation

As described in **Section 5.2**, the potential development in the Cross Street Precinct comprises residential, retail and commercial land uses.

The average trip rate for medium density residential flat buildings within Sydney urban areas, as published by the Roads and Maritime Services, is identified as 0.4 – 0.5 trips per dwelling within the AM and PM peak hour periods respectively. On this basis, the potential development would expect to generate up to 41 trips in the AM and PM peak hour. This has also been conservatively applied to the Saturday peak hour assessment. The ratio of inbound to outbound trips in the AM peak is assumed to be 10:90, conversely PM peak inbound to outbound ratio is assumed to be 90:10. Saturday trips are assessed as a 50:50 inbound and outbound movements.

At full development it is assumed that Cross Street Precinct will include approximately 4,600sqmGFA of commercial development i.e. existing + potential yield. The Roads and Maritime Guide to Traffic Generating Developments – updated traffic survey (TDT 2013/04a) indicates the Sydney average trip rate for large scale commercial precincts is 1.6 trips / 100 sqm and 1.2 trips / 100 sqm during the AM and PM peak hour respectively. Applied to the Cross Street Precinct the commercial development will generate an additional 18 trips / hour during the AM peak and 13 trips during the PM peak hour.

Whilst the total potential uplift in retail, based on the growth scenario, is in the order of 756 sqm, the Cross Street Precinct would provide approximately 4,600sqm of retail space. The average trip rate for retail precincts, with a total floor area in the area in the range of 20,000 and 30,000 sqm, is 5.9 trips / 100sqm and 7.5 trips / 100 sqm during the PM peak and Saturday peak respectively. On this basis the total retail trips generated will be 45 trips / hour and 57 trips / hour in the Thursday PM peak hour and Saturday peak hour.

The total trip generation associated with the potential development is summarised in **Table 5-3**.

Table 5-3 Double Bay Town Centre Potential Development Trip Generation

| Site / Land Use | Residential | Commercial | Retail | Total |
|-----------------|-------------|------------|--------|-------|
| AM peak | 41 | 18 | - | 59 |
| PM peak | 41 | 13 | 45 | 99 |
| Saturday peak | 41 | - | 57 | 98 |

Source: SCT Consulting; 2021

5.5 Intersection Performance Results

Intersection operational analysis for key intersections within the Double Bay Town Centre is provided below following the introduction of the potential development uplift in the Cross Street Precinct by 2027.

5.5.1 Cross Street / Bay Street

Modelling analysis indicates that the intersection of Cross Street / Bay Street will operate with sufficient levels of spare capacity in 2027, for both the AM, PM and Saturday peak periods, following completion of the potential development within the Cross Street Precinct. Results, provided in **Table 5-4**, indicate that a LoS of A is forecast in all peak periods with DoS values no higher than 0.19. The 0.19 DoS values were recorded for the PM peak hour and Saturday peak hour periods in 2027.

Table 5-4 Cross Street / Bay Street: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 827 | 0.18 | 9.9 | A | 4 |
| PM Peak Hour | 757 | 0.19 | 9.1 | A | 4 |
| Saturday Peak Hour | 780 | 0.19 | 9.1 | A | 4 |

Source: SCT Consulting; 2021

5.5.2 William Street / Bay Street

A summary of the modelling results at the intersection of William Street / Bay Street are presented in **Table 5-5**. The results indicate that the intersection is forecast to perform at satisfactory LoS A with sufficient levels of capacity to accommodate future growth in 2027. DoS values no higher than 0.35 are recorded for all peak periods.

Table 5-5 William Street / Bay Street: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 1,029 | 0.35 | 10.4 | A | 17 |
| PM Peak Hour | 789 | 0.34 | 10.6 | A | 16 |
| Saturday Peak Hour | 893 | 0.35 | 10.7 | A | 16 |

Source: SCT Consulting; 2021

5.5.3 Ocean Avenue / Greenoaks Avenue

The intersection performance of Ocean Avenue / Greenoaks Avenue is summarised in **Table 5-6**. Modelling results indicate the intersection is forecast to operate at LoS B during the AM peak and LoS A during both PM and Saturday peak periods. DoS values no higher than 0.67 are recorded for all peak periods.

Table 5-6 Ocean Avenue / Greenoaks Avenue: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 1,813 | 0.67 | 16.2 | B | 53 |
| PM Peak Hour | 1,347 | 0.51 | 11.6 | A | 28 |
| Saturday Peak Hour | 1,496 | 0.57 | 10.8 | A | 34 |

Source: SCT Consulting; 2021

5.5.4 New South Head Road / Bay Street

Modelling results for the intersection of New South Head Road / Bay Street are presented in **Table 5-7**. The network results indicate the intersection is forecast to operate at LoS B during the Saturday peak and LoS A during both AM and PM peak period. DoS values no higher than 0.59 are recorded for all peak periods.

Table 5-7 New South Head Road / Bay Street: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 3,422 | 0.39 | 6.7 | A | 2 |
| PM Peak Hour | 3,339 | 0.47 | 9.0 | A | 24 |
| Saturday Peak Hour | 3,634 | 0.59 | 14.7 | B | 16 |

Source: SCT Consulting; 2021

5.5.5 New South Head Road / Manning Road

The intersection performance of New South Head Road / Manning Road is provided in **Table 5-8**. During the AM peak hour, the intersection is forecast to operate at capacity with a LoS of D and DoS of 1.00. The intersection is forecast to operate satisfactorily at LoS A during both PM and Saturday peak periods with remaining spare capacity to accommodate future growth in 2027. DoS values no higher than 1.00 are recorded for all peak periods.

Table 5-8 New South Head Road / Manning Road: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 3,428 | 1.00 | 43.2 | D | 229 |
| PM Peak Hour | 3,367 | 0.83 | 13.4 | A | 106 |
| Saturday Peak Hour | 3,201 | 0.76 | 12.0 | A | 106 |

Source: SCT Consulting; 2021

5.5.6 New South Head Road / Knox Street

Modelling analysis for the intersection of New South Head Road / Knox Street is provided in **Table 5-9**. The SIDRA results show that the intersection will operate at an acceptable LoS B during the AM peak and LoS A during both PM and Saturday peak periods with remaining capacity to cater for potential traffic increase in 2027. DoS values no higher than 0.91 are recorded for all peak periods.

Table 5-9 New South Head Road / Knox Street: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 2,944 | 0.91 | 14.5 | B | 104 |
| PM Peak Hour | 2,883 | 0.83 | 5.5 | A | 48 |
| Saturday Peak Hour | 2,419 | 0.43 | 5.4 | A | 46 |

Source: SCT Consulting; 2021

5.5.7 New South Head Road / Cross Street / Bellevue Road / Kiaora Road

Modelling analysis indicates that the intersection of New South Head Road / Cross Street / Bellevue Road / Kiaora Road will operate near capacity with a DoS of 0.95, 0.97 and 0.98 in the AM, PM and Saturday peak hour respectively. Results, provided in **Table 5-10**, indicate that a LoS C is forecast in all peak periods with DoS values no higher than 0.98.

Table 5-10 New South Head Road / Cross Street / Bellevue Road / Kiaora Road: 2027 Intersection Performance

| Peak Period | Vehicles | DoS | Average Delay (sec) | LoS | 95 th percentile back of queue (m) |
|--------------------|----------|------|---------------------|-----|---|
| AM Peak Hour | 3,885 | 0.95 | 37.8 | C | 204 |
| PM Peak Hour | 3,606 | 0.97 | 32.7 | C | 144 |
| Saturday Peak Hour | 3,633 | 0.98 | 35.5 | C | 200 |

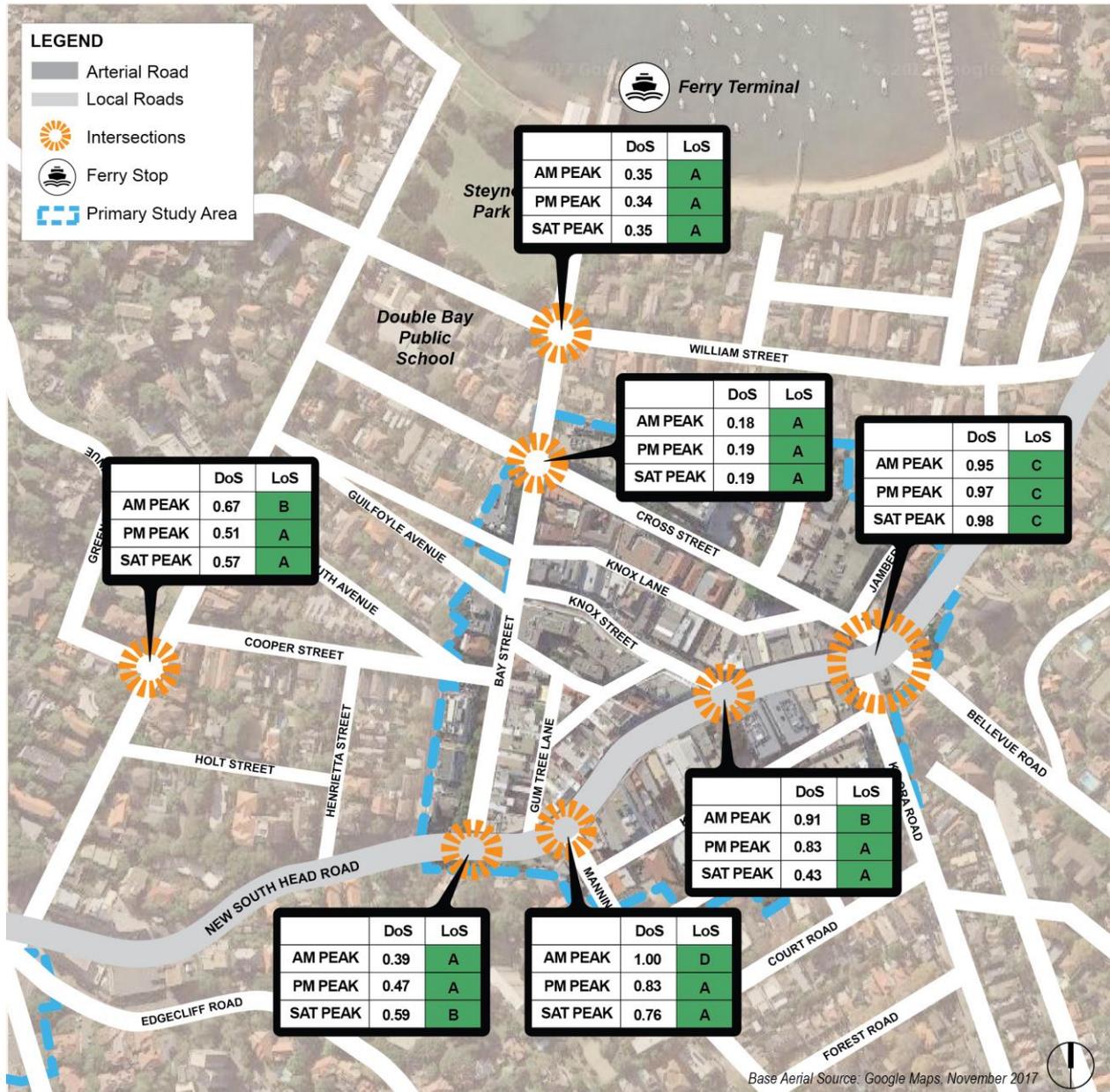
Source: SCT Consulting; 2021

5.6 Intersection Performance Summary

A summary of the overall intersection LoS and DoS in the 2027 AM, PM and Saturday peak periods are provided in Figure 5-2.

By 2027, the intersection of New South Head Road with Cross Street / Bellevue Road / Kiaora Road is forecast to operate near capacity at a satisfactory LoS C in all peak periods. During the AM peak hour, the intersection of New South Head Road / Manning Road is forecast to operate at capacity with a LoS of D and DoS of 1.00. All other intersections operate at LoS A to LoS B and satisfactorily accommodate for forecast travel demands associated with the potential full development.

Figure 5-2 Double Bay Town Centre Intersection Performance: 2027 Full Development



Source: SCT Consulting; 2021

5.7 Public Transport, Walking and Parking Impact Summary

An analysis of Journey to Work and Household Travel Survey data has been undertaken to estimate the number of trips that are likely to be generated from the potential development of Cross Street Precinct.

For the purpose of analysis, it has been assumed that the modal split data from the 2011 Census⁴ Journey to Work Data provides a suitable reflection of the proportion of trips being undertaken by all travel modes during the weekday AM and PM peak hour periods, where a high proportion of trips during this timeframe are associated with journey to work trips.

For the Saturday peak hour period, Household Travel Survey proportional mode split has been used. It is acknowledged that Household Travel Survey provides the information surrounding trips made by residents on an average weekday, however, analysis of Household Travel Survey information indicates that over 50 per cent trips made by residents of statistical area "Eastern Suburbs (North)" are likely to be associated with shopping, personal business and social and recreational activities. On this basis, the Household Travel Survey is considered reflective of the trips likely to be made during the Saturday peak period and reflect typical travel characteristic and mode choice associated with these trips.

5.7.1 Public Transport

Journey to Work travel mode data indicates that during the peak hour period public transport trips account for approximately 42 per cent outbound trips and 20 per cent of inbound trips. Train trips account for 34 per cent and 16 per cent of these trips respectively, whilst bus trips account for four per cent of inbound and outbound trips. Ferry trips account for four per cent of inbound trips.

Household travel data indicates that approximately six per cent of all trips are undertaken by train, while five per cent of all trips throughout the day are undertaken by bus. Ferry trips are not recorded.

On this basis **Table 5-11**, provides a summary of the number of additional train, bus and ferry trips that are likely to be generated by the potential development of the Cross Street Precinct. The peak number of trips for train are during the AM and PM peak hours in the outbound and inbound directions respectively. At full development this accounts for 36 trips in the AM peak and 56 trips in the PM peak. As detailed in **Section 3.3.3** the Sydney Train Network has capacity to cater for the potential increase in travel demand.

Similarly, there are over 11 bus services per hour in the peak travel demand direction during AM and PM peak hour periods, at full development this would equate to less than one additional passenger per bus service. As the majority of services are not at full capacity (refer **Section 3.3.2**), it is anticipated that the bus network can cater for this increase in demand.

Ferry growth, based on the current low proportion of usage, is anticipated to grow by approximately four trips in the AM peak and seven trips in the PM peak. This is in an outbound and inbound direction of travel, respectively. The current 30 minute frequency of ferry services during peak periods prevents the mode from being a viable alternative to high frequency buses which connect residents to Edgecliff Station.

Table 5-11 Public Transport Trip Generation

| Mode | AM Peak ⁵ | | PM Peak ⁶ | | Saturday Peak ⁷ | |
|-------|----------------------|----------|----------------------|----------|----------------------------|----------|
| | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound |
| Train | 5 | 36 | 56 | 10 | 7 | 7 |
| Bus | 1 | 4 | 7 | 2 | 6 | 6 |
| Ferry | - | 4 | 7 | - | - | - |

Source: SCT Consulting; 2021

⁴ 2016 data not available at time of publication

⁵ Based on Journey to Work Data (2011)

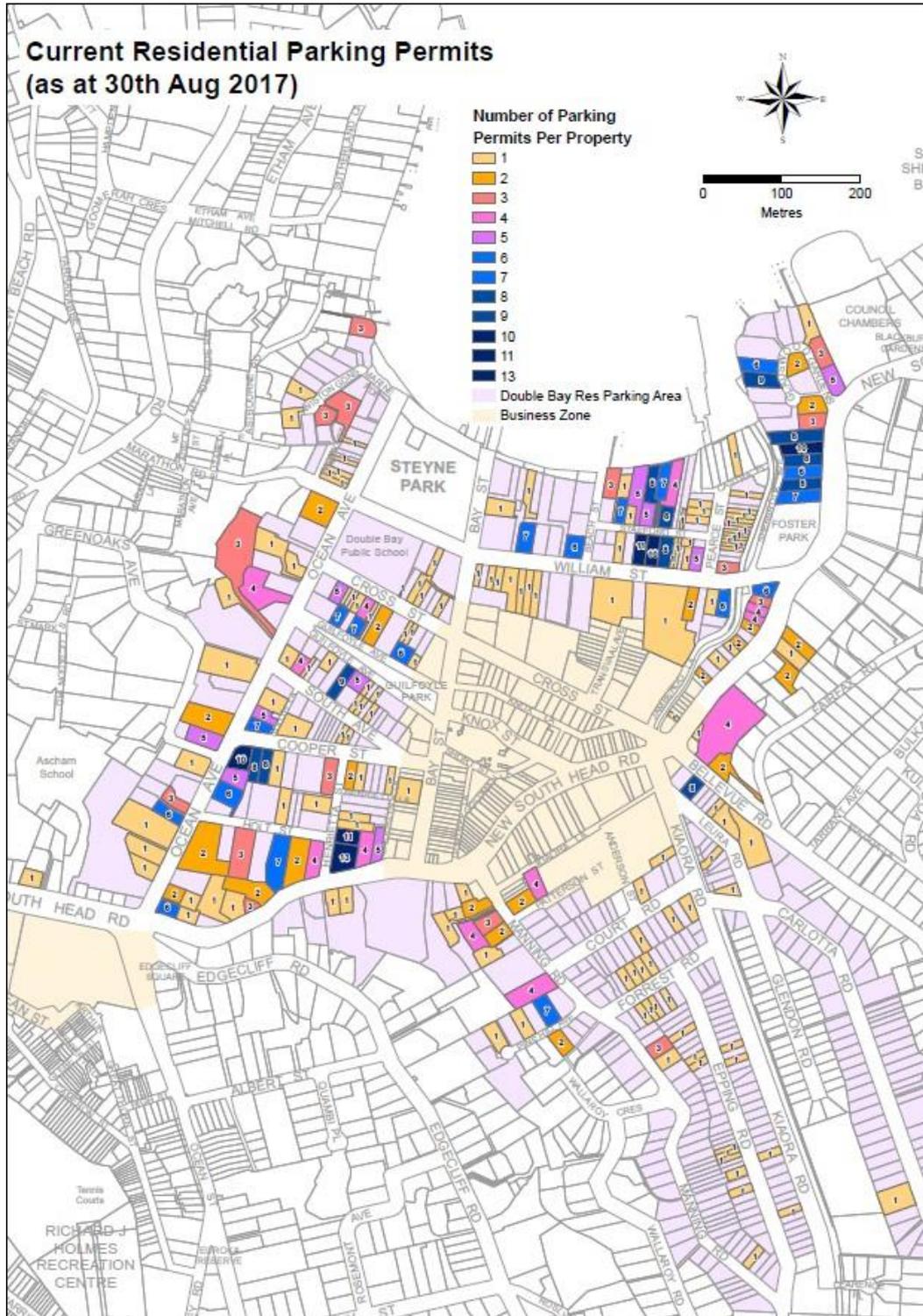
⁶ Based on Journey to Work Data (2011)

⁷ Based on Household Travel Survey Data (2015/16)

5.7.2 Parking

Potential developments may increase the parking capacity of the Town Centre, however this would likely be offset by the additional parking demands generated by the new developments which may impact on the surrounding road network. It is recommended that the impact of the potential development on the surrounding street network be monitored at regular intervals, in line with the development expansion, to ascertain the level of car parking occupancy which cannot be quantified at this stage. This may potentially lead to an extension of parking provision if required. An illustration of WMC’s residential parking permit scheme, which may require extension, is provided in **Figure 5-3**.

Figure 5-3 WMC Current Residential Parking Permit Scheme



Source: WMC; 2017

5.7.3 Walking

Journey to Work travel mode data indicates that during the peak hour period “walked only” trips accounts for approximately 12 per cent outbound trips and 10 per cent of inbound trips. This is a significant representation of active transport and a reflection of the density of Double Bay and proximity to surrounding employment land uses. In addition to this, residents and visitors to Double Bay Town Centre also walk in order to access public transport trips, such as the bus stops on North South Head Road, Edgecliff Station located approximately 400m to the south east and to the Double Bay Ferry Wharf located on the northern edge of the study area. Under the potential future development of the Cross Street Precinct, and based on current Journey to Work data, it is forecast that an additional 16, 26 and 72 walking trips would be realised in the AM, PM and Saturday peak hour respectively. The current Double Bay Town Centre street network has sufficient capacity to cater for this increase in demand. The broader question, of how pedestrian amenity is fostered and increased within the Double Bay Town Centre, is discussed within **Section 6**.

5.7.4 Cycling

WMC have identified cycling as a key component of active transport travel that is to be improved as a mode share through targeted infrastructure improvements. Treatments proposed for WMC to achieve this aim to:

- Cater to existing cycling desire lines in the Double Bay area such as Ocean Avenue and William Street;
- Improve safety outcomes;
- Generate increased demand for active transport leading into the local centres and key public transport hubs of Edgecliff Train Station and Double Bay Ferry Wharf; and,
- Cater for the emergence of new technologies such as electric bikes and electric scooters. These will make climbing steep hills easier which could result in greater active transport demand.

The WMC Active Transport Plan (2021) sets out a prioritisation framework for the delivery of walking and cycling infrastructure across the Woollahra LGA, including the Double Bay Town Centre.

6.0 Potential Traffic and Transport Solutions

6.1 Strategic Policy

Regardless of the level of development which is pursued within the Cross Street Precinct or Double Bay Town Centre, the resultant impact on the network will be an increased level of trip generation. Whilst this assessment has shown that the network can cater for the proposed development uplift the increased trip generation is an important consideration in the place and precinct outcomes for the area. Based on the analysis undertaken to develop the Double Bay Transport Study the following strategic policy direction / solutions are recommended for WMC to drive a successful outcome for the potential development and broader liveability of the Double Bay Town Centre:

- Provide additional car share (Go Get) spaces on street within WMC as well as dedicated parking provision within new developments and WMC car parks
 - Currently there are 271 Go Get members within the Double Bay postcode area. Go Get has room to expand as the current car provision rate is less than the desired target of 30 members per vehicle. The Go Get 2016 member survey of Double Bay members identified that 62.5 per cent owned one or more cars before joining Go Get, now 62.5 per cent do not own a car with 37.5 per cent owning only one car. Furthermore, 72.65 per cent of people indicated that if they were looking to buy or rent an apartment the availability of a car share vehicle would result in them favouring those apartments over others (29.25 per cent) or consider it somewhat favourable (43.4 per cent). These statistics demonstrate the benefit of car share vehicles in lowering car ownership rates. When coupled with new developments car share reduces the need for individuals to purchase a vehicle and, as highlighted in Section 3.5, provides significant benefits to the area in which they operate. City of Sydney Council statistics indicate that one car share vehicle can remove up to 10 local vehicles that would compete for on street parking. As such, advocating the allocation of one car space for shared vehicles to offset 10 off-street parking spaces could be considered for future developments.

WMC may also investigate the use of car share schemes in conjunction with certain residences not being eligible for access to residential parking permit schemes.
- Evaluate existing parking controls
 - Current maximum parking provision rates and parking multipliers within Part E 'General Controls for all Development' of the Woollahra Development Control Plan (2015) should be evaluated in view of considering a reduction, particularly for residential uses.
 - Consider the inclusion of mandatory car share space(s) within developments above a determined threshold. The inclusion of car share spaces under this threshold could be promoted through a reduction in overall parking spaces required for the development.
 - The price of parking within the town centre, both on and off street parking facilities, should be considered as a monetary strategy to induce mode shift away from private vehicles. WMC may choose to use funds gathered from this to subsidise forms of public transport / invest in new active transport infrastructure.
- Monitor public transport patronage
 - Data sources regarding public transport patronage are increasing thanks to advances in technology and the establishment of the Opal ticketing system. Through regular monitoring of public transport conditions WMC will be able to make informed decisions about the success of strategies and have informed discussions with Transport for NSW regarding transport needs within their LGA.
- Lobby Transport for NSW for additional services to Double Bay Ferry Wharf
 - The current service frequency for the ferry mode of travel to access the Sydney CBD from Double Bay is limited to two peak hour services. The lack of frequency limits the success of the ferry as a viable alternative mode for residents. It is recommended that WMC lobby for further services to increase the attractiveness and patronage of the mode.
- Introduce Travel Demand Management⁸ Program within Double Bay businesses
 - As shown in Section 3.1, 63 per cent of employees who live in proximity to the study area currently drive to their place of employment within the Double Bay Town Centre. This is based on an established pattern of

⁸ Travel demand management is the application of strategies and policies to reduce travel demand, or to redistribute demand in time or mode used.

travel behaviour. A Travel Demand Management program, with the aim of reducing peak period travel patterns and reliance on private vehicles, has the potential to educate these individuals on alternate modes of travel to their destination and, pending employee acceptability of the proposed scheme, may encourage greater flexibility in working hours to spread the demand placed on the arterial and local road network.

- Consider expanding the current residential parking permit scheme
 - Continue to evaluate the parking demand for the Double Bay Town Centre during the area's expansion. Potentially expand the current residential parking permit scheme depending on assessed parking impacts.
- Encourage modal shift towards walking and cycling in the Double Bay area
 - Pleasant walking environments and good walking catchments to public transport and key destinations within Double Bay create an opportunity for WMC to promote walking and cycling. Introducing programs such as walking groups promoted by the Heart Foundation and walk to school programs could help encourage a modal shift from private vehicles to walking and cycling;
 - Review speed limits within the study area to improve pedestrian safety and personal security;
 - Provide street tree planting along sections of road where there are fewer trees to give pedestrians weather protection along key walking routes; and
 - Implement the walking and cycling schemes identified within the WMC Active Transport Plan (2021).

The above strategic policies will support WMC in enhancing the transport capacity of the Double Bay Town Centre and control the level of private vehicle traffic generation of future developments. These policies will support the desired reduction in private vehicle traffic generation highlighted in Section 6.

6.2 Infrastructure Modifications

In addition to the above strategic policy directions various road infrastructure upgrades are proposed to further enhance the operation of the Double Bay Town Centre road network. These are outlined in **Figure 6–1**, **Figure 6–2** and **Figure 6–4** respectively and are for further consideration and assessment by WMC. Road infrastructure modifications are listed by priority, which has been determined by the anticipated level of impact on the road network of the Double Bay Town Centre.

6.2.1 Road Infrastructure

- ID1: Formalise Line Marking (Knox Street)
 - Currently the two lane approach, on Knox Street, to the intersection of New South Head Road / Knox Street is unmarked. Marking the lanes and designating vehicles travel path will remove the occurrence of vehicles queuing in the centre lane and reducing available storage space.
- ID2: Knox Street Kerbside Parking
 - Removal of two kerbside parking spaces on Knox Street during the AM peak will facilitate greater access to the left turn lane and provide greater efficiency for the operation of the New South Head Road / Knox Street intersection.
- ID3: Keep Clear Pavement Markings
 - Keep clear pavement markings are proposed at the intersection of Ocean Avenue / Cooper Street to prevent cars from queuing into the intersection footprint and preventing the right turn movement from Ocean Avenue to Cooper Street.

Figure 6-1 Double Bay Transport Study: Solution Development (Road Infrastructure)



Source: SCT Consulting; 2021

6.2.2 Cycling Infrastructure

The WMC Active Transport Plan (2021) outlines key infrastructure upgrades to support cycling across the Woollahra LGA. Within the Double Bay Town Centre the following is suggested:

- ID4: Providing a separated uni-directional bicycle path along Ocean Avenue
 - Providing a separated bike path along Ocean Avenue and enhancing on-road cycling visibility will encourage cycling for locals who are interested or enthused about cycling.
- ID5: Providing a separated bi-directional bicycle path along Edgecliff Road
 - Providing a separated bike path along Edgecliff Road and enhancing on-road cycling visibility will encourage cycling for locals who are interested or enthused about cycling.

Beyond the items listed in the WMC Active Transport Plan the following items are suggested to enhance cycling outcomes within the Double Bay Town Centre:

- ID6: Refresh and improve signage and linemarking at intersections of local roads
 - Refreshing and improving signage and linemarking, particularly at roundabouts will improve driver awareness of cyclists in the area.
- ID7: Provide a dedicated bike parking facility at Guilfoyle Park
 - In addition to improving cycling infrastructure within the Double Bay study area, the convenience of a dedicated bike parking facility at Guilfoyle Park will help to encourage more cycling trips into Double Bay Town Centre.

A summary of cycling infrastructure improvement options is summarised in **Figure 6–2**.

Figure 6–2 Double Bay Transport Study: Solution Development (Cycling Infrastructure)



Source: SCT Consulting; 2021

Based on the TfNSW's (2013) Sydney Cycling Futures, installation of the above treatment types would result in a facility preference change from >75% of people feeling quite or very unsafe and uncomfortable to >75% feeling very safe and comfortable along Ocean Avenue and Edgecliff Road. A summary of TfNSW cycling infrastructure preference rankings is shown in **Figure 6–3**.

Figure 6–3 Active transport facility type - preference ranking using TfNSW Classifications following potential cycling infrastructure upgrades



Source: SCT Consulting; 2021

6.2.3 Walking Infrastructure

Enhance safety and walking potential through enhanced walking infrastructure within, and surrounding, the Double Bay Town Centre by:

- ID8: Improve pedestrian amenity along key walking routes
 - Improve pedestrian amenity along key walking routes through enhanced wayfinding for pedestrians and cyclists and speed limit reviews.
- ID9: Enhance pedestrian crossing infrastructure along key walking routes
 - Enhancing pedestrian crossing infrastructure along key walking routes (pending warrants assessment) could make pedestrians feel safer and encourage more people to walk instead of drive.

A summary of walking infrastructure improvement options is summarised in **Figure 6-4**.

Figure 6-4 Double Bay Transport Study: Solution Development (Walking Infrastructure)



Source: SCT Consulting; 2021

7.0 Summary and Next Steps

7.1 Summary

The Double Bay Transport Study has centred on the assessment of a potential development scenario for the Cross Street Precinct within the Double Bay Town Centre – coupled with the proposed closure of Knox Street between Bay Street and Goldman Lane. The assessment has focused on the identification of potential impacts and found that:

- Existing public transport servicing the Double Bay Town Centre has sufficient capacity to meet increased travel demand associated with the potential full development scheme.
- Existing active transport infrastructure within and around Double Bay is suitable to cater for the increase in trip generation resulting from the potential development uplift in the Cross Street Precinct. However, greater emphasis, through policy and infrastructure, can be made to support an increase in active transport as a travel mode.
- The road network responds favourably to the potential increase in development with results indicating the existing network infrastructure can cater for the development and Knox Street closure based on existing patterns of travel behaviour. Regardless, various policies and strategic directions are available for WMC to further enhance the precinct outcomes. It is recommended that WMC consider implementing these policies / strategies which include:
 - Providing additional Go Get (car share) parking spaces
 - Evaluating existing parking controls
 - Monitoring public transport
 - Lobby Transport for NSW for additional ferry services
 - Introducing travel demand management programs within Double Bay
 - Expanding the current residential parking permit scheme
 - Encouraging a modal shift from driving in private vehicles to walking and cycling to key destinations like Double Bay town centre and Double Bay Public School.

In addition, minor modifications to intersections can also be made to further enhance network performance. These modifications would support the proposed multi-modal strategies / policies.

7.2 Next Steps

Following review of the Double Bay Transport Study documentation the following next step is recommended for action by WMC:

- Progress and implement the various strategic policies / solutions identified within **Section 6** to foster improved multi-modal planning and operational outcomes within the Double Bay Town Centre.

