# Bowral: Analysis of Bong Bong Street's intersection with Merrigang Street *final*

Prepared for Wingecarribee Shire Council
File 7300/10

This document is the adopted "draft" document submitted to Council on 19 September 2012 without change, apart from marking it "final".

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# *Bong Bong Street's intersection with Merrigang Street: Analysis – final*

Prepared for Wingecarribee Shire Council

## 1.0 Introduction

Wingecarribee Shire Council commissioned High Range Analytics to prepare a traffic microsimulation model of the Bowral Town Centre in 2010. This model was built and used to test a number of land use development and road improvement strategies in 2010 and 2011. Subsequently, Wingecarribee Shire Council asked High Range Analytics to run further tests that considered possible changes to the mode of control at the intersection of Bong Bong Street and Merrigang Street. This report describes these further analyses.

The traffic context of Bowral is outlined in Chapter 2 along with a brief description of the microsimulation model.

The scenarios tested are described in outline in Chapter 3. Chapters 4 through 7 describe the details of the scenarios and provide a summary of the modelling.

# 2.0 Traffic Context and Modelling Background

Bowral is a vibrant town centre in the Southern Highlands located about an hour and a half south west of Sydney. The traffic network in Bowral, during periods of peak demand, is under considerable load, exhibiting queuing and delays in parts. A traffic model was developed in 2010 in order to assess existing conditions and to test the operational performance of potential amendments to town centre traffic arrangements and land use.

The application of microsimulation traffic modelling in Bowral is a useful step in assisting to assess current traffic system performance and to assess changes to the traffic system, primarily because it represents operational behaviour in the traffic network, including the effects of friction and queuing, as well as re-routing by drivers as network costs change.

The model was built to analyse the afternoon school peak, nominally from 3pm to 4pm on a Friday. Based on counts and information from RMS's traffic signal control system (SCATS), this is considered to be the critical period for network performance. The model is based on a large dataset that describes existing traffic behaviour, including traffic volumes, turning movements at most town centre intersections and car parks, travel times, pedestrian crossing and traffic signal operations and queuing, as well as the physical attributes of the road and traffic system. Features built into the model include the effect of friction due to on-street car parking and operation of marked pedestrian foot crossings, traffic signal operations, traffic demands that represent those observed on the survey day, as well as a spatially accurate representation of the road network. The base model uses data from April and May 2010.

The model uses Paramics version 5.2 and applies several plug-ins developed by Azalient for the then RTA. The plug-ins extend the functionality of the core Paramics application.

The key findings of the base model analysis were that the northern part of the town centre suffers from a bottleneck as northbound traffic seeks to exit the town. There are three main routes available to northward moving traffic:

- Station Street
- Bong Bong Street
- Bendooley Street and Merrigang Street

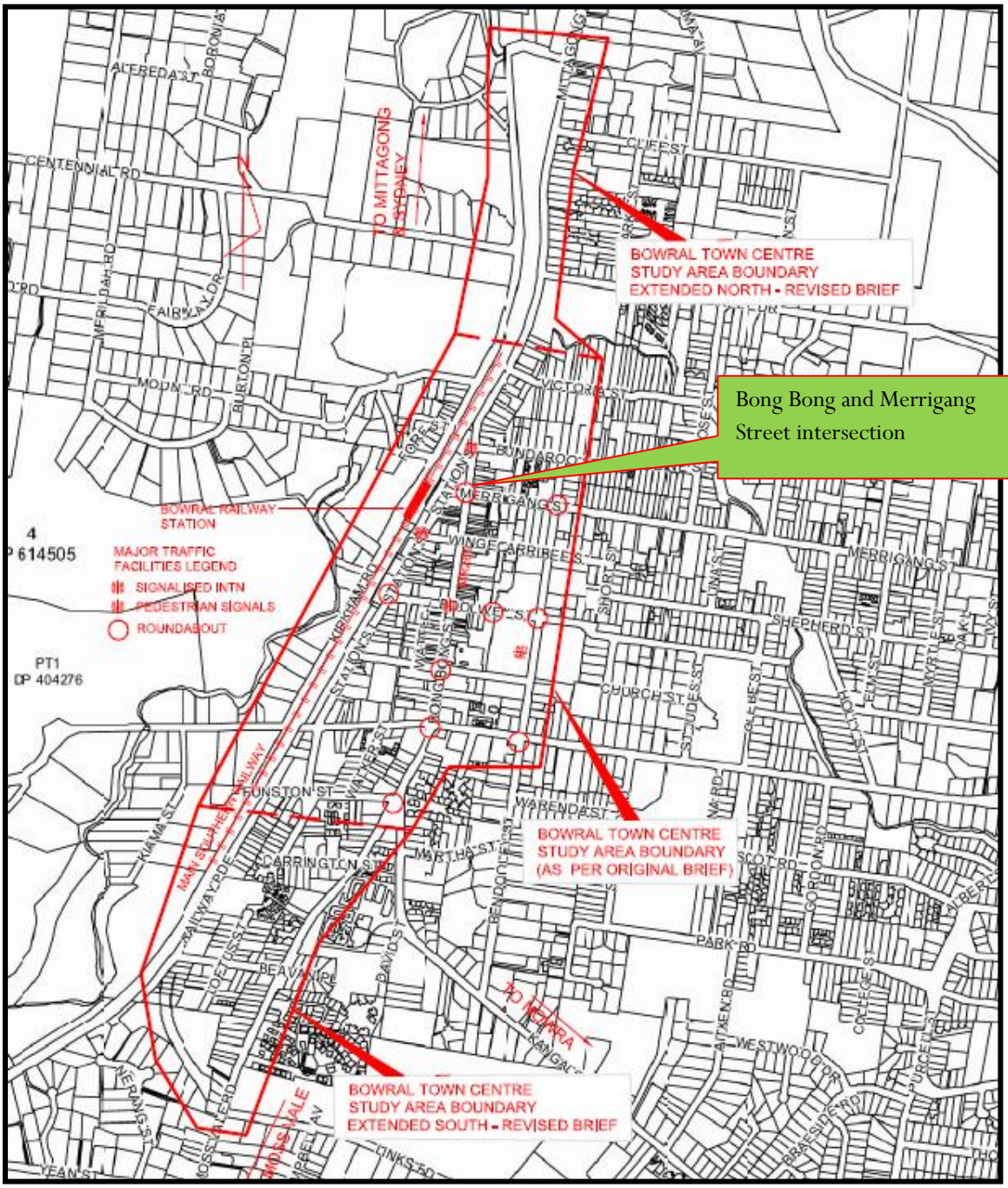
These three all converge at the northern end of town, where all northbound traffic must pass through the Station Street and Bong Bong Street signals. Consequently, there is extensive queuing westbound on Merrigang Street east of Bong Bong Street and associated queuing on Bong Bong Street. The operation of the roundabout at Bong Bong Street and Merrigang Street is affected by queues of traffic trying to move north along Bong Bong Street from both Bong Bong Street south and Merrigang Street east. This adversely affects the efficient feed of northbound traffic to the Bong Bong Street signal's stop line at Station Street.

A further finding of the base model establishment was that the model network is prone to lock-ups associated with the multiple mini-roundabouts within the town centre. This is a known issue with Paramics version 5.2. The implication of this is that the process of optimising routing and vehicle costs within the model is time consuming.

This current report examines the likely implications of a potential change to the mode of control of the Bong Bong Street and Merrigang Street intersection from roundabout to traffic signals.

The model extent is shown by Figure 2-1 and the location of the Bong Bong Street and Merrigang Street intersection is highlighted.

*Figure 2-1 – Model extent and location of Bong Bong and Merrigang Street intersection*



# 3.0 Bong Bong Street and Merrigang Street Intersection

## 3.1 General

Modelling of the town centre network, as noted in the previous chapter, identified the operation of the Bong Bong Street and Merrigang Street intersection as having a substantial impact on the ability of the road network in the northern part of Bowral to process traffic demands. This was primarily due to the operation of this roundabout intermittently preventing northbound traffic from reaching the Bong Bong Street stopline at the Station Street signals – the main issue is queuing within the roundabout.

A short term option to address this was previously identified and entailed the opening of Bundaroo Street at its intersection with Station Street to:

- Bring it within control of the Station Street and Bong Bong Street signals; and,
- Permit additional movements (currently left in left out only) at the intersection, mainly the right turn from Bundaroo Street to the north (i.e., to Mittagong Road).

Modelling of this arrangement indicated it would take some traffic out of the Bong Bong Street and Merrigang Street roundabout, reducing average delays at this intersection, and supporting additional land use development within Bowral town centre. The small amount of traffic removed from the roundabout would substantially free-up its operation, by reducing the instances of queues blocking the facility.

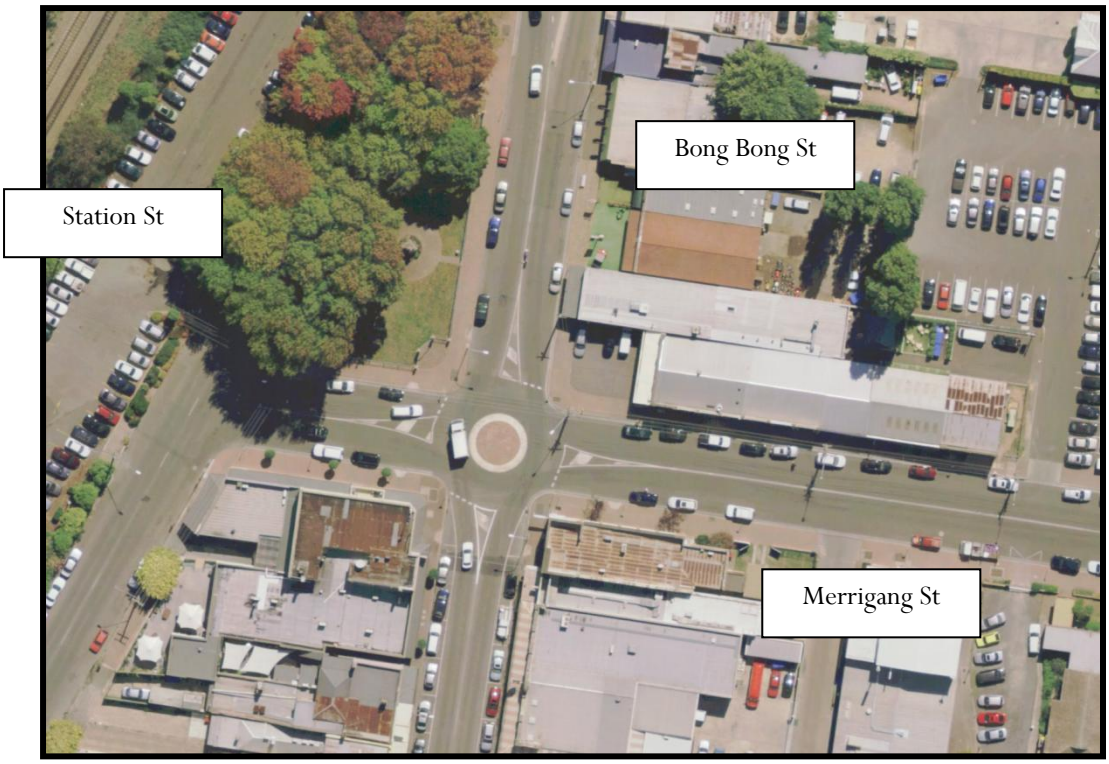
A longer term option to provide additional effective traffic capacity was to convert the intersection of Station Street, Bong Bong Street and Bundaroo Street to a large capacity roundabout.

Against this background, WSC requested modelling analysis of a proposal to introduce signals at Bong Bong Street and Merrigang Street. The signals would provide improved pedestrian facilities, when compared with the current roundabout.

## 3.2 Intersection arrangements

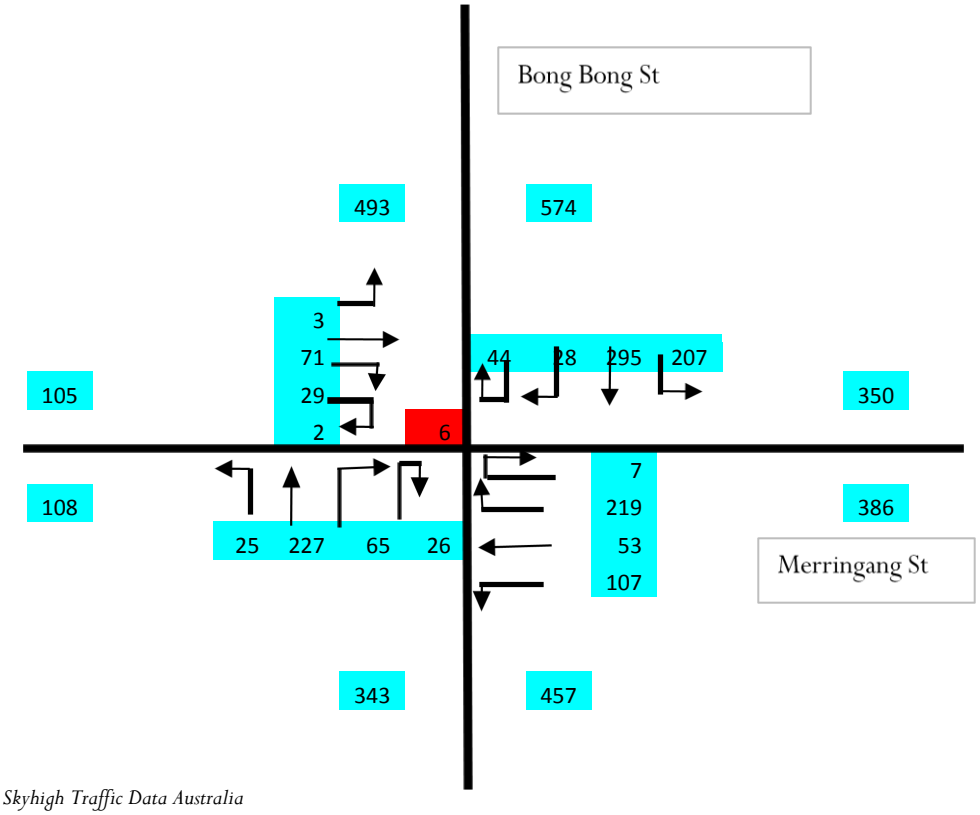
The current intersection is a single lane circulating roundabout with a single lane on each of the four approaches. The following figure indicates current arrangements.

*Figure 3-1 – Existing intersection of Bong Bong Street and Merrigang Street*




*Source: WSC*

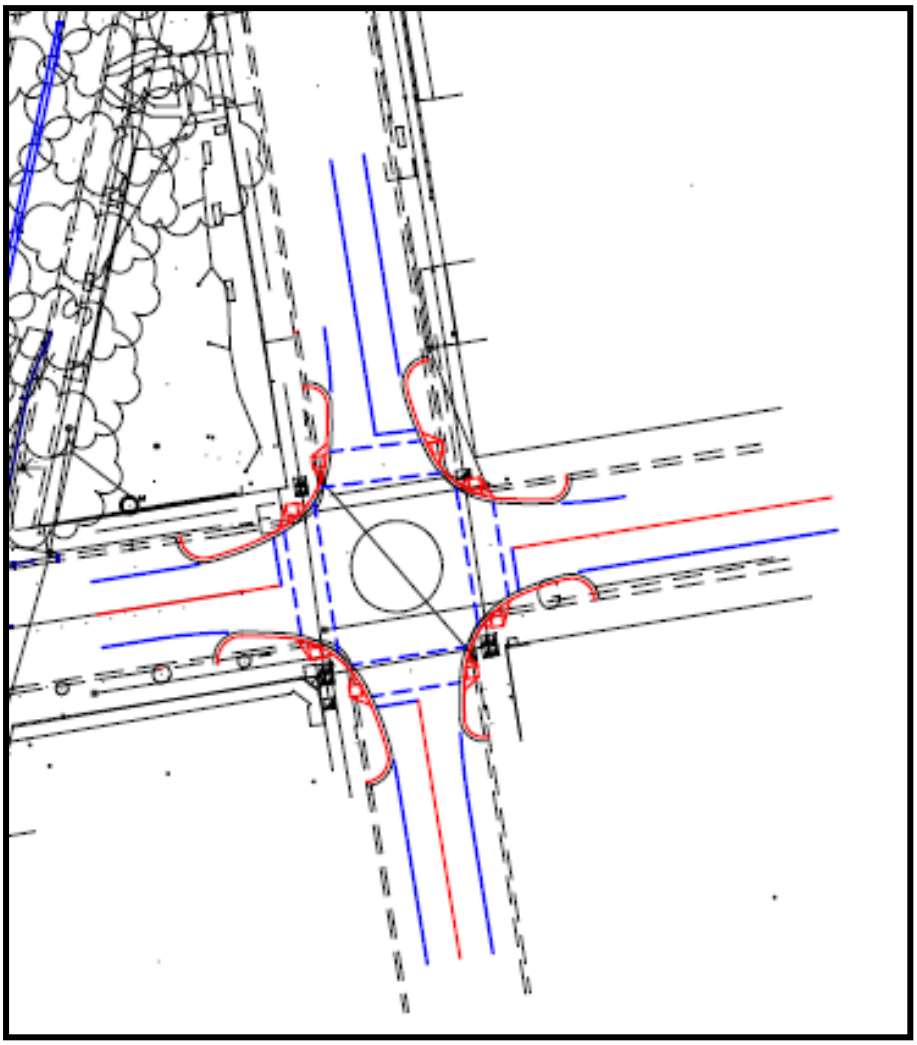
*Figure 3-2 – Existing turning movement volumes*




*Source: Skyhigh Traffic Data Australia*

WSC prepared an initial concept design for traffic signals. This involved single lane approaches with pedestrian facilities on each arm and is shown on Figure 3-3 below.

***Figure 3-3 – Preliminary concept design Bong Bong and Merrigang Street for testing***



*Source: WSC*

## 3.2 Tests

- Test A – introduce signals at Bong Bong Street and Merrigang Street within the base model.
- Test B – introduce signals Bong Bong Street and Merrigang Street with Victoria Street land use development and signals at Mittagong Road and Victoria Street; and then test development threshold for additional town centre traffic generation.
- Test C - introduce signals Bong Bong Street and Merrigang Street with Victoria Street land use development and signals at Mittagong Road and Victoria Street and opening of Bundaroo Street with signals; and then test development threshold for additional town centre traffic generation.
- Test D - introduce signals Bong Bong Street and Merrigang Street with Victoria Street land use development and signals at Mittagong Road and Victoria Street; and convert the Station Street, Bong Bong Street and Bundaroo Street intersection to a high capacity two-lane roundabout; and test with additional town centre traffic generation.

The tests are aimed at establishing the feasibility of signals at the intersection of Bong Bong Street and Merrigang Street:

- Within the current and near-future road networks, and whether the opening of Bundaroo Street is required;
- How the signals might function with the proposed opening of Bundaroo Street and the ability to handle additional traffic; and,
- If signals were introduced in the near future at Bong Bong Street and Merrigang Street, whether the long term option (of a large capacity roundabout at Station Street, Bong Bong Street and Bundaroo Street) would still be appropriate.

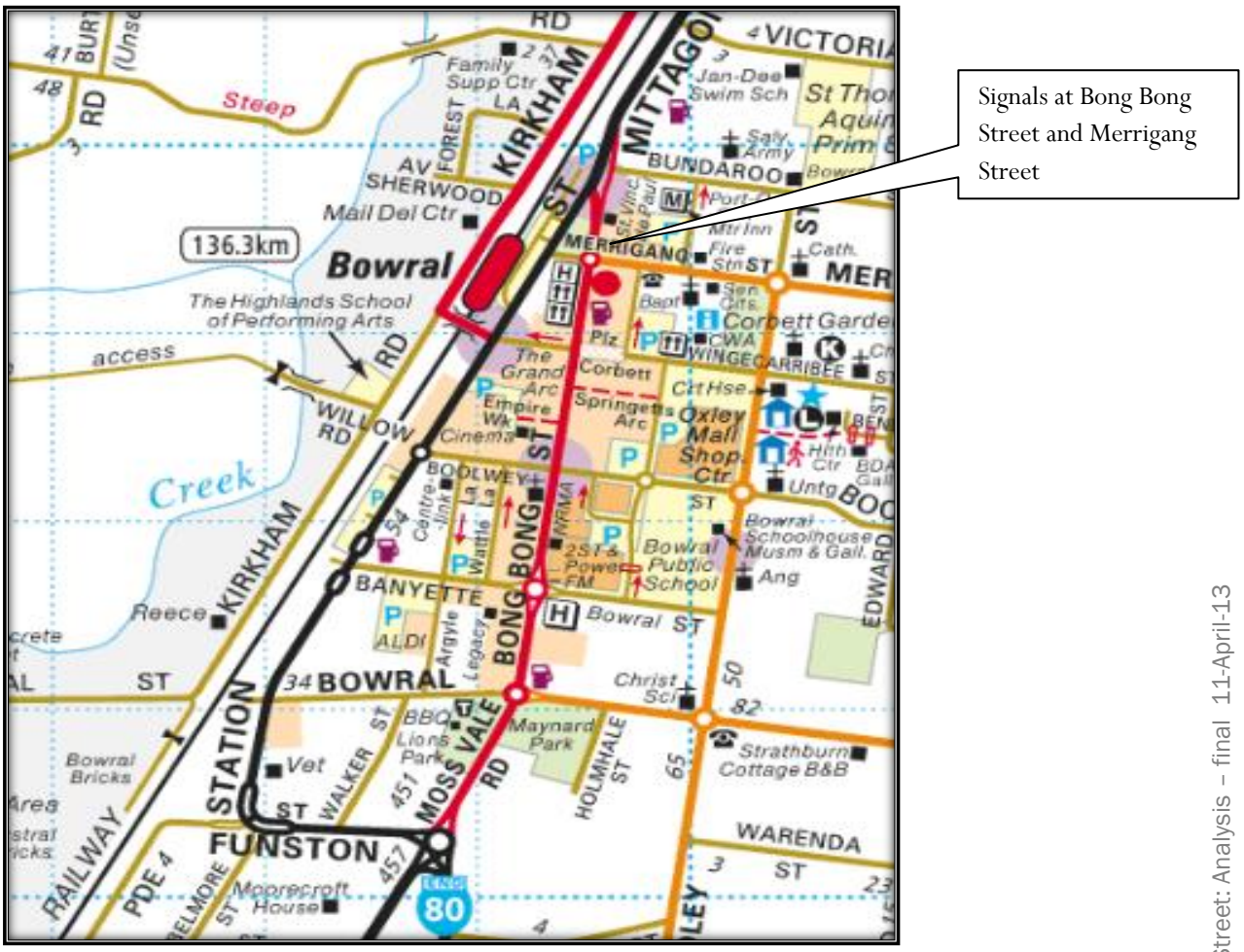
Subsequent sections of this report describe each of the tests in more detail and summarise their results.

# 4.0 Test A – Existing Conditions plus Signals at Bong Bong and Merrigang Street

## 4.1 Outline

This option uses the base model (reflecting current conditions) with the conversion of the current mini roundabout at the intersection of Bong Bong and Merrigang Street to traffic signals.

***Figure 4-1 – Location of tested changes***




## 4.2 Model changes

- Signals introduced at the intersection of Bong Bong Street and Merrigang Street as:
  - conventional phasing (i.e., two-phase system with filter right turns on all approaches)
  - every third cycle has left turn red phase signals of 14 seconds on all approaches except for the western approach to capture the impact of vehicle/pedestrian conflicts on traffic capacity[1]
  - running a common cycle time with signals at the intersection of Station Street and Bong Bong Street
  - offsets set to feed Bong Bong Street south through movement onto the end of phase A and initial part of the phase B northbound at Station Street and Bong Bong Street signals, with the filter right turn from Merrigang Street (east) feeding onto the end of the B phase and start of the A phase at Station Street and Bong Bong Street – this arrangement meant that part of the

[1] An all-red phase every third cycle was also tested initially and performed similarly to the late start approach adopted for testing of this and subsequent test cases.

two main northbound feeds would get some green time at the Bong Bong Street stopline of the Station Street and Bong Bong Street signals. Other offsets were tested, but led to excess queuing back from the Bong Bong Street approach to the Station Street and Bong Bong Street signals.

- Route choice rules adjusted to get a better spread of traffic within the network, to avoid the situation of heavily congested routes with parallel alternative routes being lightly trafficked.

## 4.3 Results

This model operates satisfactorily, completing five random seed runs.

The average delay and level of service[2] at the Bong Bong and Merrigang Street and the Station Street and Bong Bong Street intersections are summarised in the following table.

***Table 4-1 Approach and intersection average delays (sec) and levels of service for five completed model runs***

| Intersection | Approach | Seed 560 | Seed 5321 | Seed 137 | Seed 601027 | Seed 559 |
|---|---|---|---|---|---|---|
| Bong Bong & Station Street | north | 14.5 | 14.4 | 18.1 | 15.6 | 19.0 |
| Bong Bong & Station Street | south | 21.5 | 23.0 | 22.0 | 23.2 | 20.1 |
| Bong Bong & Station Street | south west | 20.0 | 20.2 | 19.4 | 20.9 | 20.5 |
| | | | | | | |
| Bong Bong & Station Street | all | 18.5 | 18.8 | 19.6 | 19.6 | 19.9 |
| Level of service (LOS) | | B | B | B | B | B |
| | | | | | | |
| Bong Bong & Merrigang Street | north | 21.9 | 21.8 | 25.5 | 23.0 | 30.0 |
| Bong Bong & Merrigang Street | east | 45.1 | 55.1 | 50.1 | 57.1 | 67.0 |
| Bong Bong & Merrigang Street | south | 31.1 | 23.3 | 36.1 | 27.1 | 28.3 |
| Bong Bong & Merrigang Street | west | 36.8 | 35.8 | 40.2 | 35.7 | 38.1 |
| | | | | | | |
| Bong Bong & Merrigang Street | all | 32.5 | 32.1 | 36.2 | 34.6 | 41.0 |
| Level of service (LOS) | | C | C | C | C | C |

The signals at Bong Bong Street and Merrigang Street work satisfactorily with delays of between 30 and 40 seconds, which is consistent with LOS C.

Appendix A contains a comparison of route costs.

[2] Note – these are prepared using the LOS plug-in and are indicative of the delays encountered at the intersections in the model; average delay is the delay across all movements in the intersection; critical delay is the same as average delay for TCS and RAB, but is the movement with the highest delay for priority intersections. The LOS criteria used in this analysis are:

LOS A 0 to 14.5 sec avg delay; LOS B 14.5 to 28.5 sec avg delay; LOS C 28.5 to 42.5 sec; LOS D 42.5 to 56.5 sec avg delay; LOS E 56.5 to 70.5 avg delay; and LOS F greater than 70.5 sec.

# 5.0 Test B – Existing Conditions plus Signals at Bong Bong and Merrigang Street and Victoria Street Changes

## 5.1 Outline

This is the base model with:

- the conversion of the current mini roundabout at the intersection of Bong Bong and Merrigang Street to signals,
- the approved land use development at the intersection of Victoria Street and Mittagong Road , and
- traffic signals introduced at the intersection of Victoria Street and Mittagong Road.

Further tests involve the following demands cases:

Demand Case A:

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking , and
- Additional demand at Merrigang Street public car park.

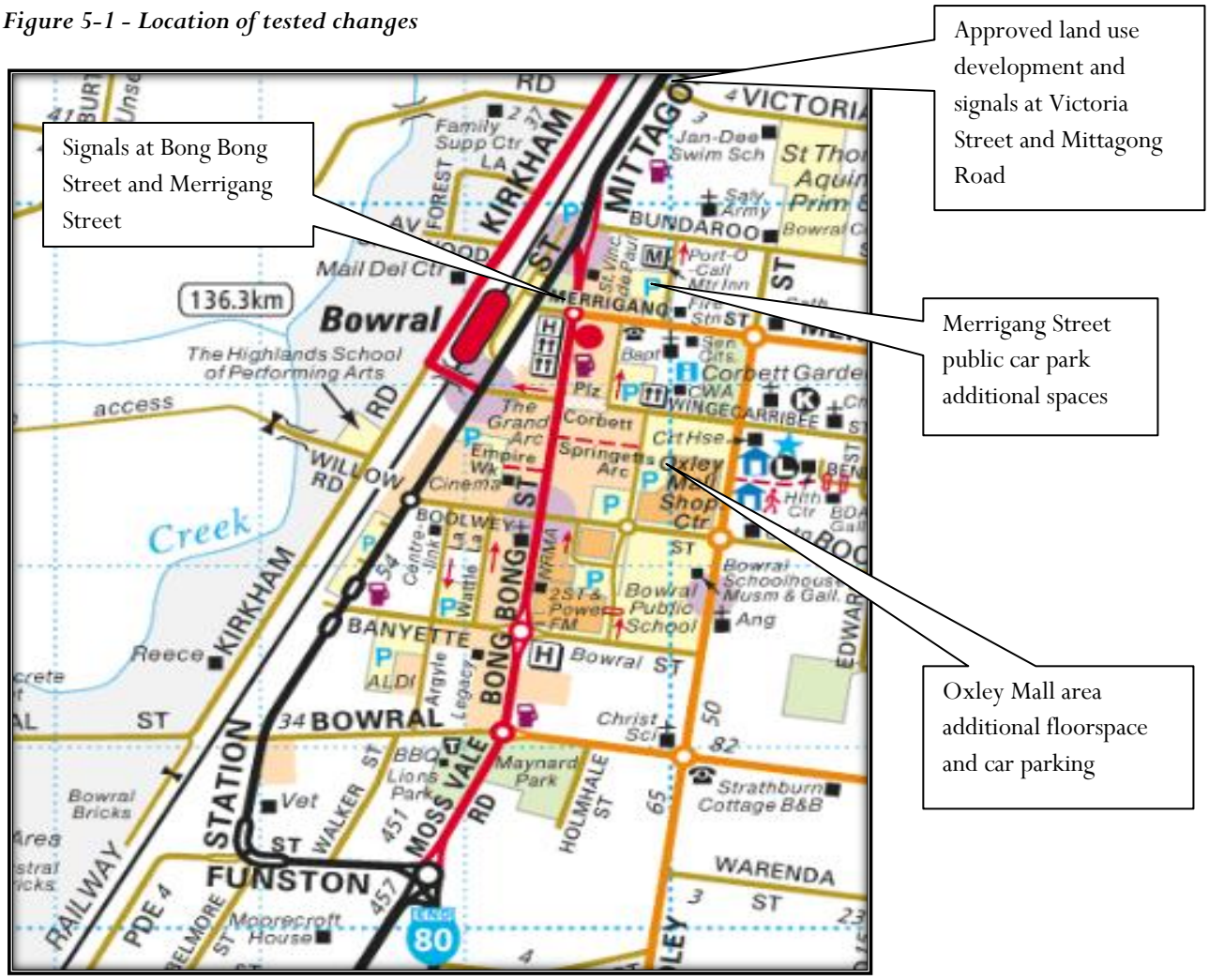
Demand Case B:

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking.

Demand Case C:

- Additional demand at Oxley Mall area of approximately half the amount of incremental traffic generation in Demand Case B.

*Figure 5-1 - Location of tested changes*




## 5.2 Model changes

***Test B:***

- Signals introduced at Bong Bong Street and Merrigang Street as:
  - conventional phasing (i.e., two-phase system with filter right turns on all approaches)
  - every third cycle has left turn red signals for seconds on all approaches except to capture the impact of vehicle/pedestrian conflicts on traffic capacity
  - running a common cycle time with signals at the intersection of Station Street and Bong Bong Street
  - offsets set to feed Bong Bong Street south through movement onto the red phase B and initial part of the green phase B northbound at Station Street and Bong Bong Street signals, with the filter right turn from Merrigang Street (east) feeding onto the end of the green B phase and start of the red B phase at Station Street and Bong Bong Street
- Signals introduced at Victoria Street and Mittagong Road[3] as:
  - Three-phase with filter right turn in
  - Phases introduced to account for modest pedestrian crossing impacts on traffic capacity
  - Running common cycle time as signals at Station Street and Bong Bong Street

[3] This intersection and signal arrangement is the same as that used in previous modelling.

- Additional demand associated with the traffic generation of the approved land use development at Victoria Street and Mittagong Road (both the north-east and south-east corners of the intersection)
- Route choice rules adjusted to get a better spread of traffic within the network, to avoid the situation of heavily congested routes with parallel alternative routes being lightly trafficked

***Test B Demand Case A:***

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking (458 additional trips)
- Additional demand at Merrigang Street public car park (260 additional trips)
- Additional route choice adjustments

***Test B Demand Case B:***

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking (458 additional trips)
- Additional route choice adjustments

## 5.3 Results

With Demand Case A, the model was subject to lock-ups and efforts were made to resolve the causes of the lock-ups and to more evenly spread traffic within the network. This optimisation was not successful at obtaining satisfactory model operation, and at this stage, it is likely that this network scenario will not support this demand case. However, this is not certain and further optimisation may identify satisfactory operation.

With Demand Case B satisfactory network operation was achieved, with the model completing its analysis for five random seed values. Model operations indicate visually there is obviously more traffic in the model and intermittent queues form in the northern end of the model, around the Bong Bong Street and Merrigang Street intersection.

The average delay and level of service[4] at the Bong Bong and Merrigang Street and the Station Street and Bong Bong Street intersections are summarised in the following table.

[4] Note – these are prepared using the LOS plug-in and are indicative of the delays encountered at the intersections in the model; average delay is the delay across all movements in the intersection; critical delay is the same as average delay for TCS and RAB, but is the movement with the highest delay for priority intersections.

*Table 5-1 Approach and intersection average delays (sec) and levels of service for five completed model runs*

| Intersection | Approach | Seed 560 | Seed 28 | Seed 86524 | Seed 137 | Seed 601027 |
|---|---|---|---|---|---|---|
| Bong Bong & Station Street | north | 15.1 | 16.7 | 16.3 | 17.2 | 16.2 |
| Bong Bong & Station Street | south | 21.8 | 21.7 | 22.4 | 21.0 | 22.7 |
| Bong Bong & Station Street | south west | 22.1 | 20.4 | 21.8 | 21.3 | 20.7 |
| | | | | | | |
| Bong Bong & Station Street | all | 19.4 | 19.4 | 20.0 | 19.7 | 19.6 |
| Level of service (LOS) | | B | B | B | B | B |
| | | | | | | |
| Bong Bong & Merrigang Street | north | 26.7 | 35.3 | 33.5 | 27.9 | 32.9 |
| Bong Bong & Merrigang Street | east | 92.7 | 131.8 | 139.9 | 75.1 | 105.2 |
| Bong Bong & Merrigang Street | south | 29.4 | 41.6 | 37.8 | 31.5 | 38.9 |
| Bong Bong & Merrigang Street | west | 41.6 | 36.6 | 38.4 | 37.9 | 40.0 |
| | | | | | | |
| Bong Bong & Merrigang Street | all | 46.2 | 60.3 | 61.3 | 42.9 | 53.7 |
| Level of service (LOS) | | D | E | E | D | D |

The variation in the average delay (and LOS) at Bong Bong Street and Merrigang Street is indicative of the higher utilisation of the intersection. With SCATS working to optimise signal operations (in the real world), it is reasonable to expect that actual delays at this intersection would probably be less than indicated by this analysis.

Appendix B contains a comparison of route costs.

# 6.0 Test C – Existing Conditions plus Signals at Bong Bong and Merrigang Street and Victoria Street changes and reconfiguration of Bundaroo Street

## 6.1 Outline

This is the base model with:

- the conversion of the current mini roundabout at the intersection of Bong Bong and Merrigang Street to signals,
- the approved land use development at the intersection of Victoria Street and Mittagong Road ,
- signals at the intersection of Victoria Street and Mittagong Road, and
- reconfiguration of Bundaroo Street's intersection with Bong Bong Street to convert from unsignalised left in left out to signal controlled permitting left in, as well as left and right out.

Further tests involve the following increases in demands:

Demand Case A:

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking , and
- Additional demand at Merrigang Street public car park.

Demand Case B:

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking.

Demand Case C:

- Additional demand at Oxley Mall area of approximately half the amount of incremental traffic generation in Demand Case B.

*Figure 6-1 - Location of tested changes*

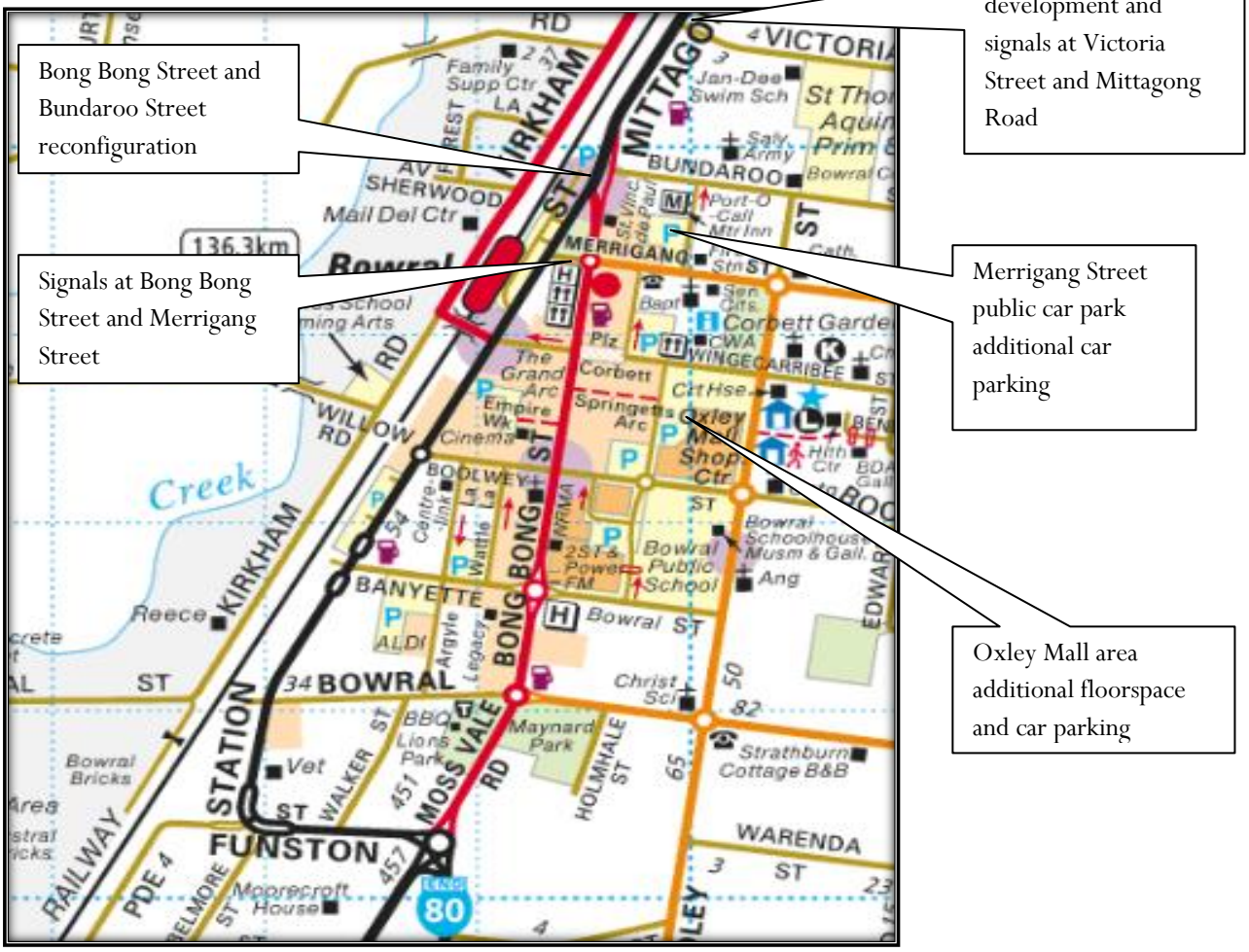
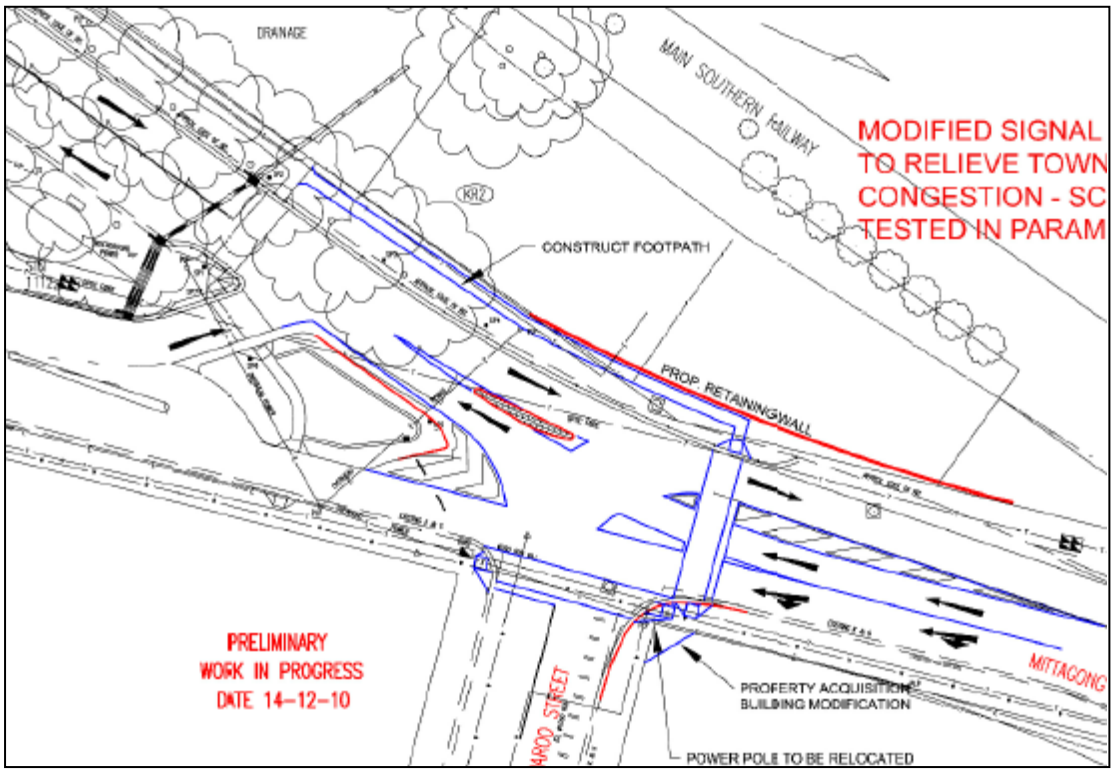


*Figure 6-2 – Preliminary layout of proposed reconfiguration of the intersection of Bong Bong Street and Bundaroo Street*




*Source: WSC*

## 6.2 Model changes

***Test C:***

- Signals introduced at Bong Bong Street and Merrigang Street as:
  - conventional phasing (i.e., two-phase system with filter right turns on all approaches)
  - every third cycle has left turn red signals for seconds on all approaches except to capture the impact of vehicle/pedestrian conflicts on traffic capacity
  - running a common cycle time with signals at the intersection of Station Street and Bong Bong Street
  - offsets set to feed Bong Bong Street south through movement onto the red phase B and initial part of the green phase B northbound at Station Street and Bong Bong Street signals, with the filter right turn from Merrigang Street (east) feeding onto the end of the green B phase and start of the red B phase at Station Street and Bong Bong Street
- Signals introduced at Victoria Street and Mittagong Road[5] as:
  - Three-phase with filter right turn in
  - Phases introduced to account for modest pedestrian crossing impacts on traffic capacity
  - Running common cycle time as signals at Station Street and Bong Bong Street
- Additional demand associated with the traffic generation of the approved land use development at Victoria Street and Mittagong Road (both the north-east and south-east corners of the intersection)
- reconfiguration of Bundaroo Street's intersection with Bong Bong Street to convert from unsignalised left in left out to signal controlled permitting left in, as well as left and right out

[5] This intersection and signal arrangement is the same as that used in previous modelling.

- Route choice rules adjusted to get a better spread of traffic within the network, to avoid the situation of heavily congested routes with parallel alternative routes being lightly trafficked

***Test C Demand Case A:***

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking (458 additional trips)
- Additional demand at Merrigang Street public car park (260 additional trips)
- Additional route choice adjustments

***Test C Demand Case B:***

- Additional demand at Oxley Mall area including additional retail floorspace and public car parking (458 additional trips)
- Additional route choice adjustments

## 6.3 Results

This model achieves satisfactory operation for 5 seed values with the higher demand scenario (Demand Case A).

The average delay and level of service[6] at the Bong Bong and Merrigang Street and the Station Street and Bong Bong Street intersections are summarised in the following table.

[6] Note – these are prepared using the LOS plug-in and are indicative of the delays encountered at the intersections in the model; average delay is the delay across all movements in the intersection; critical delay is the same as average delay for TCS and RAB, but is the movement with the highest delay for priority intersections.

*Table 6-1 Approach and intersection average delays (sec) and levels of service for five completed model runs*

| Intersection | Approach | Seed 560 | Seed 5321 | Seed 137 | Seed 98812 | Seed 601027 |
|---|---|---|---|---|---|---|
| Bong Bong & Station Street | north | 21.4 | 16.1 | 17.0 | 17.1 | 16.9 |
| Bong Bong & Station Street | east | 88.4 | 22.8 | 22.7 | 23.9 | 22.7 |
| Bong Bong & Station Street | south | 47.1 | 25.4 | 26.2 | 24.7 | 26.5 |
| Bong Bong & Station Street | south west | 25.9 | 20.3 | 21.7 | 21.3 | 20.6 |
| | | | | | | |
| Bong Bong & Station Street | all | 32.4 | 21.2 | 22.0 | 21.9 | 21.7 |
| Level of service (LOS) | | C | B | B | B | B |
| | | | | | | |
| Bong Bong & Merrigang Street | north | 32.2 | 30.1 | 29.8 | 28.2 | 31.2 |
| Bong Bong & Merrigang Street | east | 105.2 | 133.6 | 134.6 | 81.4 | 109.9 |
| Bong Bong & Merrigang Street | south | 62.5 | 45.0 | 37.5 | 35.8 | 39.8 |
| Bong Bong & Merrigang Street | west | 40.1 | 37.1 | 39.3 | 38.6 | 41.3 |
| | | | | | | |
| Bong Bong & Merrigang Street | all | 52.5 | 57.5 | 57.0 | 44.1 | 52.3 |
| Level of service (LOS) | | D | E | E | D | D |

The results of this analysis indicate that the opening of Bundaroo Street at Bong Bong Street (as shown in Figure 6-2) provide a meaningful contribution to network capacity and that it would operate satisfactorily with the intersection of Bong Bong Street and Merrigang Street controlled by signals.

Consistent with the comments made in the previous chapter, it is likely that the SCATS signal control system (in the real world) would provide phase splits at the two intersections that are more optimal than those applied in the model, and this could increase the effective capacity of the intersections.

Appendix C contains a comparison of route costs.

# 7.0 Test D – Long term Town Centre Distributor Road plus Signals at Bong Bong and Merrigang Street

## 7.1 Outline

This is the base model with:

- the conversion of the current mini roundabout at the intersection of Bong Bong and Merrigang Street to signals,
- the approved land use development at the intersection of Victoria Street and Mittagong Road ,
- signals at the intersection of Victoria Street and Mittagong Road,
- development of Station Street as a two-lane each way road between Bundaroo Street and Bowral Street with a two lane roundabout at Station and Bundaroo Street,
- duplication of the Wingecarribee Street rail overbridge and signal control of the intersection of Wingecarribee Street and Kirkham Road, and
- additional demand at: Oxley Mall area; Merrigang Street car park; at corner of Mittagong Road and Bundaroo Street; Sherwood Village; a site at the corner of Moss Vale Road and Bowral Street and; a site on Banyette Street.

*Figure 7-1 - Location of tested changes*

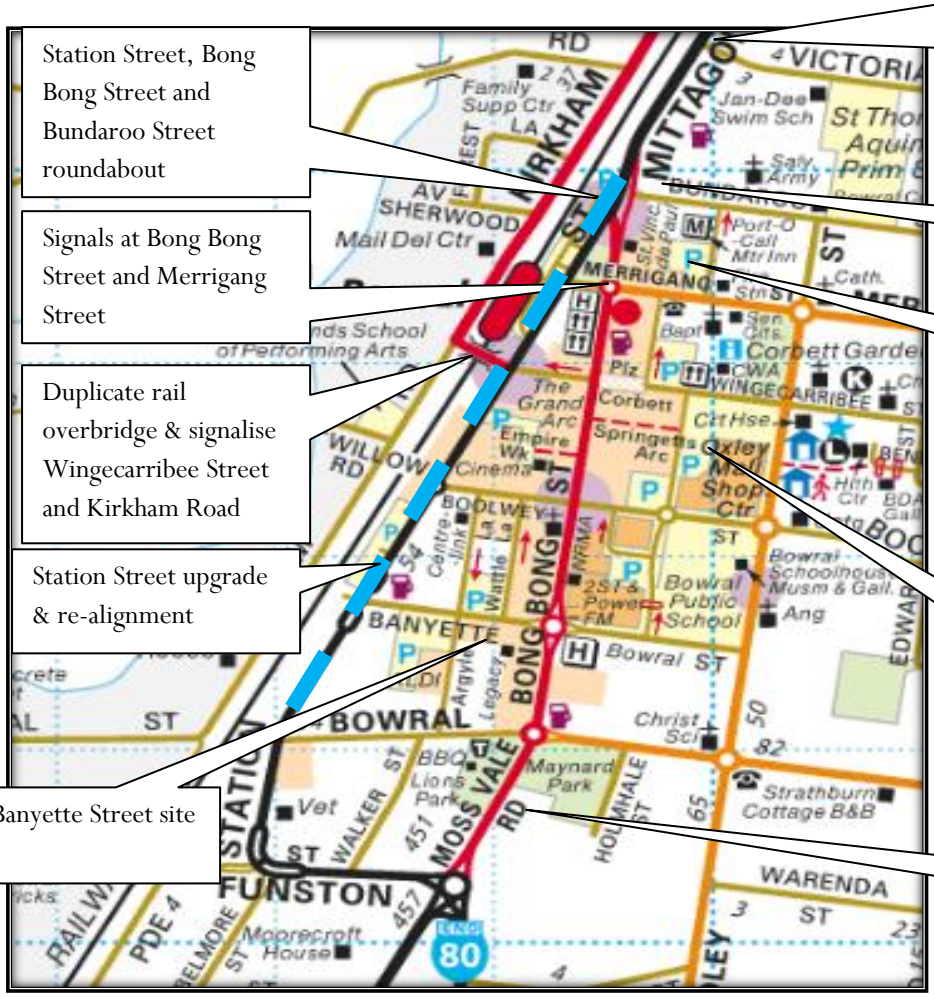
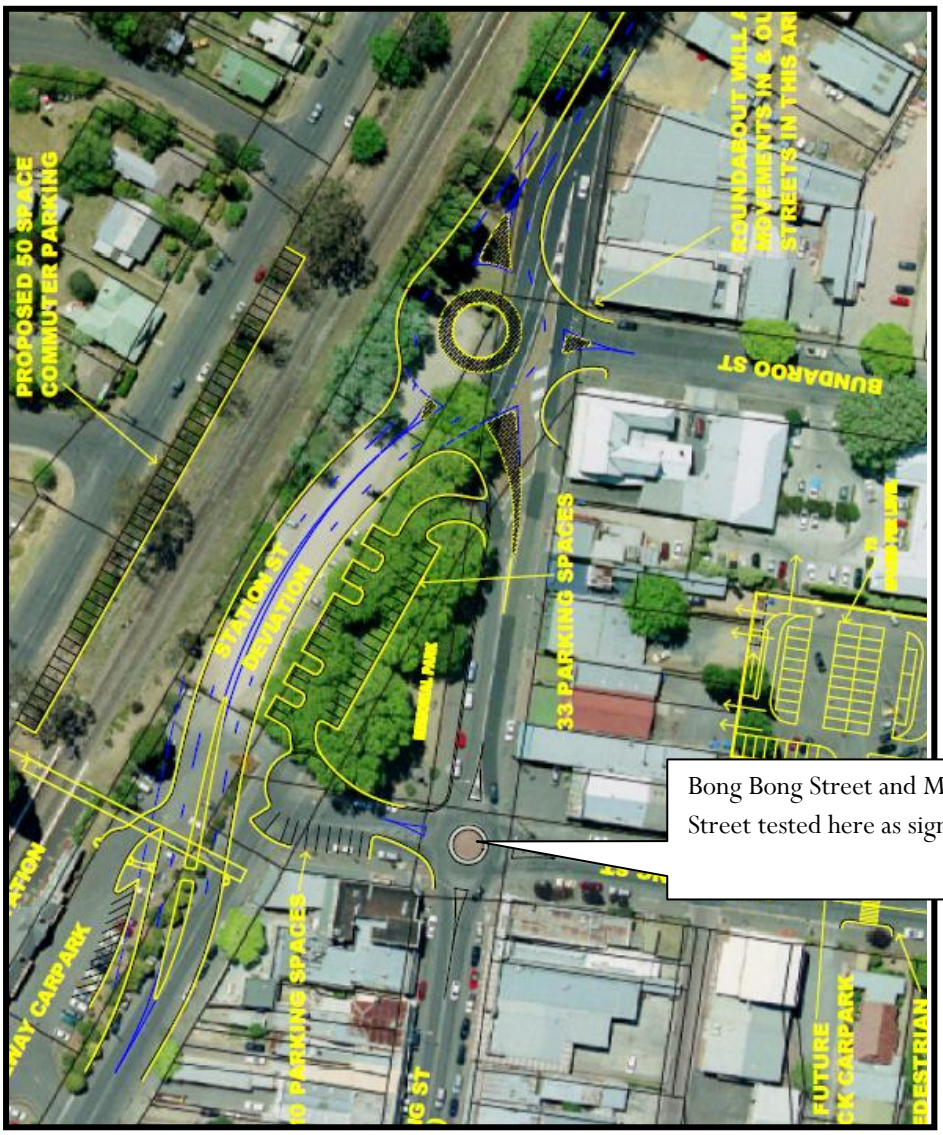


*Figure 7-2 – Preliminary layout of proposed reconfiguration of the intersection of Station Street, Bong Bong Street and Bundaroo Street as a two-lane roundabout*




*Source: WSC*

## 7.2 Model changes

***Test D:***

- Signals introduced at Bong Bong Street and Merrigang Street as:
  - conventional phasing (i.e., two-phase system with filter right turns on all approaches)
  - every third cycle has left turn red signals for seconds on all approaches except to capture the impact of vehicle/pedestrian conflicts on traffic capacity
  - running a common cycle time with signals at the intersection of Station Street and Bong Bong Street
  - offsets set to feed Bong Bong Street south through movement onto the red phase B and initial part of the green phase B northbound at Station Street and Bong Bong Street signals, with the filter right turn from Merrigang Street (east) feeding onto the end of the green B phase and start of the red B phase at Station Street and Bong Bong Street

- Signals introduced at Victoria Street and Mittagong Road[7] as:
    - Three-phase with filter right turn in
    - Phases introduced to account for modest pedestrian crossing impacts on traffic capacity
    - Running common cycle time as signals at Station Street and Bong Bong Street
- Development of Station Street as a two-lane each way road between Bundaroo Street and Bowral Street with a two lane roundabout at Station and Bundaroo Street,
- Duplication of the Wingecarribee Street rail overbridge and signal control of the intersection of Wingecarribee Street and Kirkham Road (west side of bridge),
- Additional demand at: Oxley Mall area; Merrigang Street car park; at corner of Mittagong Road and Bundaroo Street; Sherwood Village; a site at the corner of Moss Vale Road and Bowral Street; and a site on Banyette Street, and
- Route choice rules adjusted to get a better spread of traffic within the network, to avoid the situation of heavily congested routes with parallel alternative routes being lightly trafficked.

## 7.3 Results

The model operates satisfactorily, completing four random seed runs.

The signals at Bong Bong Street and Merrigang Street work satisfactorily with the high capacity roundabout at Station Street, Bong Bong Street, Bundaroo Street and Mittagong Road.

The average delay and level of service[8] at the Bong Bong and Merrigang Street and the Station Street, Bong Bong Street, Bundaroo Street and Mittagong Road intersections are summarised in the following table.

***Table 7-1 Approach and intersection average delays (sec) and levels of service for four completed model runs***

| Intersection | Approach | Seed 560 | Seed 28 | Seed 7771 | Seed 601027 |
|---|---|---|---|---|---|
| Bong Bong & Station Street | north | 7.2 | 7.4 | 7.3 | 7.3 |
| Bong Bong & Station Street | east | 35.4 | 26.5 | 33.5 | 24.6 |
| Bong Bong & Station Street | south | 12.4 | 10.9 | 11.9 | 12.6 |
| Bong Bong & Station Street | south west | 22.8 | 23.9 | 23.7 | 18.9 |
| | | | | | |
| Bong Bong & Station Street | all | 14.1 | 13.5 | 14.2 | 12.5 |
| Level of service (LOS) | | A | A | A | A |
| | | | | | |
| Bong Bong & Merrigang Street | north | 17.1 | 17.6 | 17.8 | 15.1 |
| Bong Bong & Merrigang Street | east | 35.7 | 32.7 | 44.6 | 35.0 |
| Bong Bong & Merrigang Street | south | 25.8 | 23.7 | 28.9 | 25.4 |
| Bong Bong & Merrigang Street | west | 7.5 | 39.9 | 30.0 | 11.4 |
| | | | | | |
| Bong Bong & Merrigang Street | all | 26.0 | 24.3 | 29.9 | 24.3 |
| Level of service (LOS) | | B | B | C | B |

[7] This intersection and signal arrangement is the same as that used in previous modelling.

[8] Note – these are prepared using the LOS plug-in and are indicative of the delays encountered at the intersections in the model; average delay is the delay across all movements in the intersection; critical delay is the same as average delay for TCS and RAB, but is the movement with the highest delay for priority intersections.

This analysis indicates that the large capacity roundabout and upgrade of Station Street would provide additional traffic capacity which could support a long term increase in activity in the town centre.

Appendix D contains a comparison of route costs.

# Appendix A – Travel Time Comparison: Test A

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | A | | | | | | |
| Seed: | 560 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 16 | 270 | 230 | 260 | 340 |
| | Bong Bong Street | | 21 | 260 | 220 | 260 | 290 |
| | Bendooley Street & M | | 3 | 240 | 170 | 250 | 290 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 6 | 190 | 150 | 230 | 230 |
| | Bundaroo Street & Ber | | 0 | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 25 | 110 | 100 | 110 | 110 |
| | Merrigang Street | | 16 | 110 | 100 | 110 | 120 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 5 | 310 | 290 | 300 | 300 |
| | Station Street | | 244 | 340 | 290 | 340 | 370 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 305 | 280 | 250 | 270 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 2 | 160 | 160 | 160 | 160 |
| | Bong Bong Street | | 99 | 160 | 130 | 150 | 180 |
| | Station Street | | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | A | | | | | | |
| Seed: | 5321 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 14 | 280 | 230 | 280 | 340 |
| | Bong Bong Street | | 39 | 260 | 210 | 250 | 300 |
| | Bendooley Street & M | | 2 | 220 | 170 | 260 | 260 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 10 | 200 | 150 | 210 | 220 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 37 | 110 | 100 | 110 | 110 |
| | Merrigang Street | | 16 | 120 | 110 | 120 | 130 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 10 | 280 | 260 | 270 | 300 |
| | Station Street | | 276 | 290 | 270 | 290 | 310 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 262 | 280 | 240 | 270 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 8 | 160 | 150 | 160 | 170 |
| | Bong Bong Street | | 91 | 150 | 120 | 140 | 170 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | A | | | | | | |
| Seed: | 137 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 25 | 230 | 200 | 230 | 250 |
| | Bong Bong Street | | 30 | 240 | 200 | 240 | 270 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 12 | 200 | 160 | 200 | 280 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 35 | 110 | 100 | 110 | 110 |
| | Merrigang Street | | 23 | 140 | 120 | 150 | 160 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 7 | 310 | 300 | 300 | 330 |
| | Station Street | | 249 | 330 | 270 | 310 | 380 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 332 | 270 | 250 | 270 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 3 | 150 | 130 | 130 | 180 |
| | Bong Bong Street | | 86 | 150 | 130 | 150 | 170 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

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|---|---|---|---|---|---|---|---|
| Test: | A | | | | | | |
| Seed: | 601027 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 22 | 220 | 200 | 220 | 240 |
| | Bong Bong Street | | 23 | 250 | 190 | 260 | 290 |
| | Bendooley Street & M | | 2 | 310 | 230 | 390 | 390 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 8 | 240 | 180 | 260 | 280 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 42 | 110 | 110 | 110 | 110 |
| | Merrigang Street | | 14 | 130 | 110 | 120 | 140 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 6 | 340 | 280 | 360 | 370 |
| | Station Street | | 222 | 300 | 260 | 290 | 330 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 283 | 270 | 250 | 260 | 280 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 4 | 160 | 150 | 150 | 190 |
| | Bong Bong Street | | 93 | 160 | 130 | 150 | 170 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

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|---|---|---|---|---|---|---|---|
| Test: | A | | | | | | |
| Seed: | 559 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 13 | 230 | 210 | 230 | 250 |
| | Bong Bong Street | | 28 | 240 | 200 | 240 | 280 |
| | Bendooley Street & M | | 2 | 220 | 160 | 280 | 280 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 11 | 200 | 190 | 200 | 220 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 42 | 110 | 100 | 110 | 110 |
| | Merrigang Street | | 18 | 150 | 130 | 150 | 160 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 5 | 330 | 270 | 340 | 370 |
| | Station Street | | 257 | 330 | 280 | 320 | 370 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 291 | 280 | 250 | 270 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 5 | 140 | 130 | 140 | 150 |
| | Bong Bong Street | | 97 | 150 | 130 | 150 | 170 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# Appendix B – Travel Time Comparison: Test B

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | B | | | | | | |
| Seed: | 560 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 28 | 280 | 240 | 270 | 350 |
| | Bong Bong Street | | 10 | 250 | 220 | 260 | 270 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 42 | 200 | 160 | 200 | 230 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 69 | 110 | 100 | 110 | 120 |
| | Merrigang Street | | 6 | 130 | 110 | 140 | 150 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 12 | 360 | 300 | 370 | 440 |
| | Station Street | | 224 | 340 | 300 | 320 | 360 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 1 | 300 | 300 | 300 | 300 |
| | Station Street | | 236 | 270 | 250 | 270 | 290 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 2 | 350 | 180 | 520 | 520 |
| | Bong Bong Street | | 80 | 180 | 140 | 170 | 230 |
| | Station Street | | 26 | 310 | 230 | 330 | 350 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | B | | | | | | |
| Seed: | 28 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 31 | 260 | 230 | 260 | 310 |
| | Bong Bong Street | | 25 | 270 | 230 | 260 | 310 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 39 | 260 | 230 | 270 | 310 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 59 | 140 | 110 | 120 | 170 |
| | Merrigang Street | | 5 | 130 | 120 | 140 | 140 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 12 | 370 | 350 | 380 | 430 |
| | Station Street | | 226 | 350 | 300 | 350 | 390 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 360 | 360 | 360 | 360 |
| | Station Street | | 211 | 270 | 240 | 270 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 2 | 160 | 120 | 210 | 210 |
| | Bong Bong Street | | 86 | 160 | 130 | 160 | 180 |
| | Station Street | | 16 | 260 | 210 | 250 | 330 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | B | | | | | | |
| Seed: | 86524 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 26 | 260 | 220 | 270 | 310 |
| | Bong Bong Street | | 27 | 250 | 200 | 240 | 300 |
| | Bendooley Street & M | | 1 | 330 | 330 | 330 | 330 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 50 | 250 | 210 | 260 | 300 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 75 | 130 | 100 | 110 | 130 |
| | Merrigang Street | | 5 | 130 | 110 | 120 | 160 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 10 | 400 | 360 | 390 | 460 |
| | Station Street | | 219 | 330 | 300 | 320 | 340 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 390 | 390 | 390 | 390 |
| | Station Street | | 240 | 270 | 250 | 280 | 300 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 11 | 150 | 140 | 140 | 160 |
| | Bong Bong Street | | 89 | 170 | 130 | 170 | 200 |
| | Station Street | | 24 | 240 | 190 | 240 | 270 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

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|---|---|---|---|---|---|---|---|
| Test: | B | | | | | | |
| Seed: | 137 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 34 | 260 | 210 | 250 | 290 |
| | Bong Bong Street | | 16 | 230 | 210 | 230 | 250 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 42 | 230 | 200 | 220 | 260 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 74 | 110 | 100 | 110 | 120 |
| | Merrigang Street | | 7 | 130 | 120 | 130 | 140 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 11 | 350 | 280 | 350 | 410 |
| | Station Street | | 205 | 330 | 290 | 320 | 350 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 380 | 380 | 380 | 380 |
| | Station Street | | 247 | 260 | 250 | 260 | 280 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 8 | 150 | 130 | 140 | 180 |
| | Bong Bong Street | | 88 | 150 | 130 | 160 | 180 |
| | Station Street | | 27 | 220 | 180 | 230 | 250 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | B | | | | | | |
| Seed: | 601027 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 27 | 260 | 230 | 260 | 290 |
| | Bong Bong Street | | 25 | 290 | 260 | 280 | 300 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 41 | 230 | 190 | 210 | 260 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 67 | 130 | 100 | 120 | 140 |
| | Merrigang Street | | 9 | 150 | 140 | 160 | 160 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 13 | 420 | 390 | 420 | 450 |
| | Station Street | | 214 | 330 | 290 | 330 | 360 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 229 | 260 | 240 | 260 | 290 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 5 | 140 | 130 | 130 | 140 |
| | Bong Bong Street | | 103 | 150 | 130 | 150 | 170 |
| | Station Street | | 30 | 240 | 200 | 220 | 260 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Appendix C – Travel Time Comparison: Test C

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test: | C | | | | | | |
| Seed: | 560 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 31 | 300 | 250 | 290 | 340 |
| | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 49 | 300 | 270 | 300 | 330 |
| | Bundaroo Street & Ber | | | nil | nil | nil | nil |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | | 0 | 0 | 0 | 0 |
| | Merrigang Street | | 36 | 210 | 190 | 210 | 230 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 11 | 400 | 340 | 420 | 440 |
| | Station Street | | 214 | 400 | 300 | 360 | 440 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Station Street | | 280 | 300 | 260 | 300 | 330 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 11 | 160 | 140 | 160 | 170 |
| | Bong Bong Street | | 119 | 160 | 140 | 160 | 190 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
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|---|---|---|---|---|---|---|---|
| Test: | C | | | | | | |
| Seed: | 5321 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 36 | 290 | 240 | 290 | 350 |
| | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 46 | 270 | 220 | 280 | 310 |
| | Bundaroo Street & Ber | | 3 | 250 | 250 | 250 | 270 |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 33 | 180 | 150 | 180 | 200 |
| | Merrigang Street | | 34 | 210 | 180 | 210 | 240 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 10 | 410 | 320 | 440 | 480 |
| | Station Street | | 225 | 410 | 350 | 400 | 470 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 299 | 300 | 270 | 290 | 320 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 4 | 210 | 160 | 230 | 330 |
| | Bong Bong Street | | 130 | 170 | 140 | 170 | 190 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
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|---|---|---|---|---|---|---|---|
| Test: | C | | | | | | |
| Seed: | 137 | | | | | | |
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| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 36 | 300 | 240 | 270 | 340 |
| | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 48 | 380 | 300 | 370 | 470 |
| | Bundaroo Street & Ber | | 8 | 290 | 250 | 290 | 320 |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 47 | 210 | 150 | 190 | 270 |
| | Merrigang Street | | 30 | 260 | 230 | 260 | 320 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 11 | 440 | 330 | 440 | 540 |
| | Station Street | | 235 | 430 | 400 | 430 | 470 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 299 | 310 | 270 | 300 | 330 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 8 | 190 | 170 | 210 | 220 |
| | Bong Bong Street | | 112 | 160 | 140 | 170 | 180 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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|---|---|---|---|---|---|---|---|
| Test: | C | | | | | | |
| Seed: | 98812 | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 41 | 370 | 240 | 350 | 490 |
| | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & M | | 1 | 170 | 170 | 170 | 170 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 48 | 260 | 220 | 270 | 300 |
| | Bundaroo Street & Ber | | 5 | 280 | 220 | 280 | 330 |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 33 | 190 | 150 | 190 | 220 |
| | Merrigang Street | | 34 | 230 | 170 | 220 | 280 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 11 | 370 | 340 | 360 | 390 |
| | Station Street | | 220 | 340 | 280 | 340 | 380 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 293 | 300 | 260 | 290 | 340 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 11 | 160 | 150 | 160 | 190 |
| | Bong Bong Street | | 122 | 160 | 140 | 160 | 180 |
| | Station Street | | | 0 | 0 | 0 | 0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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|---|---|---|---|---|---|---|---|
| Test: | C | | | | | | |
| Seed: | 601027 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt |
| | | | | | | | |
| via | Station Street | | 39 | 290 | 240 | 290 | 330 |
| | Bong Bong Street | | | 0 | 0 | 0 | 0 |
| | Bendooley Street & M | | 1 | 310 | 310 | 310 | 310 |
| | Bendooley Street & Bu | | na | na | na | na | na |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 60 | 300 | 260 | 290 | 350 |
| | Bundaroo Street & Ber | | 6 | 220 | 190 | 220 | 270 |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | | 47 | 170 | 140 | 170 | 200 |
| | Merrigang Street | | 29 | 200 | 180 | 200 | 220 |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 8 | 410 | 370 | 400 | 430 |
| | Station Street | | 246 | 370 | 340 | 370 | 390 |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 |
| | Station Street | | 281 | 290 | 260 | 290 | 320 |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | | 7 | 190 | 150 | 160 | 220 |
| | Bong Bong Street | | 115 | 170 | 140 | 170 | 200 |
| | Station Street | | 1 | 240 | 240 | 240 | 240 |
| | | | | | | | |
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# Appendix D – Travel Time Comparison: Test D

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|---|---|---|---|---|---|---|---|---|
| Test: | D | | | | | | | |
| Seed: | 560 | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt | |
| | | | | | | | | |
| via | Station Street | | 8 | 240 | 190 | 210 | 290 | |
| | Bong Bong Street | | 32 | 250 | 210 | 240 | 290 | |
| | Bendooley Street & M | | 4 | 220 | 200 | 200 | 260 | |
| | Bendooley Street & Bu | | na | na | na | na | na | |
| | | | | | | | | |
| Southward to Boolwey Street | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | 12 | 220 | 190 | 230 | 260 | |
| | Bundaroo Street & Ber | | 3 | 210 | 200 | 210 | 230 | |
| | | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | | |
| | | | | | | | | |
| via | Bundaroo Street | | 84 | 140 | 130 | 130 | 150 | |
| | Merrigang Street | | 52 | 160 | 140 | 150 | 170 | |
| | | | | | | | | |
| | | | | | | | | |
| North to south through | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | | 0 | 0 | 0 | 0 | |
| | Station Street | | 248 | 310 | 280 | 300 | 340 | |
| | | | | | | | | |
| South to north through | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | | 0 | 0 | 0 | 0 | |
| | Station Street | | 287 | 240 | 220 | 240 | 260 | |
| | | | | | | | | |
| | | | | | | | | |
| Boolwey Street to the south | | | | | | | | |
| | | | | | | | | |
| via | Bendooley Street | | 12 | 210 | 150 | 220 | 270 | |
| | Bong Bong Street | | 68 | 160 | 130 | 150 | 200 | |
| | Station Street | | 65 | 240 | 190 | 230 | 280 | |
| | | | | | | | | |
| | | | | | | | | |

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|---|---|---|---|---|---|---|---|
| Test: | D | | | | | | |
| Seed: | 28 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | Vehicle | Average | Lower qrt | median | Higher Qrt | |
| | | | | | | | |
| via | Station Street | 8 | 270 | 190 | 240 | 390 | |
| | Bong Bong Street | 28 | 220 | 190 | 220 | 260 | |
| | Bendooley Street & M | 1 | 200 | 200 | 200 | 200 | |
| | Bendooley Street & Bu | na | na | na | na | na | |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | 14 | 210 | 160 | 210 | 220 | |
| | Bundaroo Street & Ber | 1 | 250 | 250 | 250 | 250 | |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | 90 | 140 | 130 | 140 | 150 | |
| | Merrigang Street | 45 | 160 | 130 | 150 | 180 | |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | |
| | Station Street | 205 | 310 | 260 | 290 | 360 | |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | 0 | 0 | 0 | 0 | 0 | |
| | Station Street | 273 | 250 | 230 | 250 | 270 | |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | 9 | 170 | 140 | 170 | 190 | |
| | Bong Bong Street | 64 | 160 | 140 | 160 | 180 | |
| | Station Street | 74 | 230 | 180 | 220 | 260 | |
| | | | | | | | |
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|---|---|---|---|---|---|---|---|---|
| Test: | D | | | | | | | |
| Seed: | 7771 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Northward from Boolwey Street | | | Vehicle | Average | Lower qrt | median | Higher Qrt | |
| | | | | | | | | |
| via | Station Street | | 6 | 300 | 210 | 340 | 360 | |
| | Bong Bong Street | | 35 | 250 | 200 | 230 | 300 | |
| | Bendooley Street & M | | | 0 | 0 | 0 | 0 | |
| | Bendooley Street & Bu | | na | na | na | na | na | |
| | | | | | | | | |
| Southward to Boolwey Street | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | 10 | 220 | 180 | 210 | 230 | |
| | Bundaroo Street & Ber | | 4 | 230 | 220 | 230 | 280 | |
| | | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | | |
| | | | | | | | | |
| via | Bundaroo Street | | 116 | 140 | 130 | 140 | 150 | |
| | Merrigang Street | | 43 | 160 | 140 | 150 | 170 | |
| | | | | | | | | |
| | | | | | | | | |
| North to south through | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | | 0 | 0 | 0 | 0 | |
| | Station Street | | 254 | 310 | 270 | 310 | 340 | |
| | | | | | | | | |
| South to north through | | | | | | | | |
| | | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | 0 | |
| | Station Street | | 267 | 240 | 220 | 240 | 260 | |
| | | | | | | | | |
| | | | | | | | | |
| Boolwey Street to the south | | | | | | | | |
| | | | | | | | | |
| via | Bendooley Street | | 10 | 160 | 130 | 150 | 170 | |
| | Bong Bong Street | | 74 | 170 | 130 | 160 | 200 | |
| | Station Street | | 56 | 210 | 170 | 220 | 250 | |
| | | | | | | | | |
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|---|---|---|---|---|---|---|---|
| Test: | D | | | | | | |
| Seed: | 601027 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Northward from Boolwey Street | | Vehicle | Average | Lower qrt | median | Higher Qrt | |
| | | | | | | | |
| via | Station Street | 11 | 230 | 190 | 230 | 260 | |
| | Bong Bong Street | 32 | 230 | 200 | 230 | 260 | |
| | Bendooley Street & M | 1 | 190 | 190 | 190 | 190 | |
| | Bendooley Street & Bu | na | na | na | na | na | |
| | | | | | | | |
| Southward to Boolwey Street | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | 14 | 230 | 190 | 220 | 260 | |
| | Bundaroo Street & Ber | 1 | 220 | 220 | 220 | 220 | |
| | | | | | | | |
| Southward to Wingecarribee Street west of Bendooley Street | | | | | | | |
| | | | | | | | |
| via | Bundaroo Street | 94 | 140 | 120 | 140 | 150 | |
| | Merrigang Street | 42 | 150 | 130 | 160 | 170 | |
| | | | | | | | |
| | | | | | | | |
| North to south through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | | 0 | 0 | 0 | 0 | |
| | Station Street | 255 | 310 | 280 | 300 | 340 | |
| | | | | | | | |
| South to north through | | | | | | | |
| | | | | | | | |
| via | Bong Bong Street | 0 | 0 | 0 | 0 | 0 | |
| | Station Street | 280 | 240 | 220 | 240 | 260 | |
| | | | | | | | |
| | | | | | | | |
| Boolwey Street to the south | | | | | | | |
| | | | | | | | |
| via | Bendooley Street | 8 | 140 | 140 | 140 | 150 | |
| | Bong Bong Street | 67 | 170 | 130 | 170 | 200 | |
| | Station Street | 56 | 230 | 190 | 220 | 260 | |
| | | | | | | | |
| | | | | | | | |