SHEPHERDS BAY

Urban Renewal Development

Stage A

Section 75W Application to Mod 3

Traffic Impact Assessment

ROAD DELAY SOLUTIONS

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Prepared for

Holdmark PROPERTY GROUP

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ABSTRACT

Road Delay Solutions Pty Ltd has been engaged by *Holdmark Property Group* to undertake investigation of the traffic impacts associated with a Section 75W Application for the Shepherds Bay Urban Renewal Project Stage A.

Stage A is commonly known as the parcel of land 157 Church Street and 8 Parsonage Street, Meadowbank.

This assessment specifically focuses on the committed infrastructure projects associated with the *Department of Planning & Infrastructure Concept Approval, MP09_0216* Mod 3 and any further identified improvements to sustain the vehicle generation associated with the proposal under this Section 75W Application.

The study incorporates the full Shepherds Bay development, Stages 1 through 9 and Stage A, assuming full occupancy and the associated traffic generation impacts.

Original Concept Application Modelling

Originally, mesoscopic comptuer based road network modelling, accompanying the Concept Application for the full Shepherds Bay Development, including Stage A, Mod 1, was predicated upon...

- → *3,000 residential apartments,*
- → *10,000m² of Commercial Floor Space,*
- → *A vehicle generation rate of 0.32vph per apartment,*
- → *The addition of 90 vehicle trips associated with supplimentary retail and recreational activities, and*
- → *A total vehicle generation of 1,250vph.*

The original input parameters for the Concept Stage A, Mod 1 model, comprised...

- → *10,000m² of commercial floor space,*
- → *A peak hour vehicle generation rate of 2 trips per 100m² of GLFA,*
- → *Passenger vehicle entry via Well Street, and*
- → *Passenger vehicle exit onto Parsonage Street.*

Stage A Envelope

The Stage A building envelope will not be changed and will adopt the already approved envelope established by the Planning Assessment Commission (PAC) in Mod 2. Specifically, the 15-storey height that forms part of the former Mod 3 application has been reduced to 10 storeys. All other elements as provided for Stage A by Mod 2 will also be retained, such as the publicly accessible, open form plaza, as well as 'the shed' retail tenancy.

Stage A Section 75W Revision

The traffic generating land uses proposed under the Stage A, 10 storey envelope, are…

- *42 residential apartments,*
- *42 serviced apartments.*
- *A Supermarket with a GFA of 2,928m² and a calculated (80% of GFA) GLFA of 2,342m² excluding common areas, walkways, garbage rooms and shared loading dock,*
- *Specialty shops with a GFA of 1,128m² and a calculated GLFA of 903m², and*
- *A Café with a GFA of 100m².*

Stage A is to provide for…

- *A total vehicle generation of 443vph during each commuter peak,*
- *Loading dock access from a dedicated entry lane adjacent to the deceleration lane, northbound in Church Street,*
- *Passenger vehicle access from a dedicated left turn lane, southbound in Parsonage Street,*
- *Construction of pedestrian refuges in Well Street and Parsonage Street, and*
- *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

Model Purpose

A mesoscopic traffic model has been created for the Meadowbank Employment Area (MEA). This is the most appropriate level of traffic modelling given the scope of the study area, where intersections are the primary cause of congestion.

The model has been developed using the *Netanal Version 2017* software which, iteratively, calculates intersection/lane capacity, vehicle delays and queueing affects at all intersections within the network in the determination of a motorist's route choice.

Mesoscopic models are typically used to highlight the needs and assess the impacts of congestion on the road network for the morning and evening commuter peak hour periods. *Netanal* calculates the impact of a network of coordinated traffic signal sites, applying the calculated signal timing offsets and reports the resultant turn movements at every intersection or node within the model.

For this assessment, year 2026 models have been built for…

- → *A typical weekday morning peak hour period (7:30AM – 8:30AM), and*
- → *A typical weekday evening peak period (5:00PM - 6:00PM).*

Traffic Generation and Distribution

All projected traffic generation rates applied to the developments within the MEA were based on the industry standard *RMS Guide to Traffic Generating Developments*.

The original Stage A Concept Model was prepared prior to the current stage definition and unit allocations. Five (5) stages were adopted in the concept model with Stage 5 now referred to as Stage A. The former concept stages 1 to 4 are now referred to as Stages 1 through 9 and previously presented a total, modelled, vehicle generation of 1,277vph, being…

→ *Stage 5 (now Stage A) - 10,000m² of commercial floor space*	*225vph*
→ *Stages 1 through 4 (now Stages 1 -9) 3,000 residential apartments*	*962vph*
→ *Nominal retail and service vehicle trips*	*90vph*
→ ***Total modelled vehicle generation***	***1,277vph***

Stage A, Mod 2, proposed a calculated a total vehicle generation for Stages 1 through 9 and inclusive of Stage A, of 1,148vph during the peak periods. This equates to 566vph for Stage A alone, each peak.

This Stage A Section 75W, proposes a calculated vehicle generation for all development stages of 1,020vph, which is a reduction of 128vph when compared to the former Mod 3, 15 storey envelope, and equates to 443vph for Stage A alone, each peak.

MODEL COMPARISON TABLE							
CONCEPT MODEL				CURRENT 2026 MODEL			
Original Concept Stage	Apartments or Commercial Floor Space	Adopted Generation Rate*	Generation (vph)	Section 75W Stage	Apartments or Commercial Floor Space	Adopted Generation Rate	Generation (vph)
Stages 1 - 4	3,005	0.32	962	Stages 1 -9	1,988	0.29	577
Stage 5 *(Commercial)*	10,000	0.0225	225	Stage A *(Residential)*	42	0.29	12
-				Serviced Apartments	42	0.40	17
Nominal *(Retail/Service)*	-	-	90	Stage A *(Retail)*	4,156	Various	414
				Service Vehicles *(Loading Dock)*	-	-	5
TOTAL			**1,277**				**1,020**

** Note Generation rate utilised in the Concept Model did not allow for mode shift creating a 'Worst Case' Scenario*

Table 1 **Vehicle Generation Model Comparison**
Source *Road Delay Solutions, 2018*

Traffic distribution utilised in the modelling for year 2026 was drawn from numerous sources. Residential distribution was based on the applied *BTS* trip matrices, published in 2011 and revised by the *BTS* in October 2016. The retail distribution has been determined by a catchment analysis of simillar operations.

To determine and apply the distribution of traffic generated by the proposed supermarket within the model, an analysis of the current supermarket operations of the Gladesville Shopping Village was undertaken.

This investigation revealed that patrons to the Gladesville site were generally attracted from a radial catchment no greater than 5 kilometres. It was found that the supermarket generally attracted some 72% of patrons from within a 1.5 kilometre radius of the site, a further 19% within 2kms and the majority of the remaining 8%, some 3.5kms. This distribution pattern has been applied within the trip matrices of the future year 2026 model. The distribution of traffic was proportionately applied to the percentage of residential lots within adjoining catchments.

The retail distribution was determined by a simple survey of 126 patrons entering, by vehicle, into the basement carpark of the Gladesville Shopping Village and observed heading to the supermarket. These patrons were asked to roughly estimated the distance they had travelled or their origin. The survey did not include pedestrian foot traffic.

Some 25% of patrons surveyed commented that they frequently utilised competing supermarkets and that the Gladesville store was not their sole source of groceries.

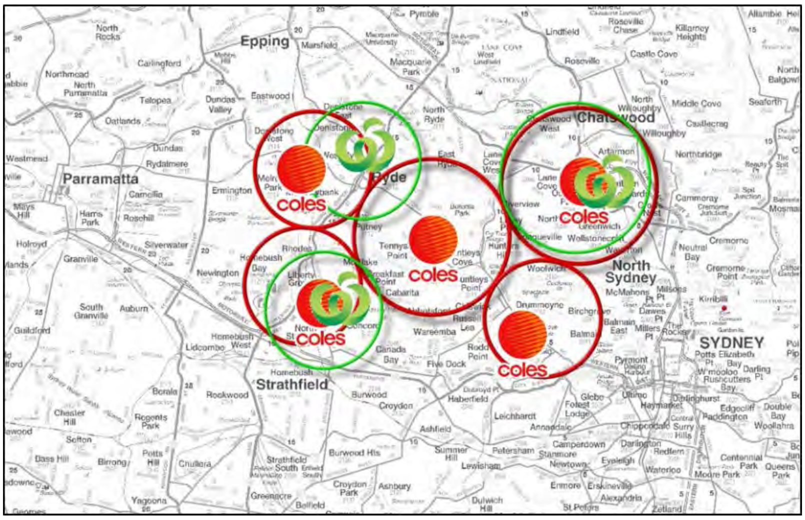


Figure 1 Current Competing Retail Operations
Source Road Delay Solutions, 2017

Model Scenarios

The mesoscopic modelling prepared during this assessment has focused on the outcomes in year 2026 of the Shepherds Bay Urban Renewal Development with and without the proposed Stage A development.

The former modelling prepared by *Road Delay Solutions*[1][2] and subsequent reviews by *Bitzios Consulting*[3] and *ARUP Consulting*, have been utilised as a base from which the committed infrastructure and future year 2026 road network have been drawn.

The respnsibilities of each consulting group, during assessment of the Concept Application, are outlined as follows...

→ *Road Delay Solutions – Engaged by Holmark to prepare the calibrated base 2010 model and future year 2026 model to determine the required infrastructure to sustain the level of development proposed in the MEA, with particular focus on the Shepherds Bay Urban Renewal,*

[1] *Concept Plan, Shepherds Bay Urban Renewal Meadowbank, Strategic Model 2026, Traffic Impact Assessment* – Road Delay Solutions, July 2012
[2] *Shepherds Bay, Meadowbank, Draft Addendum, Arterial Road Network, Traffic Signal Operation Assessment,* Road Delay Solutions, November 2012
[3] *Meadowbank Employment Area, Traffic Needs Assessment,* Bitzios Consulting, September 2012

- *Bitzios Consulting – Engaged by Ryde Council to undertake a peer review of the Traffic Impact Assessment by Road Delay Solutions and further prepare a model to determine the necessary infrastructure requirements of developments within the MEA, and*
- *ARUP Consulting – Engaged by the Department of Planning to review and audit the modelling and outcomes of both modelling reports.*

No remodelling of a calibrated base case has been undertaken for this assessment given the impacts currently experienced during construction within the precinct. Traffic counts indicate that the construction work has had an impact on travel patterns and volumes through the precinct and it was considered the traffic volumes recorded by ROAR in December 2014 provided the last coherent base to model the current traffic patterns throughout this report.

The new future year 2026 base and Stage A models, which have been prepared for this report, have been updated with the latest *BTS Journey to Work* (JTW) data for the MEA transferred into the *BTS* 2011 published trip matrices.

This assesment further analyses the committed infrastructure under the population and employment growth demands as currently recognised by the *BTS* in 2016.

Year 2026 Base Case 'No Stage A' Base Model

A revised future year '*No Stage A*' Base model was created for year 2026 to reflect the likely impacts of the Shepherds Bay development Stages 1 through 9, but excluding Stage A. This particular model incorporates...

- *Use of the BTS trip matrices published in 2011 and revised to reflect the background traffic growth extrapolated, by zone, from population and employment levels prescribed in the BTS Travel Zone Explorer (2017) which calculated as 1% per annum,*
- *The committed infrastructure treatments outlined in the Shepherds Bay Concept Approval, with the exception of traffic signal control at the Constitution Road intersection with Bowden Street and mid block pedestrian crossing in Railway Road,*
- *The traffic growth associated with the full occupancy of the Shepherds Bay development Stages 1 through 9, and*
- *Local planned growth within the MEA outlined in Council's DCP's of 2011 and 2014.*

The 2026 Base model identifies no significant requirement for infrastructure improvement within the MEA beyond the implementation of the committed infrastructure, with the notable exception of the Constitution Road intersection with Bowden Street roundabout control.

The model reports oversaturation of the critical through movements on Constitution Road. The roundabout was recommended for traffic signal control in the Traffic Impact Assessment for Stages 6 and 7 of the Shepherds Bay Development. The single lane roundabout will invariably fail as traffic volumes increase with development, but the resultant traffic volumes, over the prescribed four (4) hour period, fail to satisfy the current *RMS* warrant for signalisation.

Year 2026 Stage A Model

The Stage A model incorporates the traffic generation associated with the mixed land use calculated for the Stage A development, added to the background growth exhibited in the year 2026 Base model.

Residential and retail passenger vehicle traffic to and from the Stage A development is introduced via the introduction of a 62m long dedicated left turn lane in Parsonage Street and a fourth leg approach at the the Loop Road roundabout, respectively.

No vehicular access to Stage A is proposed from the the Loop Road/Parsonage Street roundabout. Vehicles destined for Stage A will be able to travel northbound from the roundabout in Parsonage Street and perform a U-Turn manouevre at the Well Street roundabout. Vehicles will then enter the dedicated left turn lane and proceed onto the site.

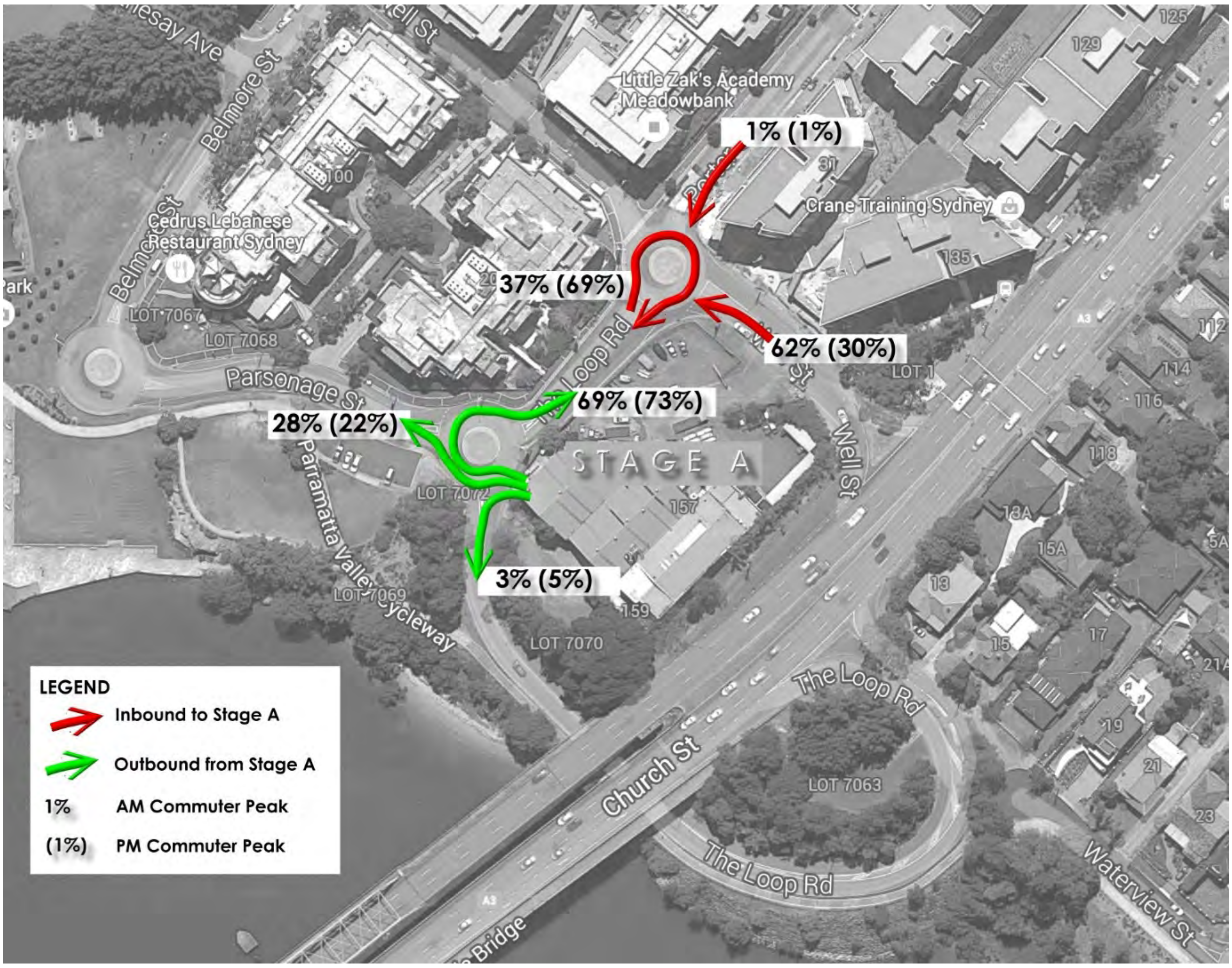


Figure 2 **Stage A Passenger Vehicle Distribution**
Source *Year 2026 Netanal Model - Road Delay Solutions, 2017*

Two (2) critical intersections were identified from the model…

- *Parsonage Street, Well Street and Porter Street (Roundabout control), and*
- *Parsonage Street and the Loop Road (Roundabout control).*

Both intersections report a satisfactory Level of Service (LoS) during both the 2026 AM and PM commuter peaks. Focus was on the 95th percentile queue lengths, reported from the year 2026 Sidra models. The inbound movements to Stage A, juxtaposed with the introduction of the U-Turn manouevre in Parsonage Street at the Well Street roundabout, pose concern for adverse impact on the Church Street arterial corridor. The resultant 95th percentile queue lengths reported for the inbound movements to the site are…

- *Parsonage Street southbound – AM 20m / PM 28m, and*
- *Well Street westbound – AM 46m / PM 107m.*

Well Street affords some 50m storage for westbound motorists. With the PM model reporting a queue length of 107m, there will be a need to permit queueing vehicles to utilise the deceleration lane on Church Street. The deceleration lane provides storage of up to 125m. It is considered that the potential use of the deceleration lane to accommodate queued traffic from the Well Street roundabout, is acceptable during the evening commuter peak given the high congestion levels and significantly reduced vehicle speeds nothbound on Church Street.

The deceleration lane is also intended to facilitate access, by heavy vehicles, to the loading dock for Stage A. It is considered the reduced speeds and congestion levels during the evening peak will moderate the potential for rear end collision by bothe passenger and heavy vehicles within the deceleration lane.

Parking

Stage A Section 75W proposes to provide for a combined 296 car parking spaces to be contained within a five (5) level, basement, carkpark on site, which brings the total parking spaces for Stages 1 through 9, inclusive of Stage A to 2,919.

STAGE A SECTION 75W VEHICLE GENERATION TABLE										
Development Component	Area (Units &/or GLFA m^2)	Daily RMS Trip Rate	AM Peak Hour GLFA RMS Trip Rate/m^2	PM Peak Hour GLFA RMS Trip Rate/m^2	AM Peak Hour Generation (vph)	PM Peak Hour Generation (vph)	AM Outbound Trips (vph)	AM Inbound Trips (vph)	PM Outbound Trips (vph)	PM Inbound Trips (vph)
Residential Apartments	42	0.72	0.29	0.29	12	12	9	3	3	9
Serviced Apartments	42	1.44	0.4	0.4	17	17	13	4	4	13
Specialty Shops*	903	1.21	0.125	0.125	113	113	85	28	28	85
Café	100	0.11	0.08	0.08	8	8	6	2	2	6
Supermarket*	2,343	1.21	0.125	0.125	293	293	103	190	190	103
TOTAL	3,346	4,029			443	443	215	228	228	215

**The Supermarket and Specialty Shops Generation rate is based on RMS Technical Direction TDT 2013/04a for the highest weekday generation - 12.5vph/100m2 of GLFA*

The combined retail GLFA excludes common areas such as walkways, garbage storage and the shared loading dock and constitutes 80% of GFA

Table 2 **Calculated Stage A Vehicle Generation**

Source *Road Delay Solutions, 2018*

The Proposed Traffic Management Solution

After analysis of the year 2026 Base and Stage A models a proposed framework of engineering treatments was formulated to sustain the projected traffic volumes.

This framework forms the basis of a Traffic Management Solution which incorporates the committed infrastructure and seeks to address the needs of motorists, pedestrians and cyclists. The proposed infrastructure involves…

- → *Construction of a Pedestrian Refuge in Well Street,*
- → *Reconstruction of the left turn kerb return from Church Street into Well Street to achieve a radius of 6m,*
- → *Reconstruction of the median island at the intersection of Church Street and Well Street to allow a minimum left turn vehicular swept path of 7.5m wide. The island/median is to also extend westbound in Well Street to sufficiently prevent right turn egress from the proposed loading dock exit,*
- → *Reconstruction of the deceleration lane, northbound, in Church Street to accommodate a service entry lane to the proposed Stage A loading dock,*
- → *Construction of a pedestrian refuge in the Loop Road prior to the roundabout at Parsonage Street,*
- → *Construction of a fourth leg onto the Loop Road roundabout at Parsonage Street to facilitate egress only from the Stage A car park,*
- → *Construction of a dedicated, 3.5m wide, left turn lane facilitating access by passenger vehicle to the Stage A car park, and*
- → *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

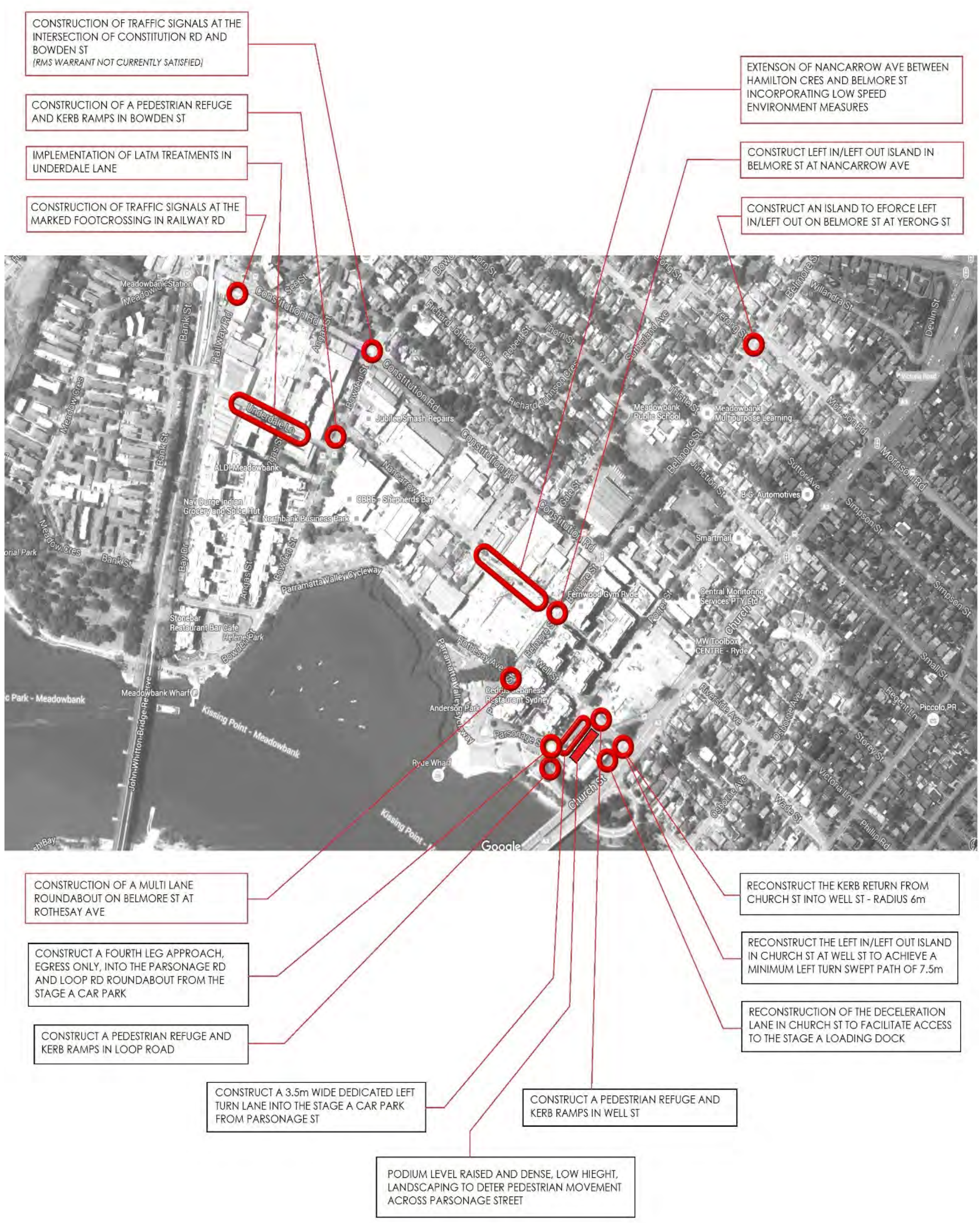


Figure 3 **Approved and Committed Infrastructure**

Source *Road Delay Solutions, 2018*

1 INTRODUCTION

Road Delay Solutions Pty Ltd has been engaged by *Holdmark Prperty Group* to undertake investigation of the traffic impacts associated with a Section 75W Application for the Shepherds Bay Urban Renewal Project Stage A. Stage A is commonly known as the parcel of land 157 Church Street and 8 Parsonage Street, Meadowbank.

This assessment specifically focuses on the committed infrastructure projects associated with the *Department of Planning & Infrastructure Concept Approval, MP09_0216* and any further, identified, improvements to sustain the increased vehicle generation associated with land use modification under the Section 75W Application.

The study incorporates the full Shepherds Bay development ,Stages 1 through 9 and Stage A, assuming full occupancy and the associated traffic generation impacts.

Former Concept Application Modelling

Formerly, comptuer based road network modelling, accompanying the Concept Application for the full Shepherds Bay Development Stages 1 through 9, including Stage A, was predicated upon…

- → *3,000 residential apartments,*
- → *10,000m² of Commercial Floor Space,*
- → *A vehicle generation rate of 0.32vph per apartment,*
- → *The addition of 90 vehicle trips associated with supplimentary retail and recreational activities, and*
- → *A total vehicle generation of 1,250vph.*

The input parameters for the former Stage A concept model comprised…

- → *10,000m² of commercial floor space,*
- → *A peak hour vehicle generation rate of 2 trips per 100m² of GLFA,*
- → *Passenger vehicle entry via Well Street, and*
- → *Passenger vehicle exit onto Parsonage Street.*

No loading dock provision was modelled during the former preparation of the concept application.

Former Mod 3

The former Mod 3 applied specifically to Stage A, proposed under a 15 storey envelope, the following…

- *8,176m² of floor space for serviced apartments or 82 serviced apartments, and*
- *4,008m² of floor space for residential apartments or 42 residential apartments.*
- *A Supermarket with a GLFA of 3,548m² excluding common areas, walkways, garbage rooms and shared loading dock,*
- *Specialty shops with a GLFA of 461m², and*
- *A Café with a GLFA of 251m².*

Stage A, under the former Mod 3 proposed…

- *A total vehicle generation of 566vph during each commuter peak,*
- *Loading dock access from a dedicated entry lane adjacent to the deceleration lane, northbound in Church Street,*
- *Passenger vehicle access from a dedicated left turn lane, southbound in Parsonage Street,*
- *Construction of pedestrian refuges in Well Street and Parsonage Street, and*
- *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

2 LOCATION

Situated on the parcel of land generally bounded by Church Street to the east, Well Street to the north, Parsonage Street to the west and The Loop Road to the south, the Stage A development is located within the precinct known as the Mea*dowbank Employment Area* (MEA).

Identifiable as 157 Church Street and 8 Parsonage Street, the site is intended for mixed use, consisting of…

- → *High end residential apartments,*
- → *Furnished, serviced apartments,*
- → *Retail Supermarket floor space,*
- → *Retail specialty shop floor space, and*
- → *A Café.*

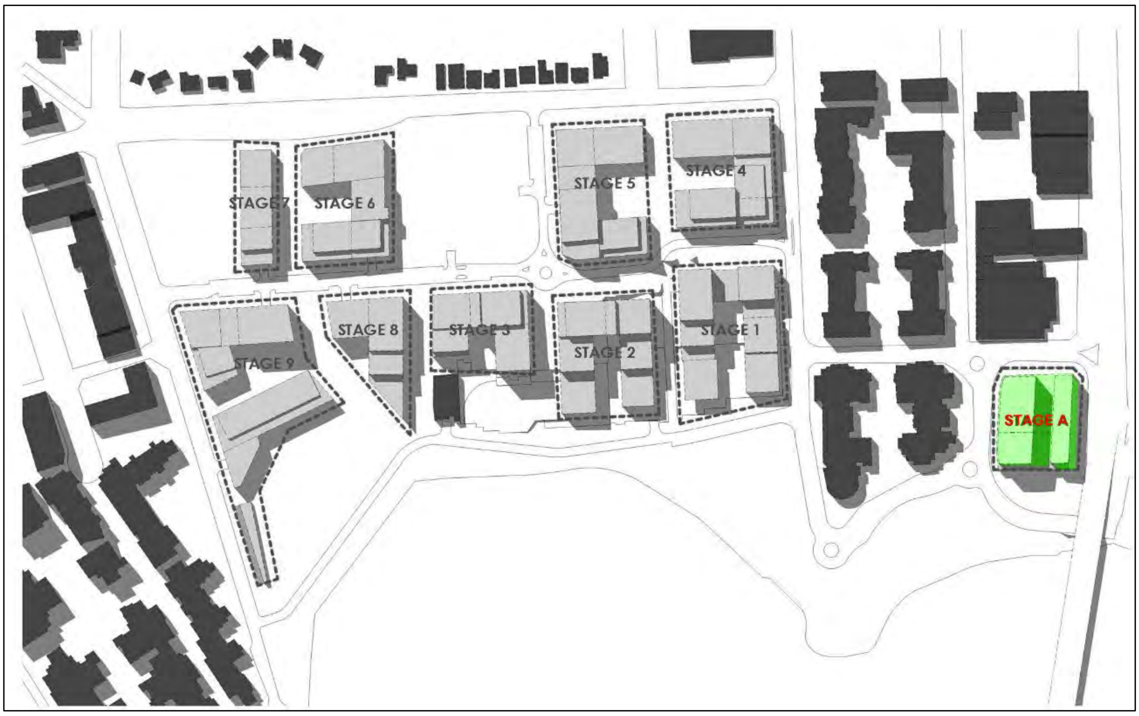


Figure 4 **Shepherds Bay Stages 1 -9 and Stage A Footprint**
Source *Robertson + Marks Architects, Revision L, 2014*

3 EXISTING CONDITIONS

ROAD NETWORK

Church Street is classified by the RMS as a *State Road* and provides the key north-south transport corridor in the area. It typically comprises six (6) traffic lanes (*ie. 3 lanes in each direction*), with opposing traffic flows separated by a central concrete median island.

Victoria Road is also classified by the RMS as a *State Road* providing a pivotal east-west transport link on the Sydney Metropolitan road network. Typically comprising six (6) trafficable lanes, with opposing traffic flows separated by a central concrete median island.

Junction Street, **Belmore Street** and **Constitution Road** form part of a *collector road system* which permit traffic to enter and leave the Meadowbank Precinct.

Generally consisting of a single trafficable lane in each direction, and with kerbside parking permitted at select locations only, the collector road network affords both local and cross regional traffic the ability to by pass congestion on the arterial road network.

Well Street, **Parsonage Street**, and **The Loop Road** are part of the local road network under the auspices of Ryde City Council. And are proposed as the primary vehicular access for Stage A.

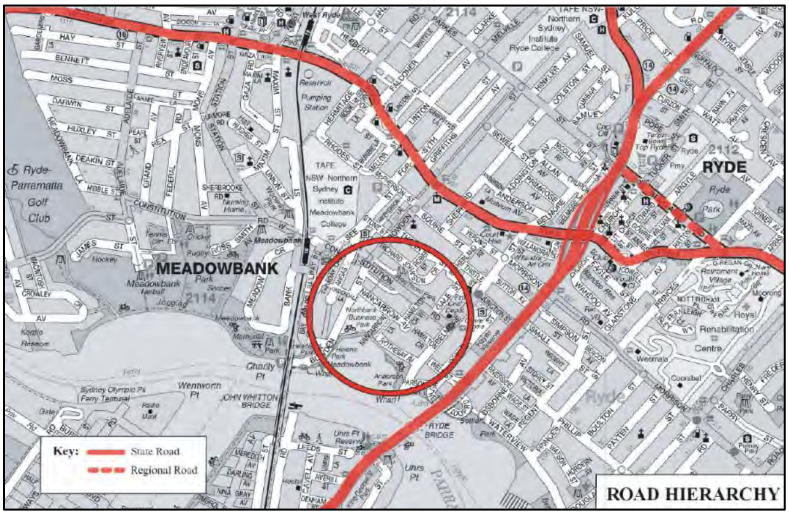


Figure 5 **Meadowbank Road Hierarchy**
Source *Google Maps, 2017*

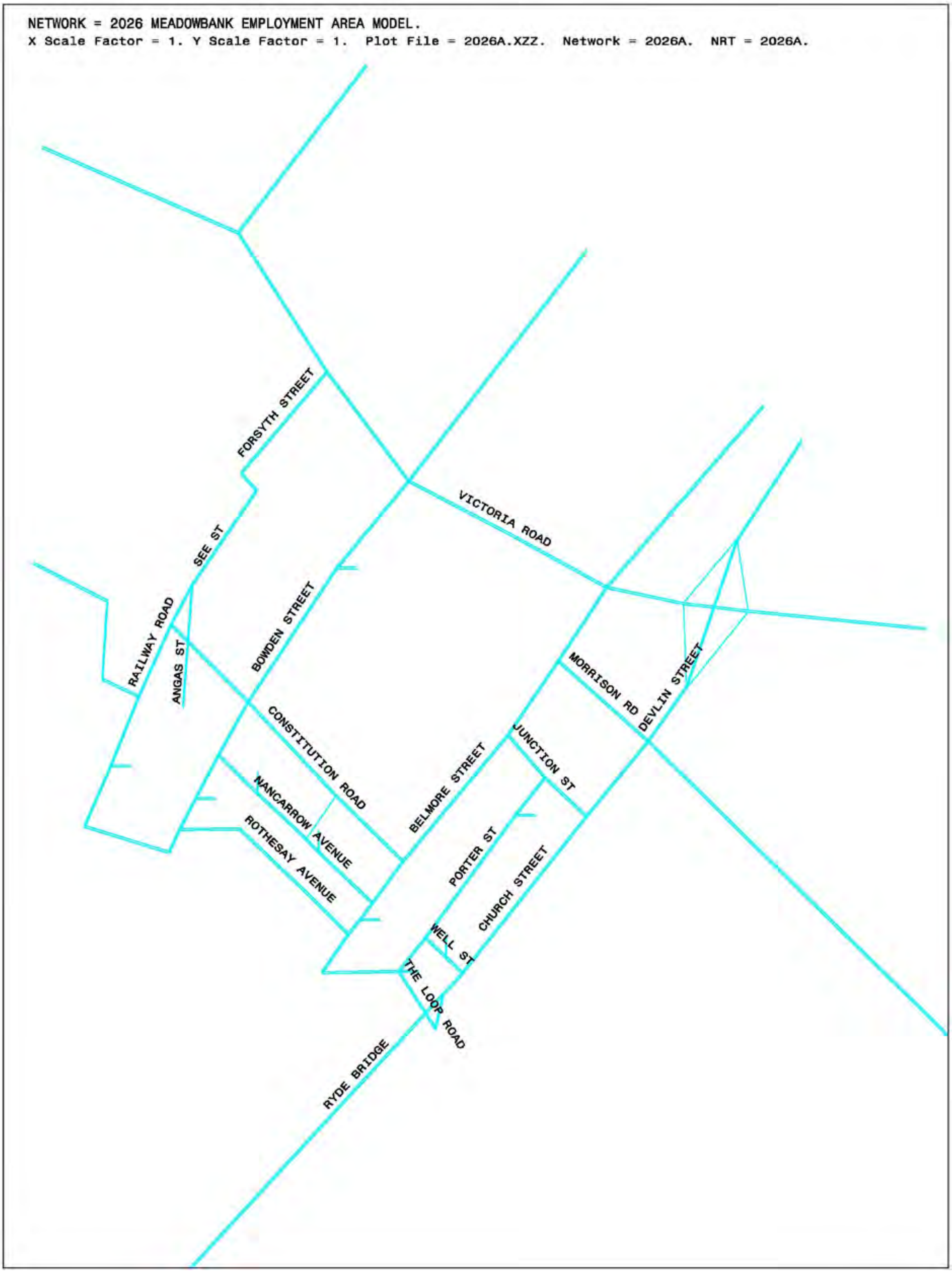


Figure 6 **MEA Precinct Model Road Network**
Source *Road Delay Solutions, 2018*

Existing Traffic Controls

The existing key traffic controls on the surrounding road network, in the vicinity of the Shepherds Bay development site, are...

- *A 70 km/h speed limit on Church Street*
- *A 60 km/h speed limit in Victoria Road,*
- *A 50km/h speed limit on Well Stret, The Loop Road and Parsonage Street,*
- *A 50 km/h speed limit on all other local roads in the area,*
- *Traffic signals on Church Street at its intersection with both Junction Street and Morrison Road,*
- *Traffic signals in Belmore Street at its intersection with both Constitution Road and Junction Street,*
- *Central median islands in Church Street and in Victoria Road ptecluding right turn movements, with the exception of those permitted at key traffic signal controlled intersections,*
- *A roundabout in Constitution Road at its intersection with Bowden Street, and*
- *Single lane circulating roundabouts in the Loop Road Street at its intersection with both Parsonage Street and Well Street.*

Traffic Counts

Road Delay Solutions commissioned *ROAR Data* to annually count key intersections within the *MEA*, in particular the intersections of Constitution Road with both Bowden Sreet and Belmore Street. These counts have been collected in or around November of each year from 2011 to 2014, inclusive.

The 2014 counts, along with the projected traffic volumes for the respective stages of development, are presented in *Appendix A*.

From the counts, the annual growth rates on each road corridor have been calculated and utilised in the operational computer based modelling of the select infrastructure upgrades associated with the planning approval.

From the collated traffic data, the annual growth in traffic has been determined by Road corridors. Understandably a negative growth rate is currently reported through the precinct given...

- *The transformation of local land uses,*
- *The vacation of local business prior to the development construction, and*
- *The impedance of construction activities for Shepherds Bay and the surrounding developments.*

NOTE *A positive growth rate is anticipated with the occupancy of Stage 1, onwards.*

While the *Bureau of Transport Statistics* (*BTS*) currently lists vehicle growth on the Metropolitan Arterial Road Network as some 1.2%, for the purpose of this assessment, an average compounded 1% growth rate annually, has been reported within the MEA and represents the level of precinct development and to assimilate the growth in cross regional traffic flow.

On top of the 1% annual growth rate, each stage of the Shepherds Bay development has been added to the future traffic projections to enable assessment of a '*worst case'* situation.

Road Corridor	Vehicles per Hour *(All vehicle types)*				Average Growth
	2011	2012	2013	2014	
AM Constitution Road Eastbound	686	692	628	621	-3.2%
AM Constitution Road Westbound	488	452	441	435	-3.7%
AM Bowden Road Northbound	420	438	363	371	-3.5%
AM Bowden Street Southbound	377	369	254	266	-9.5%
AM Belmore Street Northbound	322	337	304	300	-2.1%
AM Belmore Street Southbound	146	152	138	133	-2.9%
AM Railway Parade Northbound	766	770	632	621	-6.4%
AM Railway Parade Southbound	323	437	352	355	5.6%
PM Constitution Road Eastbound	429	340	417	513	8.3%
PM Constitution Road Westbound	619	768	667	580	-0.7%
PM Bowden Road Northbound	413	384	255	189	-22.2%
PM Bowden Street Southbound	374	389	510	540	13.7%
PM Belmore Street Northbound	322	346	331	284	-3.7%
PM Belmore Street Southbound	228	223	246	152	-10.0%
PM Railway Parade Northbound	302	344	375	372	7.4%
PM Railway Parade Southbound	815	849	906	919	4.1%
Average Annual Growth Rate					**-29.0%**

Table 3 **Current Road Network Growth Rates**
Source *Road Delay Solutions, 2015*

4 FUTURE CONDITIONS

STAGE A

This Section 75W Application applies specifically to Stage A, proposing under a 10 storey envelope and indicatively the following specifications (subject to DA)...

- *4,608m² of floor space for serviced apartments or 42 serviced apartments, and*
- *4,270m² of floor space for residential apartments or 42 apartments, being...*
  - *Eight (8) 1 bedders,*
  - *Twenty four (24) 2 bedders, and*
  - *Ten (10) 3 bedders.*

Therefore, the Stage A, 10 storey envelope, traffic generating landuses include...

- *42 serviced apartments,*
- *42 residential apartments,*
- *A Supermarket with a GFA of 2,928m² inclusive of common areas, walkways, garbage rooms and shared loading dock,*
- *Specialty shops with a GFA of 1,128m², and*
- *A Café with a GFA of 100m².*

Stage A, under this Section 75W application is to provide for...

- *A total vehicle generation of 443vph during each commuter peak,*
- *Loading dock access from a dedicated entry lane adjacent to the deceleration lane, northbound in Church Street,*
- *Passenger vehicle access from a dedicated left turn lane, southbound in Parsonage Street,*
- *Construction of pedestrian refuges in Well Street and Parsonage Street, and*
- *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

Vehicular access to Stage A is proposed to adequately define and distinguish the passenger vehicle access from that for service and heavy vehicles.

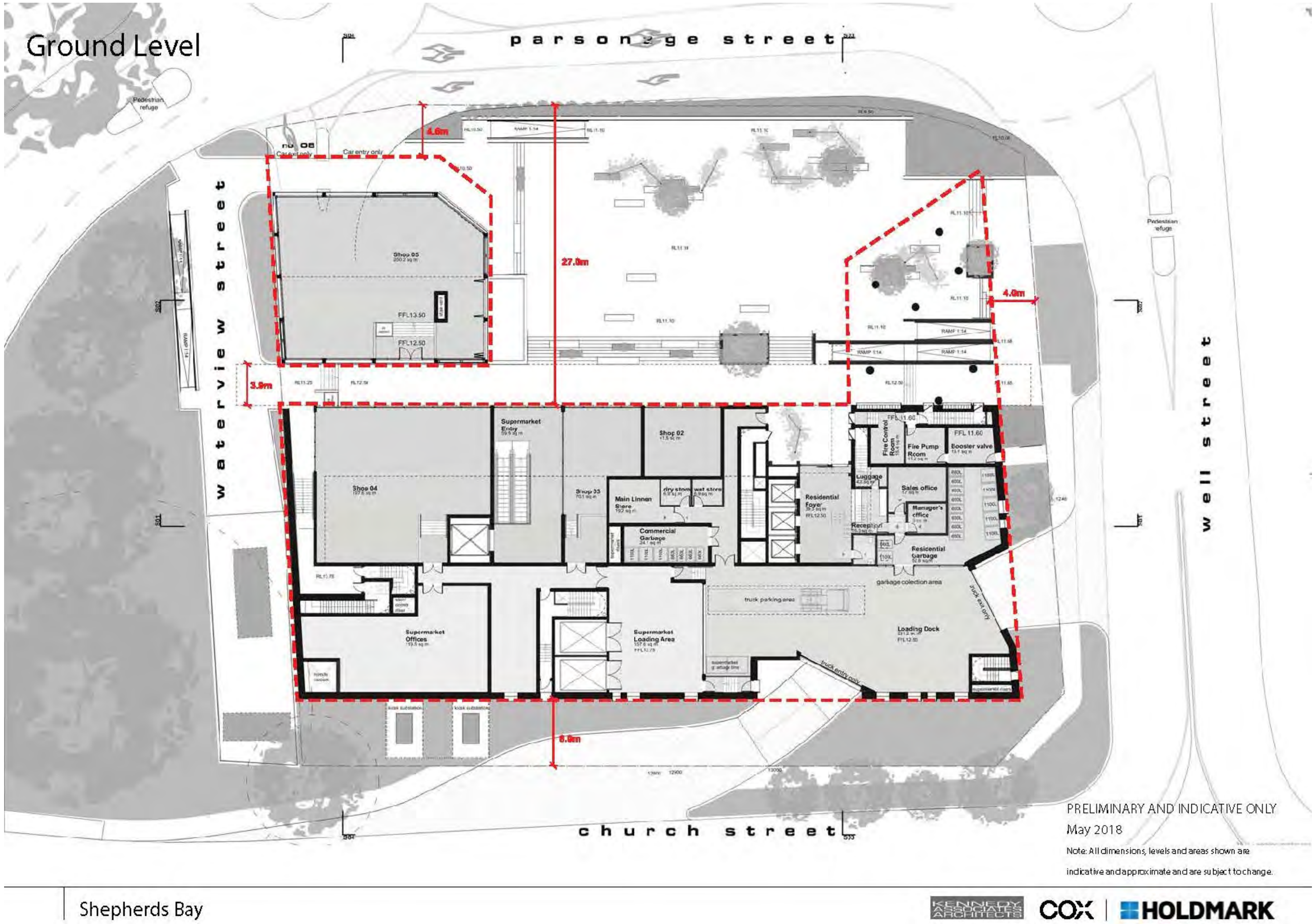


Figure 7 Development Footprint

Source *COX, 2018*

Figure 8 The Current Proposed 10 Storey Stage A Development Perspective
Source COX, 2018

Model Purpose

A mesoscopic traffic model has been created for the Meadowbank Employment Area (MEA). This is the most appropriate level of traffic modelling given the scope of the study area, where intersections are the primary cause of congestion.

The models have been developed using the *Netanal Version 2017* software which, iteratively, calculates intersection/lane capacity, vehicle delays and queueing affects at all intersections within the network in the determination of motorist route choice.

Mesoscopic models are typically used to highlight the needs and assess the impacts of congestion on the road network for the morning and evening commuter peak hour periods. Netanal calculates the impact of a network of coordinated traffic signal sites, applying the calculated cycle commencement offsets and reports the resultant turn movements at every intersection or node within the model.

For this assessment, the year 2026 model scenarios have been built for…

- *A typical weekday morning peak hour period (7:30AM – 8:30AM), and*
- *A typical weekday evening peak period (5:00PM - 6:00PM).*

Traffic Generation

All projected traffic generation rates applied to development within the MEA have been based on the industry standard *RMS Guide to Traffic Generating Developments* and supplimental Technical Directions.

The former Concept Model was prepared prior to the current stage definition and unit allocations. Five (5) stages were adopted in the concept model with Stage 5 now referred to as Stage A. The former concept stages 1 to 4 are now referred to as Stages 1 through 9 and previously presented a total, modelled, vehicle generation of 1,277vph, being…

- *Stage 5 (now Stage A) - 10,000m^2 of commercial floor space* — *225vph*
- *Stages 1 through 4 (now Stages 1 -9) 3,000 residential apartments* — *962vph*
- *Nominal retail and service vehicle trips* — *90vph*
- ***Total modelled vehicle generation*** — ***1,277vph***

This Stage A Section 75W Application proposes a combined vehicle generation, for all development stages, of 1,148vph, which is a reduction of 129vph when compared to the former concept model.

MODEL COMPARISON TABLE							
CONCEPT MODEL				CURRENT 2026 MODEL			
Concept Stage	Apartments or Commercial Floor Space	Adopted Generation Rate*	Generation *(vph)*	Section 75W Stage	Apartments or Commercial Floor Space	Adopted Generation Rate	Generation *(vph)*
Stages 1 - 4	3,005	0.32	962	Stages 1 -9	1,988	0.29	577
Stage 5 *(Commercial)*	10,000	0.0225	225	Stage A *(Residential)*	42	0.29	12
-				Serviced Apartments	82	0.40	33
Nominal *(Retail/Service)*	-	-	90	Stage A *(Retail)*	4,260	Various	521
				Service Vehicles *(Loading Dock)*	-	-	5
TOTAL			**1,277**				**1,148**

** Note Generation rate utilised in the Concept Model did not allow for mode shift creating a 'Worst Case' Scenario*

Table 4 **Vehicle Generation Model Comparison**
Source *Road Delay Solutions, 2017*

Based upon the *RMS Technical Direction TDT 2013/04a* high density residential apartment developments, the traffic generation for Stage A has adopted a conservative generation rate of 0.29 vehicles per hour (vph) per apartment, for both the morning and evening commuter peak periods, respectively. This generation rate is commensurate with sub-regional precincts, considered conservative and aid in determining the appropriate warrants for infrastructure.

Following discussions with a number of generic service providers such as Coles Gladesville Shopping Village, Council's garbage operators, etc… the heavy vehicle generation, associated with the Stage A retail and service operations is considered to be in the order of 1% of the total vehicle generation, equating to some 5-6 trucks during each one (1) hour commuter peak period.

Garbage services, utilising the proposed loading dock, will invariably coordinate with the Shepherds Bay residential development Stages 1 through 9 and are anticipated to occur between the hours of 1pm to 2:30pm, daily.

Woolworths has indicated that 14m rigid trucks are the preferred delivery vehicle for this particular supermarket size.

To substatiate the heavy vehicle generation rates adopted, observations were undertaken at two (2) loading docks servicing simillar size supermarket and specialty retail operations in Gladesville and in Mona Vale.

Both loading docks reported only minimal heavy vehicular activity during the commuter peak periods with only 4-5 trucks, and service vehicles, arriving during that time.

Vehicle Generation Period	RMS Vehicle Generation Rate			
	Sydney Average	Sydney Range	Regional Average	Regional Range
AM peak (1 hour) vehicle trips per unit	**0.19**	**0.07-0.32**	0.53	0.39-0.67
AM peak (1 hour) vehicle trips per car space	0.15	0.09-0.29	0.35	0.32-0.37
AM peak (1 hour) vehicle trips per bedroom	0.09	0.03-0.13	0.21	0.20-0.22
PM peak (1 hour) vehicle trips per unit	**0.15**	**0.06-0.41**	0.32	0.22-0.42
PM peak (1hour) vehicle trips per car space	0.12	0.05-0.28	0.26	0.11-0.40
PM peak (1 hour) vehicle trips per bedroom	0.07	0.03-0.17	0.15	0.07-0.22
Daily vehicle trips per unit	1.52	0.77-3.14	4.58	4.37-4.78
Daily vehicle trips per car space	1.34	0.56-2.16	3.22	2.26-4.18
Daily vehicle trips per bedroom	0.72	0.35-1.29	1.93	1.59-2.26

NB. A residential generation rate of 0.29vph per apartment has been adopted for modelling purposes.

Table 5 **RMS Vehicle Generation Rates**
Source *Extract from RMS Technical Direction TDT 2013/04a, 2013*

STAGE A SECTION 75W VEHICLE GENERATION TABLE										
Development Component	Area (Units &/or GLFA m^2)	Daily RMS Trip Rate	AM Peak Hour GLFA RMS Trip Rate/m^2	PM Peak Hour GLFA RMS Trip Rate/m^2	AM Peak Hour Generation (vph)	PM Peak Hour Generation (vph)	AM Outbound Trips (vph)	AM Inbound Trips (vph)	PM Outbound Trips (vph)	PM Inbound Trips (vph)
Residential Apartments	42	0.72	0.29	0.29	12	12	9	3	3	9
Serviced Apartments	42	1.44	0.4	0.4	17	17	13	4	4	13
Specialty Shops*	903	1.21	0.125	0.125	113	113	85	28	28	85
Café	100	0.11	0.08	0.08	8	8	6	2	2	6
Supermarket*	2,343	1.21	0.125	0.125	293	293	103	190	190	103
TOTAL	3,346	4,029			443	443	215	228	228	215

**The Supermarket and Specialty Shops Generation rate is based on RMS Technical Direction TDT 2013/04a for the highest weekday generation - 12.5vph/100m2 of GLFA*
The combined retail GLFA excludes common areas such as walkways, garbage storage and the shared loading dock and constitutes 80% of GFA

Table 6 **Stage A S75W Calculated Vehicle Generation**
Source *Road Delay Solutions, 2018*

Construction Stage	No of Apartments *(units)*	RESIDENTIAL VEHICLE GENERATION					
		Adopted Rate per Unit	Generation *(vph)*	AM Outbound *(80%)*	AM Inbound *(20%)*	PM Outbound *(20%)*	PM Inbound *(80%)*
1	246	0.29	71	57	14	14	57
2 and 3	498	0.29	144	116	29	29	116
4 and 5	511	0.29	148	119	30	30	119
6 and 7	311	0.29	90	72	18	18	72
8 and 9	422	0.29	122	98	24	24	98
Stage A Residential	42	0.29	12	10	2	2	10
Stage A Serviced Apartments	42	0.4	17	13	3	3	13
TOTALS	**2,072**		**606**	**484**	**121**	**121**	**484**

Table 7 **Residential Vehicle Generation by Development Stage**
Source *Road Delay Solutions, 2018*

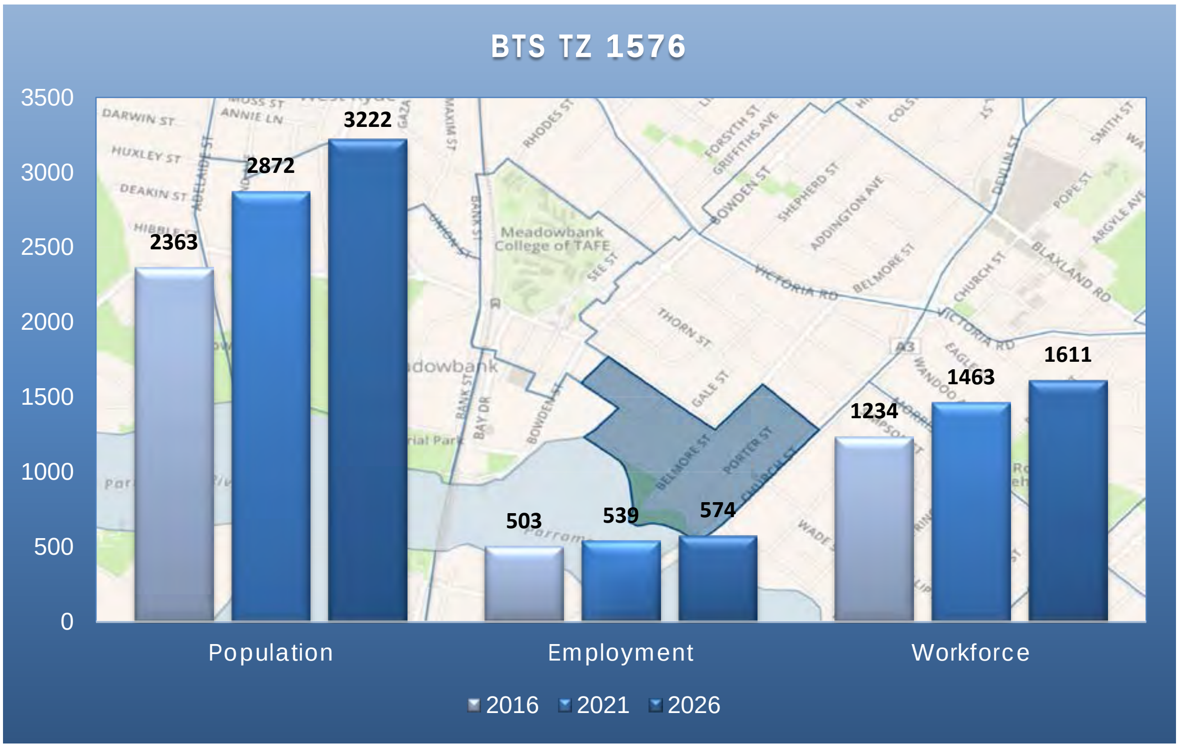


Figure 9 **Projected MEA Growth Levels**
Source *BTS Zone Explorer, 2017*

Residential Vehicle Trip Distribution

Traffic distribution has been drawn from numerous sources. Residential distribution was based on the applied *BTS* trip matrices, published in 2011, and utilised in the modelling for year 2026.

The retail distribution has been determined by a catchment analysis of simillar operations in Gladesville.

The residential vehicle distribution pattern utilised in the modelling has been based upon the applied trip matrices published by the *BTS* in 2011 and aggregated to correspond with the *BTS JTW Explorer* for Travel Zones (TZ) 1576 and 1591. Given the reduced population currently within the MEA zone, as a result of construction associated with the Shepherds Bay development, the adjacent TZ 1591 (*predominantly medium to high density residential*) has also been utlised to form a realistic appraisal of JTW distribution patterns from the precinct and provide a resalistic comparison to the applied year 2026 trip matrices.

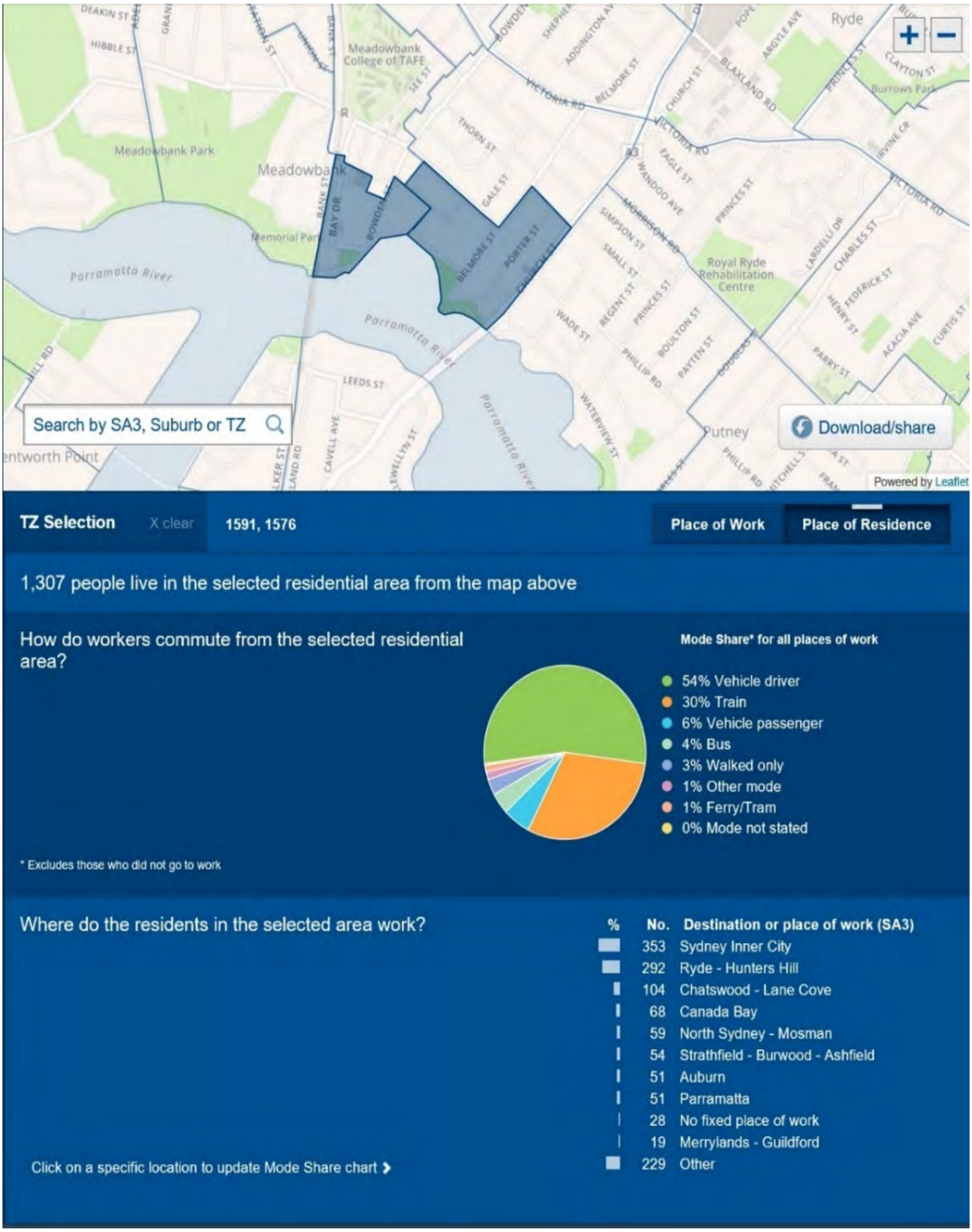


Figure 10 **Meadowbank Precinct JTW Distribution and Mode Choice**

Source *BTS JTW Explorer, 2017*

Retail Vehicle Trip Distribution

An analysis of the current supermarket operations in the Gladesville Shopping Village was undertaken and found that patrons were generally attracted from a radial catchment of less than 5 kilometres, given the proximity of competing operations. It was found that the Gladesville supermarket generally attracted some 72% of patrons from within a 1.5 kilometre radius of the site, a further 19% within 2kms with the majority of the remaining 8%, some 3.5kms. This distribution pattern has been applied within the trip matrices of the future year 2026 model.

The distribution of traffic was proportionately applied to the percentage of residential lots within adjoining catchments.

The retail distribution was determined by a simple survey of 126 patrons entering, by vehicle, into the basement carpark of the Gladesville Shopping Village and observed heading to the supermarket. These patrons were asked to roughly estimated the distance they had travelled. The survey did not include pedestrian foot traffic.

Some 25% of patrons surveyed commented that they frequently utilised competing supermarkets and that the Gladesville store was not their sole source of groceries.

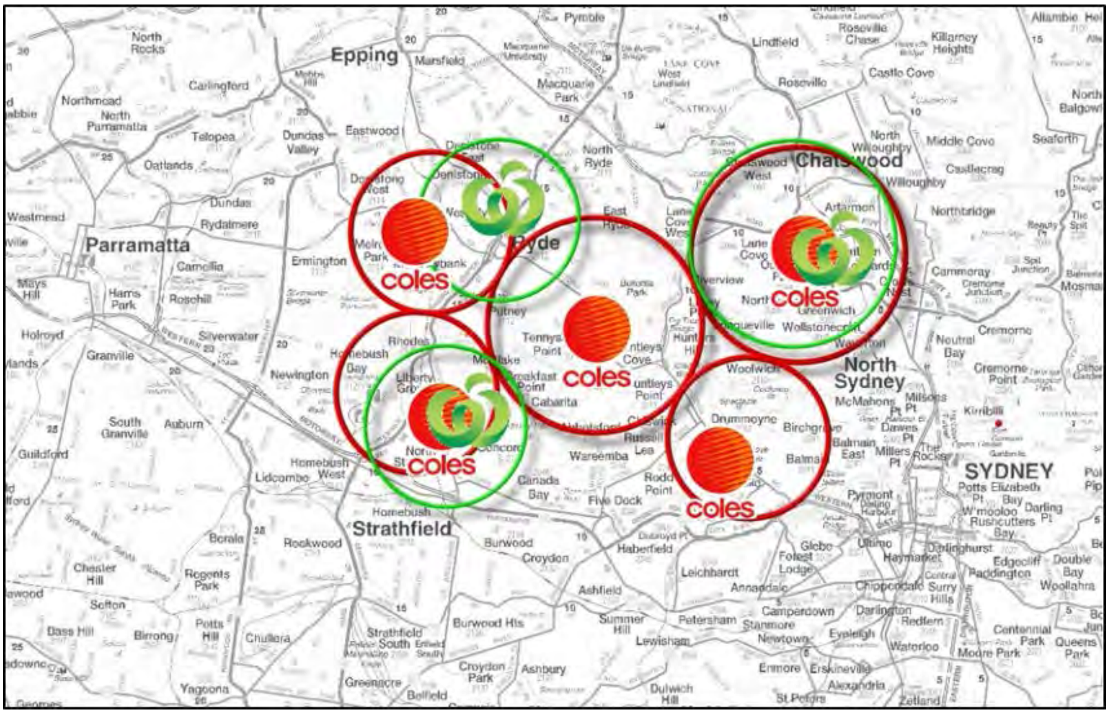


Figure 11 Current Competing Retail Operations
Source Road Delay Solutions, 2016

Mode Share

The current predominant available transport mode choices for JTW have been catalogued from those available within, or adjacent to, the *MEA*, and as defined within the *BTS* TZ 1576 (*Ryde Council Depot*) and TZ 1591.

The latest *Household Travel Survey* (HTS) data shows that average weekday trips grew by 1.0% between 2009/10 and 2010/11, which was slower than the 1.6% rate of population growth in the *Sydney Statistical Division* (SSD).

The private motor vehicle remains the dominant mode of transport embraced by the wider Sydney community. However, the *BTS* reports the *MEA* exhibits a significant public transport share, with a higher than metropolitan average of 35% attributed to train, bus and ferry modes.

In line with NSW 2021 targets, growth in public transport trips has been higher than growth in private vehicle passenger trips. Vehicle driver trips have increased by 1.5%, while train and bus trips increased by 2.6% and 2.3%, respectively. These inherent increases can be attributed to increased traffic congestion on the arterial road system, greater frequency of public transport services and improved intermodal/interchange provisions. This is clearly evident within the *MEA*.

With a walking distance in the order of 1.2km from Stage A to the Meadowbank Railway Station, it is anticipated that a significant reduction in the use of public transport for JTW trips will result. The TZ to the immediate north of the *MEA*, between Victoria Road and Constitution Road (*TZ 1573 – Ryde*), reports a combined train, bus and ferry mode share of only 9% of JTW trips. It is anticipated that this is the cumulative result of walking distance to train and ferry in conjunction with a lack of current pedestrian amenity.

Planners invariably work on the basis that commuter bus users will walk no more than 400 metres from home to the nearest stop. Data suggests travellers will walk further to catch a train, so the maximum walk distance to a station has been adopted as 800 metres.

Travel surveys have shown the median walk distance to a bus in heavily built up areas of Sydney and Melbourne is some 500 metres, with only 25% walking more than 800 metres. The data, anecdotally, suggests that train travellers infrequently elect to walk more than 800 metres if the prevailing pedestrian environment is condusive.

That is, if flat or lightly undulating, dedicated and sheltered travel paths are available incorporating minimal road crossings.

Bicycle to train is an ever growing opportunity for both efficiency and health choices. This may offer some relief from commuter traffic generation but it is considered negliable in this instance. While the walking and cycling distances may be extended for multi mode commuter trips, the same cannot be said for retail patrons. Carrying heavy shopping bags over distances greater than 600m has rarely been observed or reported.

The *BTS* data for those zones around the periphery of the *MEA* support these observations.

It can therefore be concluded that...

- → *The distance between the site and Meadowbank Railway Station will deter a significant number from walking to the railway station,*
- → *With the exception of bus travel, residents and retail patrons would be reluctant to adopt multiple travel modes,*
- → *Bus services, which currently operate along Church Street, Well Street and Parsonage Street, will provide the greatest opportunity for mode shift,*
- → *The dependency on private motor vehicle usage at the site will increase to a share in excess of 70%, and*
- → *Car share and Car Pooling opportunities will be enhanced.*

It is for the above reasons, no mode shift has been adopted in the mesoscopic modelling and the full traffic generation of 443vph has been incorporated into the model's trip matrices.

Committed Shepherds Bay Infrastructure

During the planning and approval stage, the form and level of infrastructure required, to sustain the urban renewal development, was diligently assessed.

Holdmark has expressed it's commitment to constructing the following infrastructure during the staged construction of the development, in accordance with the Department of Planning and Infrastructure Approval MP09_0216.

The committed infrastructure upgrades include…

- → *The extension of Nancarrow Avenue between Hamilton Crescent and Belmore Street,*
- → *The provision of left in/left out at the intersection of Belmore Street and Hamilton Crescent,*
- → *The provision of left in/left out at the intersection of Belmore Street and Yerong Street,*
- → *Underdale Lane Local Area Traffic Management (LATM) measures,*
- → *Installation of a pedestrian refuge on Bowden Street near Nancarrow Avenue,*
- → *Installation of roundabout in Belmore Street at Rothesay Avenue,*
- → *The provision of left in/left out at the intersection of Belmore Street and Yerong Street,*
- → *Installation of traffic signals at the intersection of Constitution Road and Bowden Street, subject to RMS warrants, and*
- → *Installation of traffic signals on Railway Road at the current pedestrian crossing near Meadowbank Railway Station, subject to RMS warrants.*

The full infrastructure program, including the necessary improvements to sustain the Stage A development, are set out in the *Traffic Management Solution* following.

5 TRAFFIC IMPACTS

Investigations into the operational traffic impacts associated with the development's vehicle generation has been undertaken using the computer based programs Netanal and SIDRA. In particular, the following intersections have been scrutinised in detail...

- → *Well Street,Parsonage Street and Porter Street,*
- → *Parsonage Street and The Loop Road,*
- → *Constitution Road with Belmore Street, and*
- → *Constitution and Bowden Street, have been closely scrutinised.*

Year 2026 Base Case 'No Stage A' Base Model

A future year '*No Stage A*' Base model was created for year 2026 to reflect the likely impacts of the Shepherds Bay development Stages 1 through 9, excluding Stage A. This model incorporates...

- → *The committed infrastructure treatments outlined in the Shepherds Bay Concept Approval, with the exception of traffic signal control at the Constitution Road intersection with Bowden Street and mid block pedestrian crossing in Railway Road,*
- → *The background traffic growth extrapolated, by zone, from population and employment levels prescribed in the BTS Travel Zone Explorer (2017),*
- → *The traffic growth associated with the full occupancy of the Shepherds Bay development Stages 1 through 9, and*
- → *Local planned growth within the MEA outlined in Council's DCP's of 2011 and 2014.*

The 2026 Base model reports a total of some 9.4% background growth from 2014 within the MEA study area. Beyond this, local LEP 3A development, including Shepherds Bay Stages 1 through 9, further increase traffic volumes within the precinct.

VEHICLE GROWTH PROJECTIONS

ROAD LINK	2014 AM PEAK	2026 AM PEAK		2014 AM PEAK	2026 PM PEAK	
		26AM BASE	26AM20		26PM BASE	26PM9
CHURCH ST NB	2985	3495	3680	3079	3003	3214
CHURCH ST SB	3184	2704	2606	3106	3077	3157
WELL ST WB	376	450	630	830	826	847
WELL ST EB	22	72	237	23	40	255
BELMORE ST NB	300	451	506	284	529	550
BELMORE ST SB	243	585	617	326	466	503
CONSTITUTION RD WB	435	696	849	632	1178	1152
CONSTITUTION RD EB	681	1204	1197	526	858	890
BOWDEN RD NB	471	666	670	274	463	463
BOWDEN RD SB	266	392	401	613	743	762

Table 8 Modelled Vehicle Growth Projections
Source Road Delay Solutions, Year 2026 Netanal Model, 2018

The 2026 Base model identifies no significant requirement for infrastructure improvement beyod the implementation of the committed infrastructure within the MEA, with the notable exception of the Constitution Road intersection with Bowden Street roundabout control. The model reports oversaturation of the critical through movements on Constitution Road.

The roundabout was recommended for traffic signal control in the Traffic Impact Assessment for Stages 6 and 7 of the Shepherds Bay Development. The single lane circulating roundabout will invariably fail as traffic volumes increase with local development. However, the resultant projected traffic volumes, during the *RMS* prescribed four (4) hour period, fail to satisfy the current warrant for signalisation.

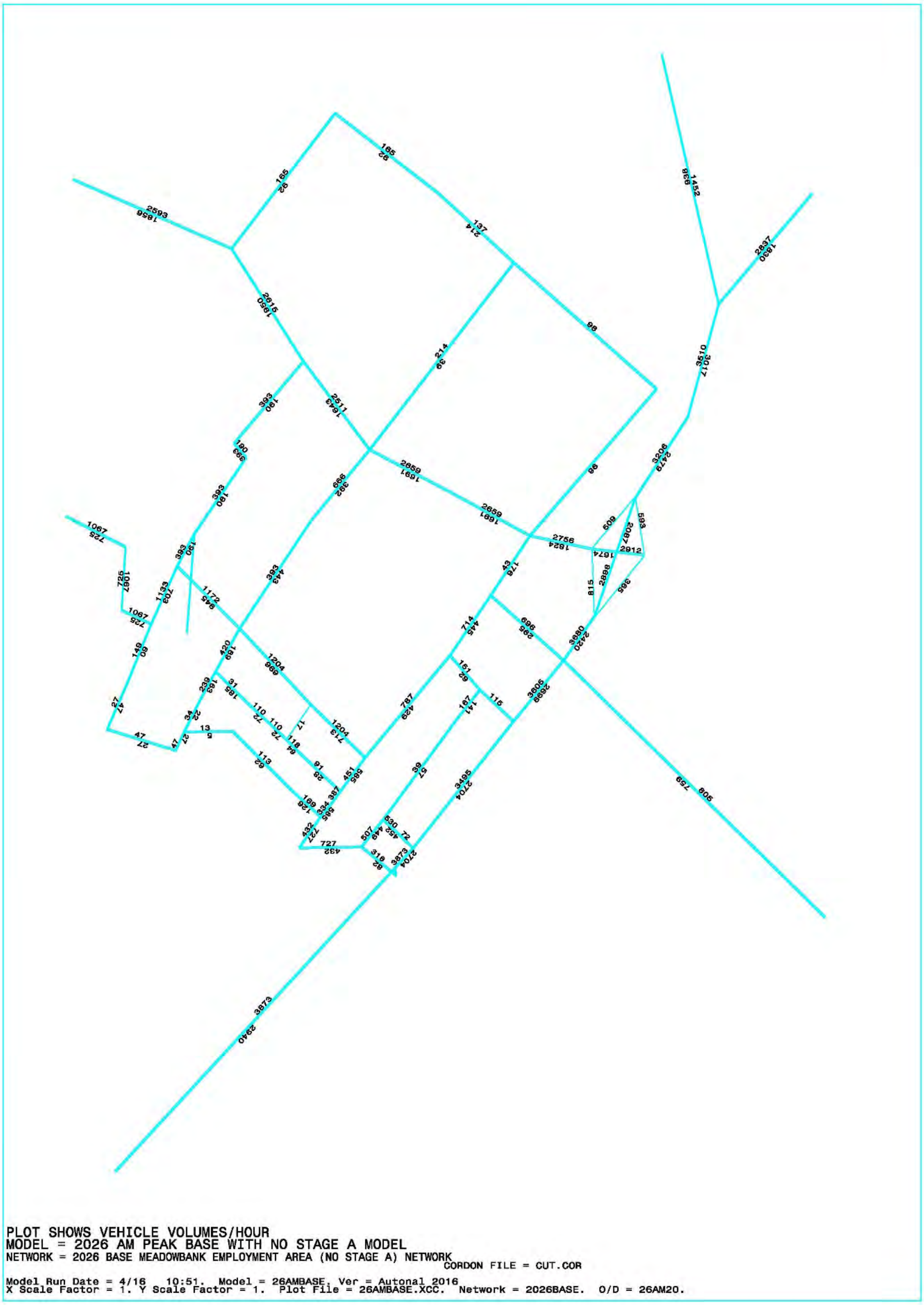


Figure 12 **2026 AM Base Traffic Projections – No Stage A Development**
Source *Road Delay Solutions, Year 2026 Netanal Model, 2018*

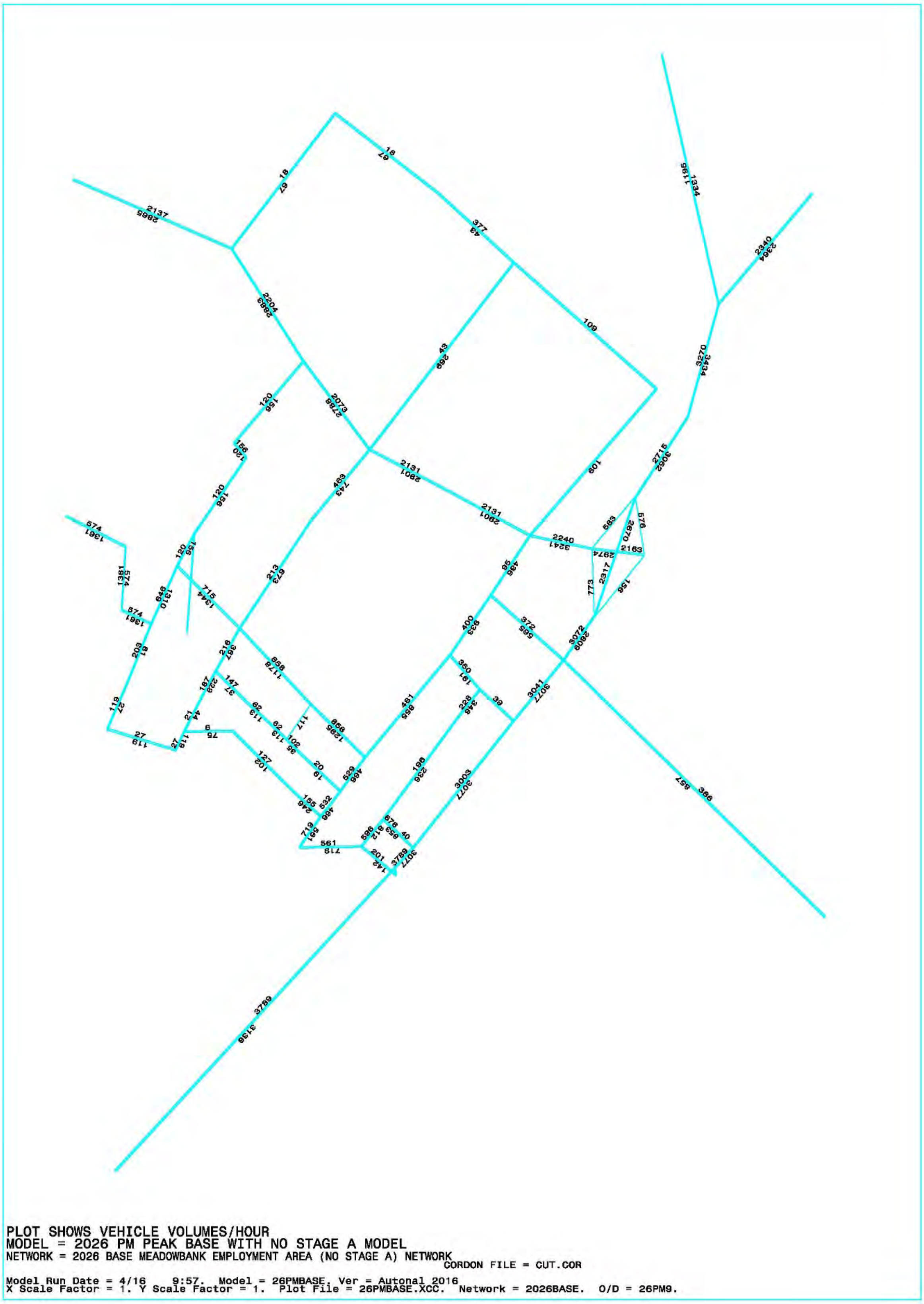


Figure 13 **2026 PM Base Traffic Projections – No Stage A Development**
Source *Road Delay Solutions, Year 2026 Netanal Model, 2018*

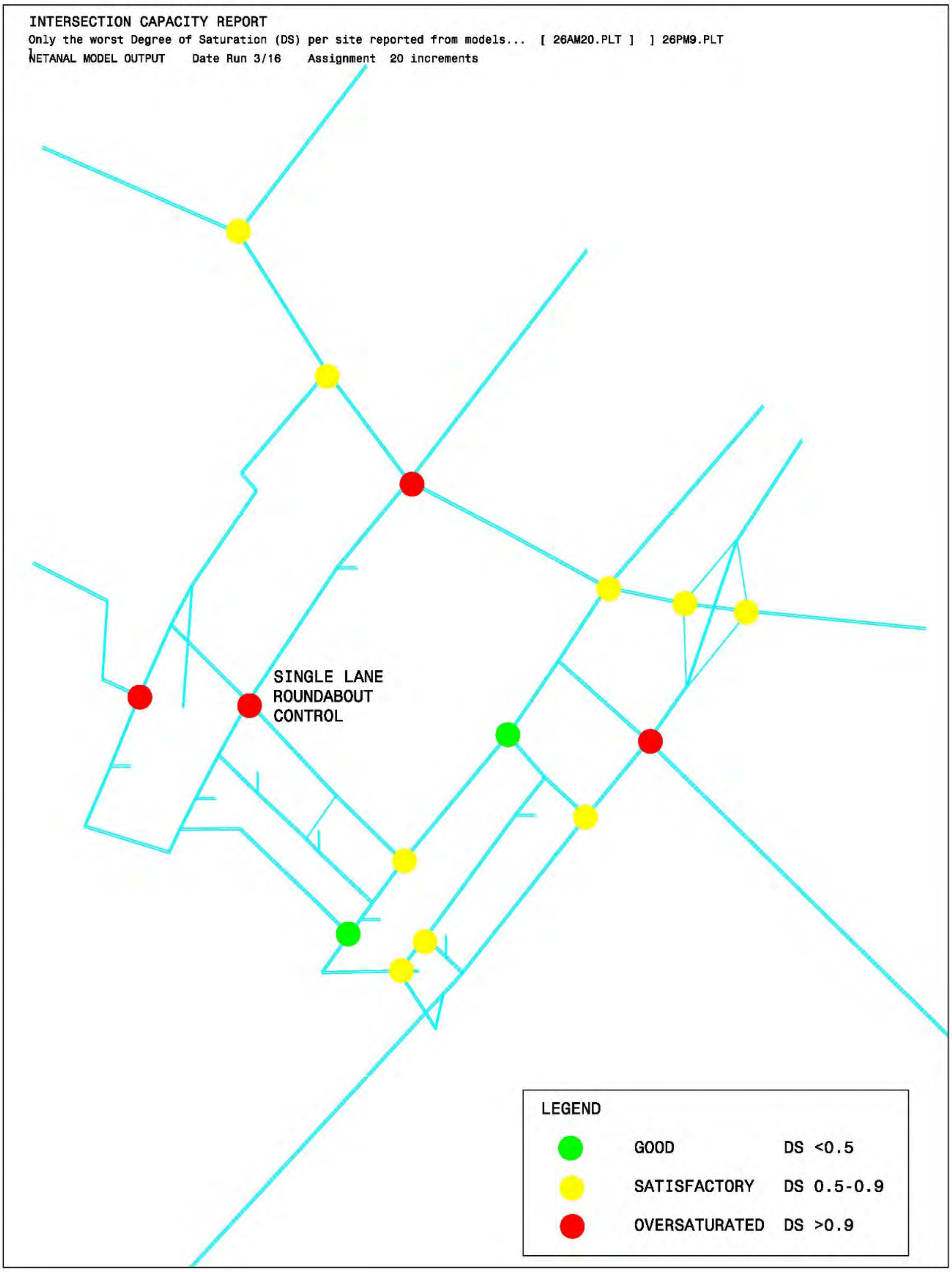


Figure 14 **2026 Base Model Congestion Levels**
Source *Road Delay Solutions, Year 2026 Netanal Model, 2018*

Year 2026 Stage A Model

The Stage A model incorporated the traffic generation associated with the mixed land use calculated for the development, added to the background growth exhibited in the year 2026 Base model.

Residential and retail passenger vehicle traffic to and from the Stage A development is proposed via the introduction of a 62m long dedicated left turn lane in Parsonage Street and a fourth leg approach at the the Loop Road roundabout, respectively.

No vehicular access to Stage A is proposed from the the Loop Road/Parsonage Street roundabout. Vehicles destined for Stage A will be able to travel northbound from the roundabout in Parsonage Street and perform a U-Turn manouevre at the Well Street roundabout. Vehicles will then enter the dedicated left turn lane and proceed into the site.

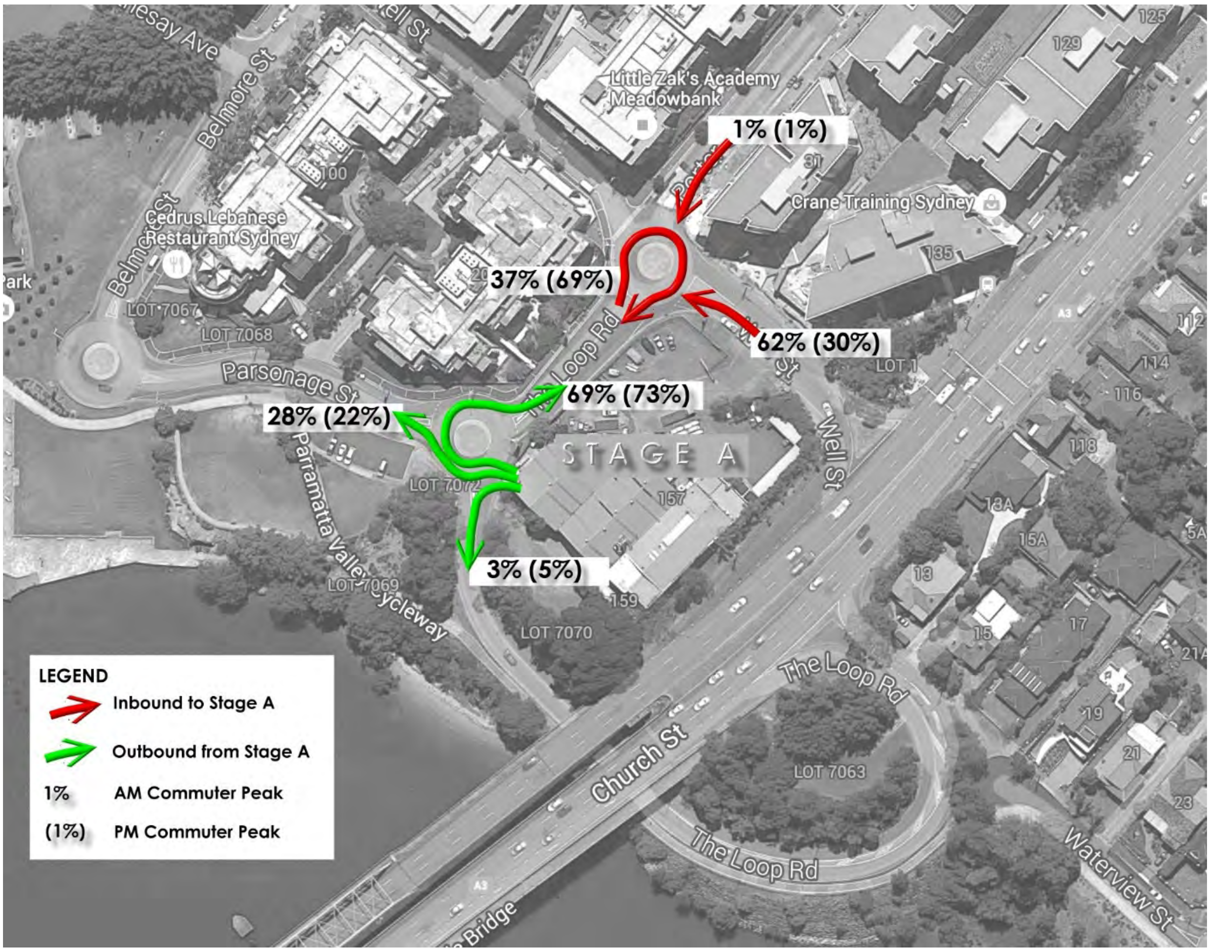


Figure 15 **Stage A Passenger Vehicle Distribution**
Source *Year 2026 Netanal Model - Road Delay Solutions, 2018*

The two (2) critical intersections identified in the model are…

- *Parsonage Street, Well Street and Porter Street (Roundabout), and*
- *Parsonage Street and the Loop Road (Roundabout).*

Both intersections report a satisfactory Level of Service (LoS) during both the AM and PM commuter peaks. Focus was on the 95th percentile queue lengths, reported from the year 2026 Sidra models. The inbound movements to Stage A, juxtaposed with the introduction of the U-Turn manouevre in Parsonage Street at the Well Street roundabout, pose concern for adverse impact on the Church Street arterial corridor. The resultant 95th percentile queue lengths reported for the inbound movements to the site are…

- *Parsonage Street southbound – AM 20m / PM 28m, and*
- *Well Street westbound – AM 46m / PM 107m.*

Well Street affords some 70m storage for westbound motorists. With the PM model reporting a queue length of 107m, there will be a need to permit queueing vehicles to utilise the deceleration lane on Church Street. The deceleration lane provides storage of up to 125m. It is considered that the potential use of the deceleration lane to accommodate queued traffic from the Well Street roundabout, is acceptable during the evening commuter peak given the high congestion levels and significantly reduced vehicle speeds nothbound on Church Street.

The deceleration lane is also intended to facilitate access, by heavy vehicles, to the loading dock for Stage A. It is considered the reduced speeds and congestion levels during the evening peak will moderate the potential for rear end collision by bothe passenger and heavy vehicles within the deceleration lane.

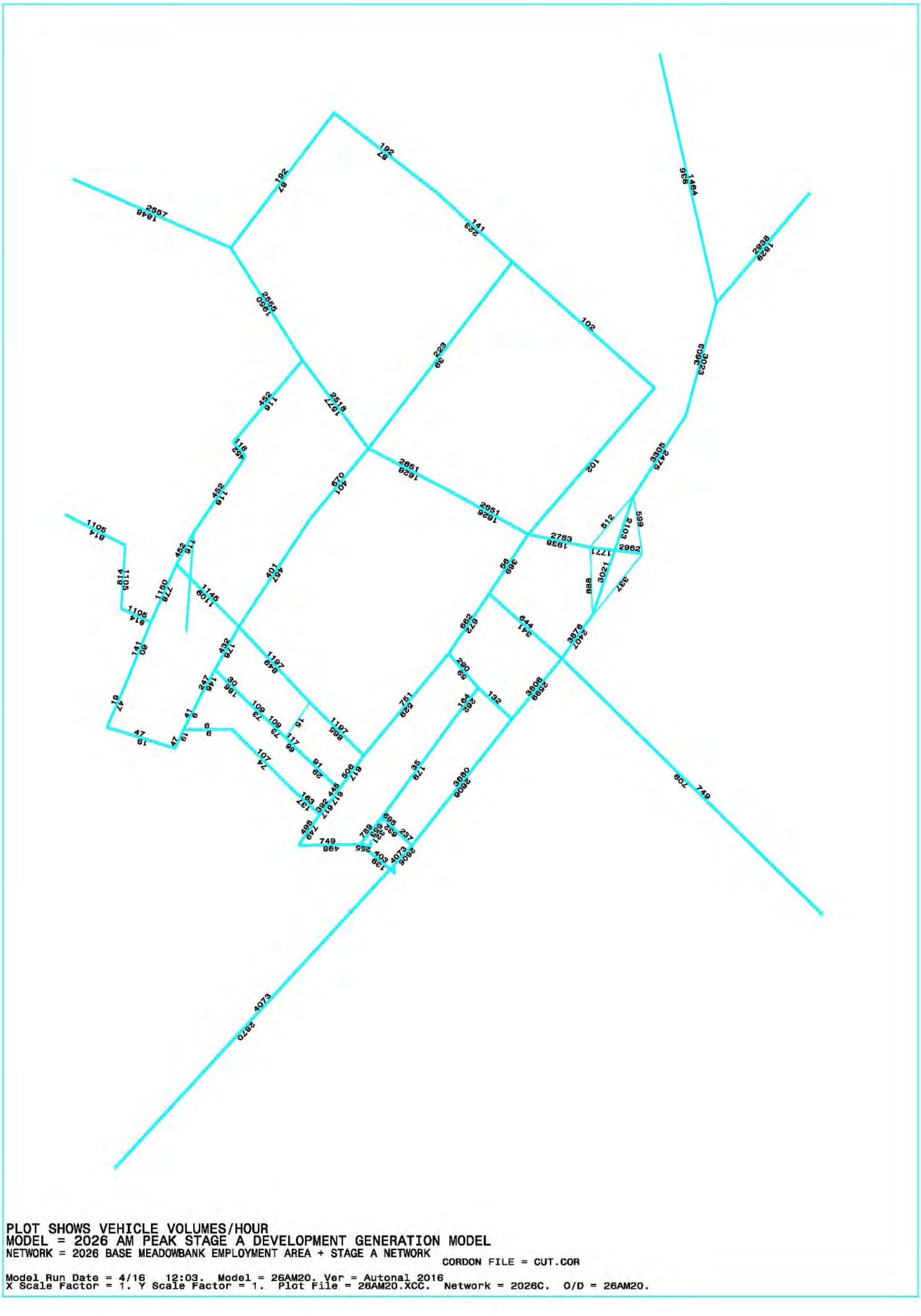


Figure 16 **2026 AM Stage A Model Traffic Projections**
Source *Road Delay Solutions, Year 2026 Netanal Model, 2018*

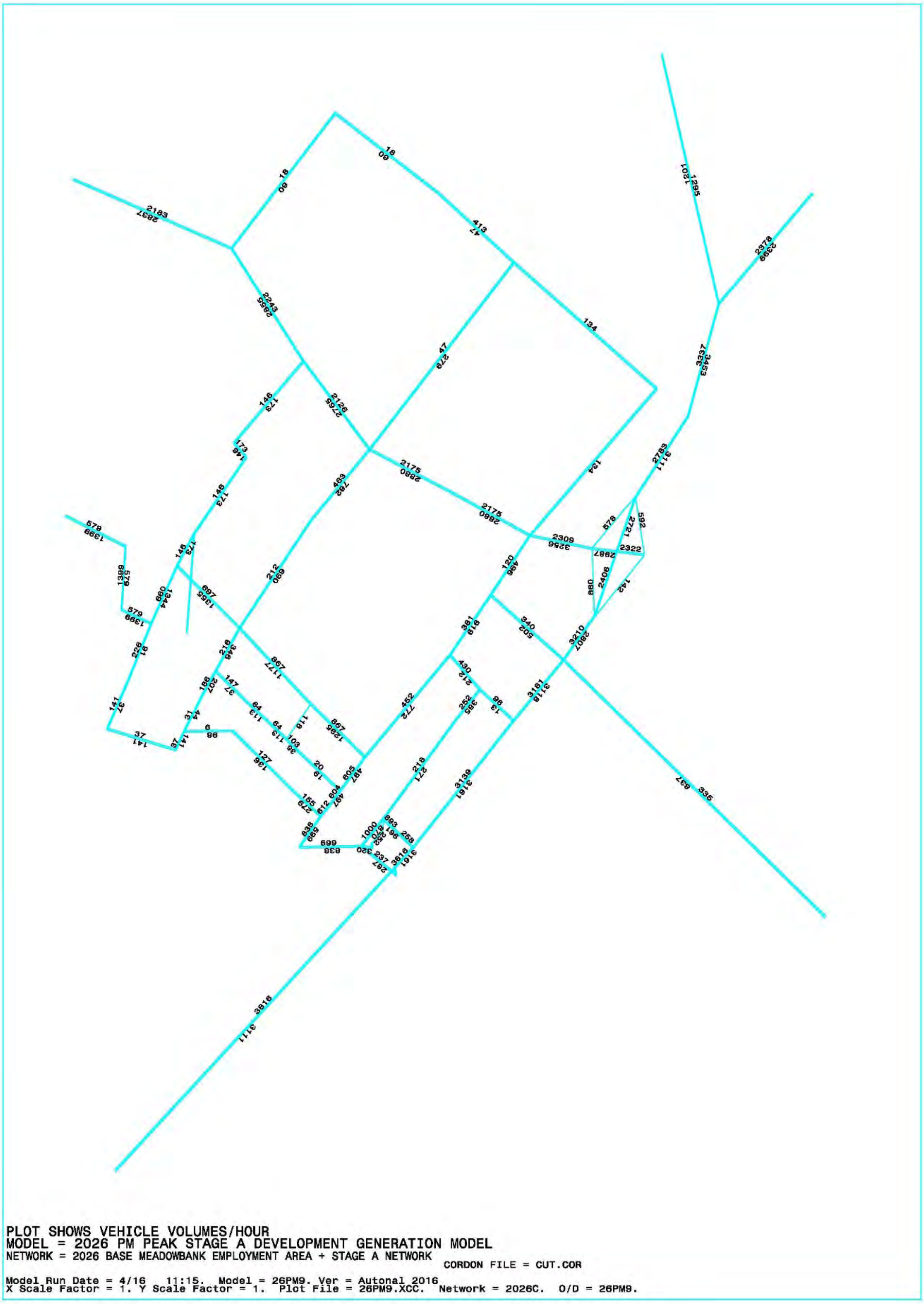


Figure 17 **2026 PM Stage A Model Traffic Projections**
Source *Road Delay Solutions, Year 2026 Netanal Model, 2018*

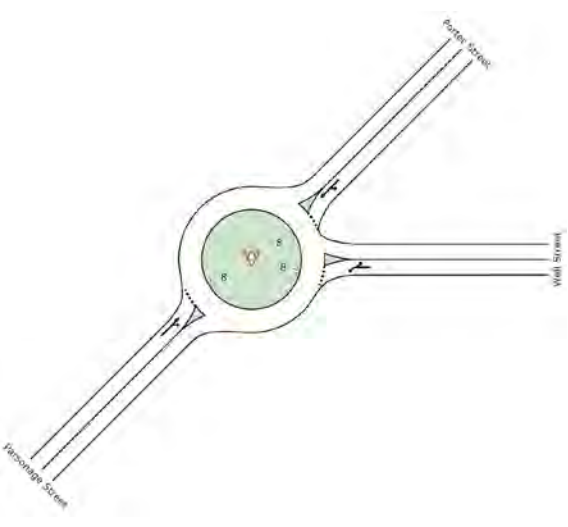
Well Street, Parsonage Street and Porter Street

Well Street serves as a critical gateway to the *MEA* and the Stage A development.

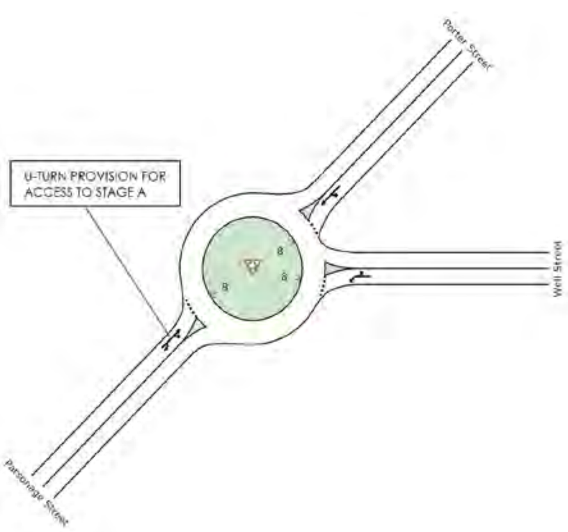
The mesoscopic modelling has identified that traffic in Well Street and Parsonage Street will increase dramatically during the morning and evening peak periods with the advent of some 9.4% background growth and the Shepherds Bay Urban Renewal, including Stage A.

During the planning stages of the project the Stage A site proposed some 10,000m^2 of commercial floor space, generating a projected 205vph.

With the amended mixed land use proposed in this application, the calculated vehicle generation has risen to 576vph, an increase of 371vph or 181%.



SIDRA INTERSECTION PERFORMANCE OUTCOMES							
WELL STREET, PARSONAGE STREET AND PORTER STREET							
Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS			0.367	0.736		
	AVG	NO	COUNTS	6.3	8.0		
	LoS			A	A		



SIDRA INTERSECTION PERFORMANCE OUTCOMES							
WELL STREET, PARSONAGE STREET AND PORTER STREET							
Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS					0.641	0.837
	AVG					8.2	14.0
	LoS					A	A

Figure 18 **Well Street, Parsonage Street and Porter Street**
Source *Road Delay Solutions, SIDRA 2018*

Modelling of the existing roundabout operation has reported a good level of Service (LoS) ‘A’ for both the AM and PM peak hour commuter periods with an effective spare capacity in excess of 100%.

With the advent of the Stage A development in year 2026, the resultant Los reported was also ‘A’ for both the AM and PM peak hours with no effective spare capacity.

The roundabout will take on the function of allowing access from the west to the Stage A development.

Several improvements are recommended in Well Street to aid pedestrian activity. The reduction of the kerb radius of the left turn slip lane entering Well Street from Church is intended to reduce the speed of vehicles allowing the introduction of a pedestrian refuge, incorporating kerb ramps.

Parsonage Street and Loop Road

The Parsonage Street intersection with the Loop Road roundabout is proposed to facilitate passenger vehicle access to and from the Stage A car park. A fourth leg from the Stage A car park into the current roundabout is proposed.

No access to the Stage A car park from the roundabout is recommended. Modelling indicates that if access were to be allowed from the roundabout the resultant increase in vehicle delay to southbound traffic in Parsonage Street would incite periodic queueing, extending back into Well Street and further on into Church Street.

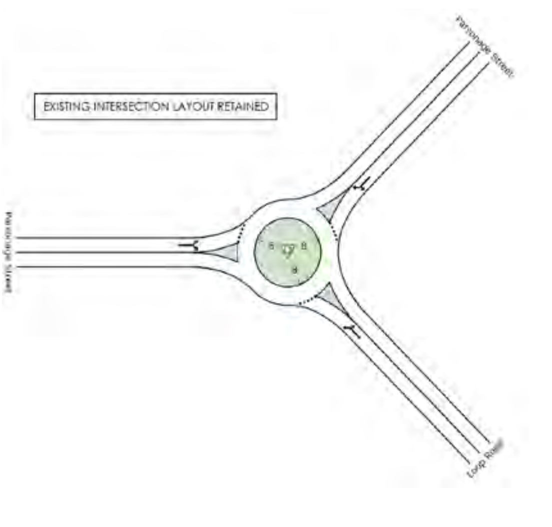
Currently, the roundabout reports a good LoS ‘A’ during both the AM and PM peak commuter periods. The low recorded vehicle volumes through the intersection is considered the result of the level of construction associated with the Shepherds Bay development and the lack of vehicle generation. Modelling indicates these volumes will increase with future residential occupation throughout the precinct.

Modelling of the projected 2026 traffic demand reported that the single lane circulating roundabout, inclusive of the fourth leg and calculated traffic generation from the Stage A development, will return good LoS ‘A’ during the AM peak and LoS ‘B’ during the PM peak hour and retain 17-20% effective spare capacity during the AM and PM peaks, respectively. The 95th percentile queue lengths in the Parsonage Street approach are reported as 20m and 28m in the AM and PM peaks, respectively

Consideration has been given to the installation of traffic signals at the intersection but was rejected after modelling indicated incresed vehicle delays in the southbound Parsonage Street approach would result in 95th percentile queue lengths in the order of some 200m, extending back onto Church Street.

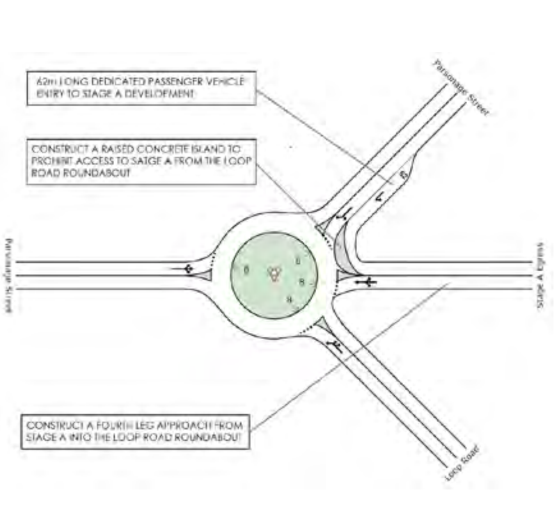
Further, no specific RMS warrant could be met for the installation of signals. However, it is considered that traffic signals would afford pedestrians and cyclists the safest form of road crossing through the intersection.

SIDRA INTERSECTION PERFORMANCE OUTCOMES
PARSONAGE STREET AND THE LOOP ROAD



Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS	0.473	0.238	0.521	0.478		
	AVG	8.3	7.2	7.0	6.7		
	LoS	A	A	A	A		

SIDRA INTERSECTION PERFORMANCE OUTCOMES
PARSONAGE STREET, THE LOOP ROAD AND STAGE A ACCESS



Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS					0.722	0.699
	AVG					9.0	11.1
	LoS					A	B

Figure 19 **Parsonage Street and The Loop Road**
Source *Road Delay Solutions, SIDRA 2018*

Constitution Road and Bowden Street

The intersection was itemised by Council, under the 2005 works program and again identified by Urban Horizon in July of 2010, to be reconstructed and operate under the control of traffic signals.

The intersection, modelled utilising the 2014 traffic demands, is controlled by a single lane circulating roundabout and reports operation at a Level of Service (LoS) ‘A’ during both the morning and evening commuter peak periods.

With the addition, to the projected 2026 background traffic growth, the Shepherds Bay Stages 1 through 9 and Stage A projected vehicle generations, the operational performance of the roundabout controlled intersection is reported by SIDRA modelling as an unsatisfactory LoS ‘E’ during the morning peak and LoS ‘F’ during the evening.

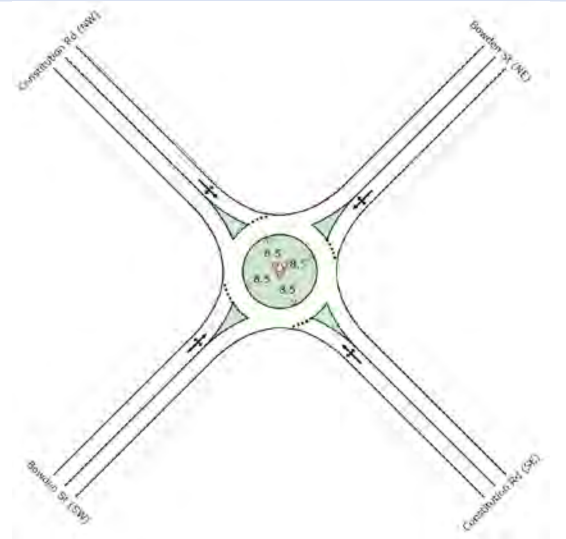
The intersection reports the possible oversaturation and 95th percentile queue lengths in excess of 700 metres, during the morning peak, in the eastbound approach of Constitution Road.

The RMS warrant, which the authority is adhereing to stringently for signalisation of the site, requires Constitution Road to realise 900vph in each direction for four (4) one (1) hour periods of a single day.

It is considered that the single lane roundabout, while providing key access to Stages 4 through 9, will fail to deliver an adequate LoS with the vehicle generations following occupancy of development Stages 6 and 7. It is considered that signals are warranted to allow satisfactory performance with development Stages 6 and 7.

The installation of traffic signal will further enhance and improve pedestrian safety at the intersection. The inroduction of marked foot crossings on each approach will create improved ‘*connectivity*’ between pedestrian paths on all approaches, which currently have only pedestrian refuges located in Bowden Street, north, and Constitution Road, west.

SIDRA INTERSECTION PERFORMANCE OUTCOMES
CONSTITUTION ROAD AND BOWDEN ROAD

Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS	0.615	0.689				
	AVG	7.5	9.8				
	LoS	A	A				

SIDRA INTERSECTION PERFORMANCE OUTCOMES
CONSTITUTION ROAD AND BOWDEN ROAD

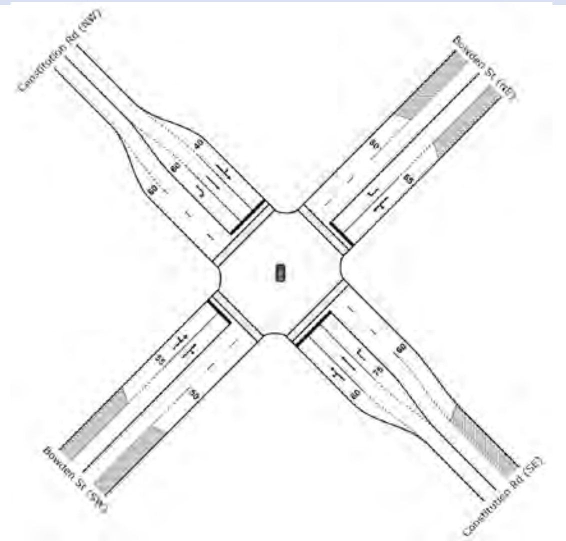
Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS			1.072	0.893	1.090	0.901
	AVG			40.6	35.1	43.0	34.8
	LoS			D	D	D	C

Figure 20 Constitution Road and Bowden Street Operational Performance
Source Road Delay Solutions, SIDRA 2018

It has been recommended that the existing single lane circulating roundabout be removed and that traffic signals be designed and installed prior to the issue of the Stage 6 Occupation Certificate.

Under the projected vehicle demands of the Stage A development, a signalised intersection is reported to perform as follows...

- *LoS 'D' during the AM peak,*
- *AM peak 95th percentile queue length of 238m in the Constitution Road eastbound approach,*
- *Los 'C in the PM peak, and*
- *PM peak 95th percentile queue length of 216m in the westbound approach.*

It is recommended that the operational performance of the site be monitored for a number of years, following the installation of traffic signals and completion of the residential component of the development, to ensure a satisfactory level of service and identification of any possible '*triggers*' for future upgrade.

Constitution Road and Belmore Street

The intersection of Constitution Road with Belmore Street currently operates at a satisfactory LoS during both the morning and evening peak commuter periods.

With the advent of Stage A and full occupation of the Shepherds Bay development, no adverse impact in operation is reported by the SIDRA modelling.

SIDRA INTERSECTION PERFORMANCE OUTCOMES
CONSTITUTION ROAD AND BELMORE STREET

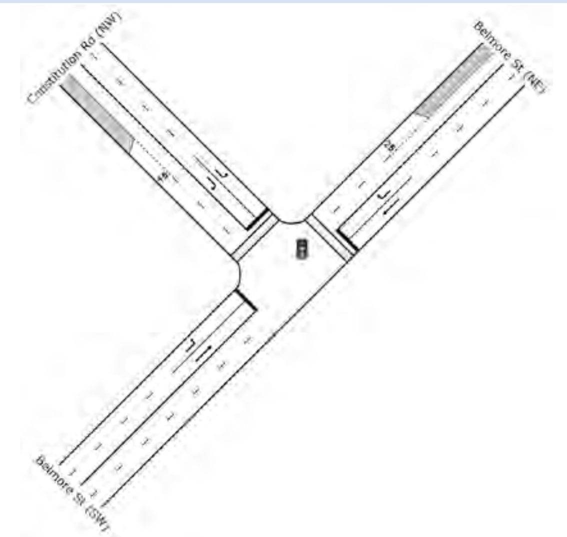
Layout	Performance Measure	2014		2026 BASE		2026 + STAGE A	
		AM	PM	AM	PM	AM	PM
	DS	0.387	0.514	0.733	0.859	0.825	0.859
	AVG	20.0	17.2	27.9	38.5	32.8	39.3
	LoS	C	B	C	D	C	D

Figure 21 Constitution Road and Belmore Street Operational Performance
Source Road Delay Solutions, SIDRA 2018

Railway Road Pedestrian Crossing

Based upon traffic counts undertaken by *R.O.A.R. Data*, and the projected vehicle generation with 100% occupation of all stages of the Shepherds Bay development, the site fails to satisfy the current *RMS* warrant for traffic signal installation and no further action is considered necessary, at this time.

The projected volume of pedestrian demand during two, typical, consecutive one-hour periods, in the morning commuter peak is 746 with the corresponding vehicle flows in Railway Road of 890 northbound and 2,330 southbound.

Extensive queuing was noted, extending to the south in Railway Road from the existing marked foot-crossing, to the railway overbridge roundabout at Bank Street.

The projected volume during two, one-hour periods, of the evening commuter peak totalled 465 with corresponding vehicle flows of 1,483 northbound and 1,532 southbound with extensive queuing noted, extending back into Constitution Road, during the evening peak.

No recent accident history has been reported at the site.

The *RMS* warrant requires the pedestrian flows to exceed 250 persons/hour for each of four (4) consecutive one (1) hour periods with conflicting vehicle flows of no less than 600vph, in each direction.

With the addition of pedestrian and vehicle generation projected from Stage A, the mid block site does not satisfy the warrant for the installation of traffic signals, at this stage. While vehicle traffic is relatively high during the two hours or each commuter peak, the traffic and pedestrian volumes drop markedly in the shoulder hour, either side of the peaks.

The site should be further monitored with future growth, following occupancy of all stages of development, to assess further, the warrant for traffic signal installation.

6 TRAFFIC MANAGEMENT SOLUTION

The management solution has been prepared to address all aspects of person mobility in and around the Stage A development site. From vehicular access to pedestrian and cyclist movements, JTW to retail operations, the recommended solution addresses the identified needs of residents, retail patrons, employees and recreational participants alike.

The limited, useable, development frontage, close proximity to a congested major arterial corridor, the demands of a burgeoning precinct accommodating significant urban renewal combined with the influence of significant cross regional traffic flow (*'rat runs'*) have posed foremidable challenges and have guided the selection of infrastructure in accordance with the *Department of Planning* publication *Development Near Rail Corridors and Busy Roads – Interim Guide*.

After analysis of the year 2026 Base and Stage A models a proposed framework of engineering treatments was formulated to sustain the projected traffic demands.

The proposed framework of infrastructure, incorporates the committed infrastructure and seeks to combine to address the needs of motorists, pedestrians and cyclists. The proposed infrastructure involves…

- → *Construction of a Pedestrian Refuge in Well Street,*
- → *Reconstruction of the left turn kerb return from Church Street into Well Street to achieve a radius of 6m,*
- → *Reconstruction of the median island at the intersection of Church Street and Well Street to allow a minimum left turn vehicular swept path of 7.5m wide. The island/median is to also extend westbound in Well Street to sufficiently prevent right turn egress from the proposed loading dock exit,*
- → *Reconstruction of the deceleration lane, northbound, in Church Street to accommodate a service entry lane to the proposed Stage A loading dock,*
- → *Construction of a pedestrian refuge in the Loop Road prior to the roundabout at Parsonage Street,*
- → *Construction of a fourth leg onto the Loop Road roundabout at Parsonage Street to facilitate egress only from the Stage A car park,*
- → *Construction of a dedicated, 3.5m wide, left turn lane facilitating access by passenger vehicle to the Stage A car park, and*
- → *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

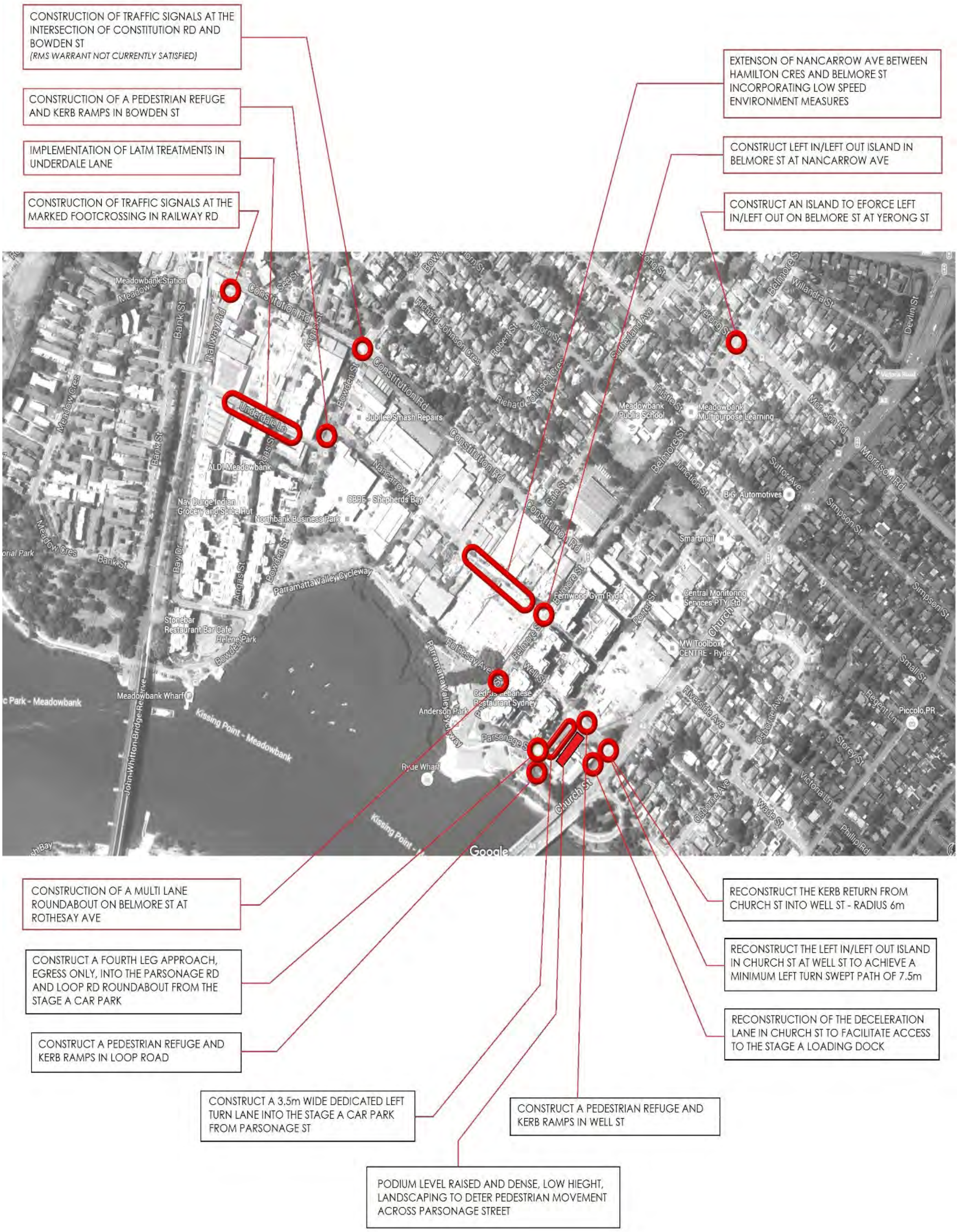


Figure 22 **Approved and Committed Infrastructure**
Source *Road Delay Solutions, 2018*

TRANSPORT DESTINATIONS

CHURCH STREET BUS STOP NORTHBOUND	120m
CHURCH STREET BUS STOP SOUTHBOUND	154m
BELMORE STREET BUS STOPS	300m
MEADOWBANK FERRY TERMINAL	240m
MEADOWBANK RAILWAY STATION	1.2km

Figure 23 **Pedestrian and Bicycle Destination Distances**
Source *Road Delay Solutions, 2018*

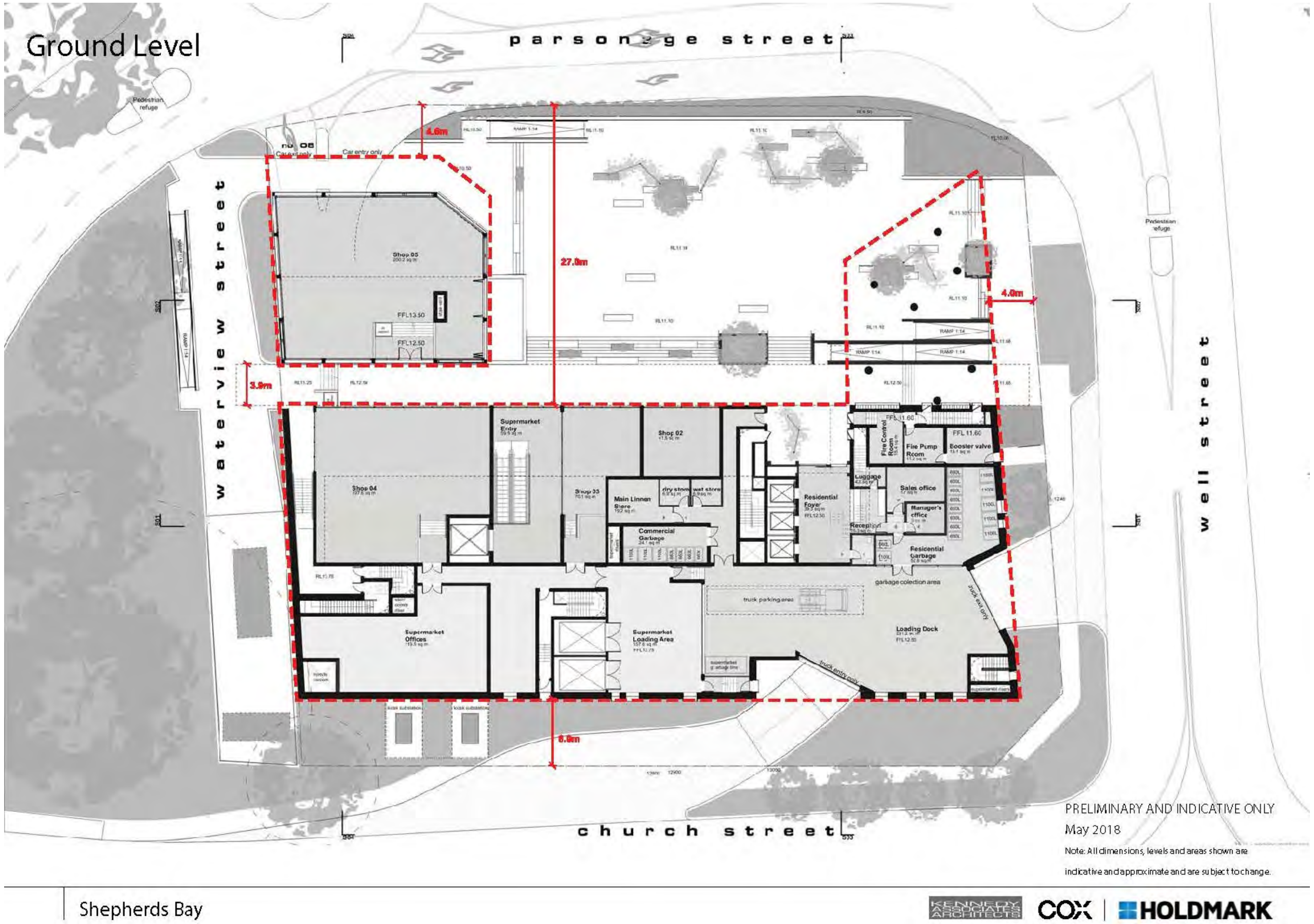


Figure 24 **Proposed Traffic Management in Context**

Source *COX, 2018*

APPROVAL ITEM NO.	COMMITTED INFRASTRUCTURE
24	**NANCARROW ROAD EXTENSION AND ROAD RESERVE UPGRADES (Stage 4)** *- Nancarrow Avenue extension,* *- Nancarrow Avenue Local Area Traffic Management (LATM) measures and all road reserve upgrades including associated pedestrian footpaths and bicycle ways, and* *- Implementation of a left-in/left-out arrangement at Belmore Street/Hamilton Crescent intersection* ***(The design is to be completed prior to the issue of the Stage 1 occupancy certificate and construction is to be completed prior to Stage 4)***
24A	**ROAD AND PEDESTRIAN INFRASTRUCTURE UPGRADES (Stages 2/3)** *(a) Installation of a temporary east/west pedestrian link, which connects the stairway at the northern end of the foreshore link between Stages 1, 2 and 3. The pedestrian link shall provide access to the public on a 24 hour basis and maintained until the provision of the Nancarrow Avenue extension.* *(b) Underdale Lane Local Area Traffic Management (LATM) measures;* *(c) Installation of a pedestrian refuge at Bowden Street / Nancarrow Avenue, and* *(d) Installation of roundabout at Belmore Street / Rothesay Avenue.* ***(Design to be completed prior to Stage 2 and construction completed prior to the issue of the Stage 2 occupancy certificate)***
25	**YERONG STREET / BELMORE STREET INTERSECTION UPGRADE (Stage 4)** *- The implementation of left-in/left-out arrangement at Belmore Street intersection with Yerong Street.* *(Design and construction to be completed prior to DA for stage 4)*
26	**ROADS AND MARITIME SERVICES REQUIREMENTS (*SEE ALSO 11.2*)** *- Investigation of warrants pertaining to the installation of traffic signals on Railway Road with the pedestrian crossing at Meadowbank Railway Station, and* *-The installation of traffic signals at the intersection of Constitution Road with Bowden Street.* ***(Where the study reveals that RMS warrants would be met for the provision of signals at either of these locations, concept design of the upgrade of the intersection to Council's and RMS's satisfaction is to be included with the DA and the works are to be completed by the proponent prior to the issue of first occupation certificate of any building of that stage)***
11.1	**PEDESTRIAN SIGNALS ON RAILWAY ROAD AT MEADOWBANK RAILWAY STATION** *- Installation of traffic signals* *- Advance warning signs* *- Lighting adjustments* *- Pavement re-sheets – 20mm AC10*
11.2	**SIGNALLING AT BOWDEN STREET AND CONSTITUTION ROAD** *- Removal of existing roundabout* *- Kerb alignment* *- Pavement construction and revitalisation* *- Utility adjustments incl. lighting* *- Installation of traffic signals* *- Pavement markings* *- Signposting* *- Footway modifications*
11.3	**ROUNDABOUT AT ROTHESAY AVENUE/BELMORE STREET** *- Removal of existing signposting* *- Central island dowelled to existing pavement – Inscribed radius min. 8m (dependent upon the turning path of a 12.5m service vehicle)* *- Single lane circulating* *- Splitter island in each approach (painted or raised kerb)* *- Significant kerb realignment* *- Drainage adjustments* *- Utility modification* *- Signage* *- Pavement markings* *- Intersection pavement re-sheet – 20mm AC 10*
11.4	**YERONG STREET AND BELMORE STREET LEFT IN/OUT** *- Removal of southern most splitter island in Belmore Street, south of Yerong Street* *- Removal of existing signposting* *- Installation of painted or raised splitter island in Yerong Street (dowel to existing pavement if raised)* *- Installation of signposting* *- Preparation and pavement re-sheet - 20mm AC 10* *- Pavement markings*

11.5	**HAMILTON "LANE" AND NANCARROW "LANE" LATM AND TWO-WAY CONSTRUCTION BETWEEN BELMORE AND BOWDEN** *- Installation of raised Watts profile speed humps or raised thresholds* *- Single lane circulating roundabout* *- Inscribed radius capable of accommodating the swept path movement of a 12.5m service vehicle* *- Painted splitter island in each approach* *- Kerb realignment* *- Drainage adjustments* *- Utility modification* *- Signage* *- Pavement markings*
11.6	**UNDERDALE LANE LATM SCHEME** *- Installation of two (2) raised "Watts" profile speed bumps* *- Kerb realignment* *- Drainage adjustments* *- Signage* *- Pavement markings Pavement markings*
11.7	**HAMILTON LANE/BELMORE STREET LEFT IN/OUT** *- Installation of painted or raised splitter island in Hamilton Crescent (dowelled to existing pavement if raised)* *- Installation of signposting* *- Pavement markings*
11.8	**INTRODUCTION OF A PEDESTRIAN FACILITY ON BOWDEN STREET AT UNDERDALE LANE** *- Construction of a raised threshold and marked foot crossing*
12	**LAND TO BE DEDICATED** *Land comprising the two-way road link to be constructed between Belmore and Bowden Streets, being the connection of Nancarrow Avenue to Hamilton Crescent to be dedicated to Council. This requires the dedication, by the proponent, of an area of land of approximately 325m² to the council.*
STAGE A IDENTIFIER	**STAGE A APPROVED MOD 2 INFRASTRUCTURE**
1A	**CONSTRUCTION OF A PEDESTRIAN REFUGE ON WELL STREET** - *Construction of a 150mm high concrete pedestrian refuge 127m to the west of Church Street* - *Construction of kerb ramps to facilitate crossing point*
2A	**RECONSTRUCTION OF THE LEFT TURN KERB RETURN IN WELL STREET AT CHURCH STREEET** - *Reconstruction of kerb return in the left turn slip lane from the Church Street deceleration lane into Well Street – Radius 6m*
3A	**RECONSTRUCTION OF THE MEDIAN ISLAND ON CHURCH STREET AT WELL STREET** - *Reconstruction of the island in the Church Street deceleration lane into Well Street to achieve a minimum 7m wide carriageway* - *Incorporation of a 900mm wide central median in Well Street to prohibit right turn movements from the Stage A loading dock*
4A	**CONSTRUCTION OF A SERVICE DRIVEWAY IN CHURCH STREET** - *Construction of a 5.2m wide driveway between the Church Street deceleration lane to the loading dock*
5A	**CONSTRUCTION OF A PEDESTRIAN REFUGE IN THE LOOP ROAD AT PARSONAGE STREET** - *Installation of a 150mm high raised concrete pedestrian refuge* - *Installation of kerb ramps to facilitate the crossing points*
6A	**CONSTRUCTION OF A FOURTH LEG TO THE LOOP ROAD ROUNDABOUT** - *Construction of a single lane approach from the Stage A car park onto the Loop Road roundabout* - *Construction of a single lane entry to the Stage A car park, devoid of aceess from the roundabout* - *Construction of a raised island to prevent entry to the Stage A car park from the roundabout* - *Installation of appropriate signposting*
7A	**CONSTRUCTION OF A DEDICATED LEFT TURN LANE IN PARSONAGE STREET SOUTHBOUND** - *Construction of a 3.5m wide single lane entry to the Stage A car park* - *Reconstruction of the eastern kerb line in Parsonage Street* - *Installation of pavement markings* - *Installation of signposting*
8A	**PARSONAGE ROAD PEDESTRIAN TREATMENT** - *Raising of the Stage A podium level fronting Parsonage Street, and employing dense, low height plantings between the kerb and the podium face*

Table 9 **Committed and Approved Stage A Infrastructure**
Source *Road Delay Solutions, 2018*

Passenger Vehicle Access

Determination of the site access has proven problematic with limited ingress and egress opportunity after consideration of four (4) critical factors…

1. *Church Street is an arterial road under the control of the RMS and currently exhibits particularly significant congestion northbound during the morning and evening peak commuter periods. As such, The RMS is reticent to allow potential access from Church Street which may further exacerbate the traffic conditions and pose a potential safety hazard.*
2. *The relatively higher surface levels of The Loop Road carriageway to those of the development and the presence of historical machinery associated with the Ryde Bridge, located on the parcel of land to the south of the site, prevent the construction of a viable entry ramp to meet with the level of the basement carpark slab.*
3. *The short length of Well Street (some 40m) and the potential for a queue formed from vehicles entering the site spilling back onto Church Street, negates the opportunity for access from Well Street.*
4. *The strict confines of the Design Award Process have limited the opportunity for potential access locations. The passenger vehicle access must conform with the design form rather than dictate. The nominated access has been chosen to seemlessly amalgamate with the building structure.*

Therefore, Parsonage Street was considered the optimum location for passenger vehicle access. Through the employment of a dedicated left turn lane onto the site, storage capacity and queue management could be achieved.

A dedicated left turn lane of some 48m long provides for approximately 8 vehicles, this combined with the anticipated 2026 southbound 95th percentile queue length in Porter Street of 40m, would suggest that sufficient storage distance can generally be achieved during the evening peak commuter period.

The 7:30am - 8:30am morning commuter peak is not considered to be the critical given the retail activities, with the exception of Woolworths (7am-8am opening time), would generally commence to trade from 8:30am.

The proposed Parsonage Street access is to incorporate a '*sheltered*' entry from the southbound dedicated lane only. No ingress to the site is proposed from the roundabout on Parsonage Street at The Loop Road. This is to be reinforced by the use of a raised concrete median/island and hazard signposting, serving as a physical barrier to vehicular entry from the roundabout.

Sensitivity modelling suggests that vehicles entering the site from the roundabout would, with priority over southbound vehicles in Porter Street, increase the reported 95th percentile queue length to some 200m, which would regularly spill back onto Church Street.

Egress from the site is proposed at the roundabout as this will afford southbound vehicles in Porter Street priority and not have a detrimental effect on queueing. Vehicles entering the site from the west may do so from…

- → *Porter Street, north of Well Street, or*
- → *Enter Porter Street from Parsonage Street, at The Loop Road, travel north and perform a 'U'-Turn at the Well Street roundabout.*

The mesoscopic modelling reported only 5vph performing the latter 'U'-Turn manoeuvre.

Simillarly, motorists from the north entering from The Loop Road, can turn into Porter Street and perform a 'U'-Turn at Well Street. The modelling again indicates only 2vph performing this manoeuvre.

The passenger vehicle entry is a proposed 6.6m wide driveway comprising 3m wide ingress and egress laneways being separated by a 0.6m wide median, connecting with the roundabout at the intersection of Loop Road at Parsonage Street. The driveways will permit access to the proposed passenger vehicle parking provision within the basement levels on the site.

Figure 25 **Passenger Vehicle Entry – Parsonage Street**
Source *COX, 2017*

Service and Heavy Vehicle Access

Service and heavy vehicle entry is proposed from the deceleration lane on Church Street, immediately south of the Well Street intersection. The access provides for the entry of garbage services, emergency vehicles and retail deliveries. The access has been designed to accommodate up to 19m articulated vehicles and should pose no significant impedence to arterial traffic flow on Church Street.

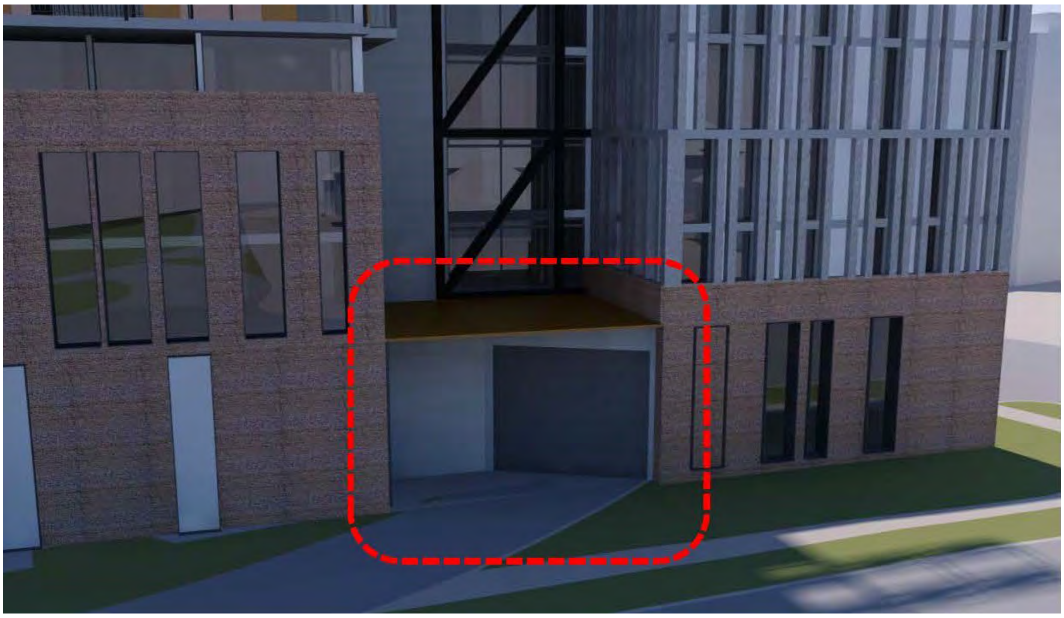


Figure 26 **Loading Dock Entry – Church Street**
Source *COX, 2017*

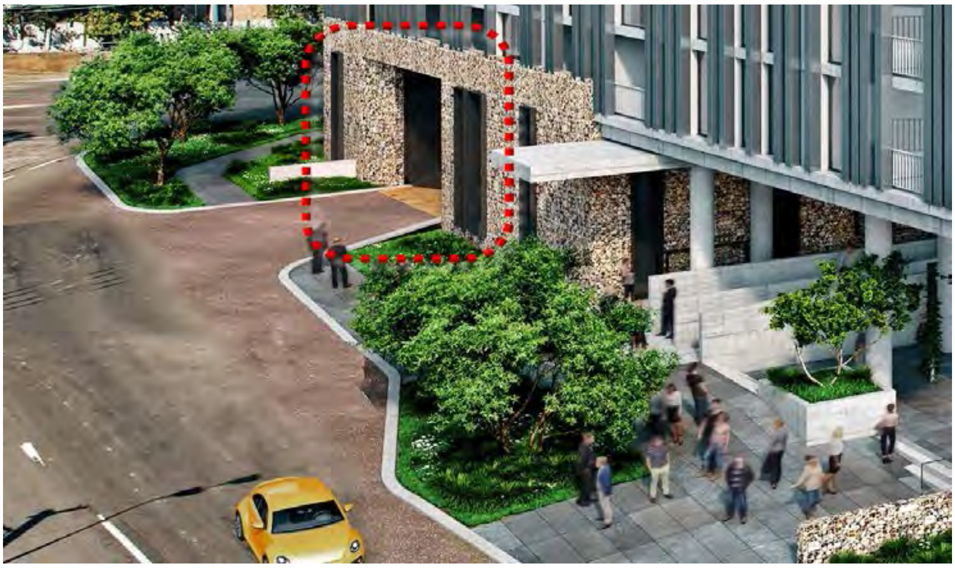


Figure 27 **Loading Dock Exit – Well Street**
Source *COX, 2017*

7 LOADING DOCK MANAGEMENT PLAN

Managing loading dock operations is critical in ensuring the workplace is without risks to health and safety. Vehicles including powered mobile plant moving in and around the hardstand area, reversing, loading and unloading can cause serious injury.

This Loading Dock Management Plan (LDMP) has been prepared by Road Delay Solutions as a guide outlining the procedures and conditions to be considered within the loading dock hardstand area associated with Stage A of the Shepherds Bay Urban Renewal.

The operational procedures are a critical component of the LDMP. The procedural requirements commence with the driver's approach to the site and continue until such time as they leave.

An efficient operation, of which the LDMP is a part, permits companies to avoid delays, minimise accidents, prevent product damage, meet timeframes and ultimately, satisfy customer demands and expectations.

Optimum operational procedures can only exist if the loading dock is properly designed, operated and maintained. With effective loading dock processes, companies can realise significant gains in productivity, energy efficiency, and safety, while cutting costs.

Information contained in this document is relevant to all individuals accessing the loading dock.

As the Stage A loading dock will serve numerous operators from the supermarket to the specialty shops, Café to the residential waste management, each operator, hereby named the *'Tenant'* will be responsible to ensure that the policies and procedures, as outlined, are observed and performed by all people within their respective organisations. This includes principal contractors, drivers, service personnel and other agents involved in the daily operation of the facility.

The retail and waste management operations are currently speculative but each *Tenant* must adhere to following guidelines.

Legal Obligations

Generally, it can be stated that everyone actively employed within the boundaries of the loading dock has a work health and safety duty.

The following outline these obligations and duties under law as they pertain to the *Tenant* and senior or delegated staff members.

The Tenant

The *Tenant* will be directly responsible for all the traffic management and material handling operations associated with the site.

Specifically, ensuring that the traffic management is executed in a way that will accommodate the differing vehicle classes and their movement to and from the loading dock.

The *Tenant* must ensure, so far as is reasonably practicable, that workers and other person are not exposed to health and safety risks arising from the daily operation of the business or undertaking.

The *Tenant* must further ensure, so far as is reasonably practicable, adequate provision has been made to permit staff, contractors, service personnel and the public the ability to enter and exit the site without risk to health and/or safety.

The *Tenant* and loading dock management staff must ensure mobile powered plant does not coincide with pedestrians or other powered mobile plant.

If there is a possibility of conflict, the plant must be fitted with a warning device alerting persons who may be at risk from its movement.

It is each *Tenant's* moral obligation to inform staff, agents and/or contractors of any commonly known local road issues pertaining to the surrounding precinct which might prove beneficial in the operation of vehicles accessing the site.

When managing traffic flow each *Tenant* must consider the appropriate action(s) to be set in place, prior to operations, to eliminate or reduce the incidence of vehicular and pedestrian conflicts.

These considerations include, but are not limited to…

- *Movements within the dock and access driveways,*
- *Pedestrian site access,*
- *During loading dock operations – peak traffic scheduling versus non-peak times,*
- *Emergency vehicle access and egress, including fire service, ambulance, and police,*
- *Any appropriate pavement marking(s) for loading area adherence and layover provision,*
- *Emergency evacuation procedures,*
- *Communication, and*
- *Waste management, and the clear delineation as to the location and presence of any permanent compactors, skip bins, or equivalent.*

Senior Staff Members

Directors and managers have a duty to exercise due diligence to ensure the business or undertaking complies with the Work Health and Safety (WHS) Act and Regulations.

This includes taking reasonable steps to ensure the business or undertaking has and uses appropriate resources and processes to eliminate or minimise risks from traffic at the workplace.

Communication

A clear line of communication is to be maintained between each *Tenant* and/or designated staff, contractors and service personnel utilising the loading dock.

It is beneficial that the *Tenants* set in place a regular line of communication to manage delivery scheduling and general loading dock operations and activities to avoid conflicts which might arise from competing arrival times.

Access Conditions

The loading dock entry is to be from the deceleration lane on Church Street. Northbound motorists leaving the Ryde Bridge, move left into the deceleration lane prior to Well Street and then proceed into the driveway to the loading dock.

The dock entry will be secured by an electronically operated roller door which must remain open during operational hours. The door will only be closed when no scheduled deliveries are pending.

Exit from the dock is onto Well Street with all drivers directed to turn left. This manouevre will allow, northbound, eastbound and westbound vehicles to utlise Parsonage Street, then Belmore Street or Constitution Avenue. Vehicles travelling south will exit onto Well Street and make their way to the Loop Road enabling them to travel south over the Ryde Bridge.

All drivers must be aware of their vehicle class, height and wieght when utilising the local roads through the precinct with respect to their legal obligations under the Motor Traffic Act.

Loading Dock Management

Each *Tenant* may delegate the safe operation of the loading dock to a suitably qualified and/or experienced staff member, hereby referred to as the Dock Manager (DM).

Each *Tenant* and nominated DM is responsible for…

- → *The effective management of service vehicle delivery and operational outcomes within the site, pertaining to the loading dock, stock rooms and waste retention areas,*
- → *The efficient unloading of all deliveries, waste and recycling pickups,*
- → *The coordination and clear understanding of delivery schedules from direct suppliers and distribution centres,*
- → *Effective coordination/communication with each of the other Tenants to ensure coincidental arrivals do not occur,*
- → *The education of drivers and/or suppliers as to appropriate delivery routes to and from the dock, with particular attention to the legal obligations by vehicle class,*
- → *The assurrance that all deliveries, in particular the supermarket, are rostered in two hour intervals to allow for unloading and egress,*
- → *No queueing of delivery vehicles entering the loading dock will be permitted. The Tenant must ensure any vehicle approaching the loading dock is directed to delay entry until such time as the dock entry is clear to access, and*
- → *All entries and exits will be performed in a forward direction only.*

Any transgression or violation contravening the above conditions may be logged by any *Tenant* and relayed to both the building supervisor, in a timely fashion.

Loading Dock Operating Hours

Given the retail operations for Stage A are speculative at this time, no operating hours can be confirmed.

At this time, the operating hours are estimated to be 6am till 11pm, Monday to Sunday. Any change to these hours must be immediately relayed to Holdmark for correction. Highly visible signs will be erected within and outside the loading dock advising the dock operating times.

The electronic roller shutters at the entry and exit will remain open during operating hours. During all other times the roller shutters will be closed (see Security).

Waste and recycling collections for each Tenant must be actioned within the operating hours.

The loading dock roller shutter will be closed outside of these hours.

Vehicle Movements

The respective *Tenants* are responsible for their specific loading dock operations.

All vehicle drivers entering the loading dock must…

- → *Enter the loading dock in a forward direction only from the northbound deceleration lane on Church Street,*
- → *Exit the loading dock in a forward direction only onto Well Street and left turn only towards Parsonage Street,*
- → *Enter the loading dock at an appropriate speed (10kmh) commendurate with the surrounding environment,*
- → *Enter the loading dock only if the dock area is clear and free of obstruction or there is sufficient space to completely traverse the footway area on Chuch Street,*
- → *Not queue in the driveway before entering the loading dock,*
- → *Ensure all loading and unloading procedures occur soley within the designated loading dock area,*
- → *Ensure no goods are loaded or unloaded on the roads surrounding the site,*
- → *Leave the loading dock immediately after all goods have been delivered,*
- → *Not park or leave delivery vehicles within the loading dock area outside of the prescribed operating hours, and*
- → *Adhere to all directions made by the respective Tenant and/or DM.*

Each driver and/or delivery provider will be issued with a Driver Direction Sheet outlining the following…

1. *You must arrive within your allotted delivery time window. Be punctual or advise the respective DM of any change.*
2. *Enter and exit the dock in a forward direction.*

3. *The maximum vehicle length permitted within the loading dock is 14m.*
4. *Do not attempt arrival before 6am on any day.*
5. *Do not wait, queue or park on the surrounding local streets.*
6. *Do not attempt unloading and delivery of manifest from the surrounding local streets. Your actions will be actionable by your supervisors and further deliveries by your company may be jeopardised.*
7. *Deactivate any radio and/or music media systems when entering the dock.*
8. *Do not leave your vehicle unattended while in the loading dock.*
9. *Adhere to all directions made by the DM.*
10. *All vehicles must be offsite by 11pm daily.*
11. *Any breaches of these conditions may result in a site ban.*

The supermarket operations may have up to 10 trucks (Class 5 - 14m rigid trucks) and up to 20 direct suppliers/vendors arrivals per day during periods of high turn over, such as at Christmas and Easter.

Typically, arrivals will be fewer, each day, outside of the busy trading peaks. One (1) supermarket delivery by 14m rigid truck and one (1) smaller vehicle by direct supplier, may occur during the peak AM and PM commuter traffic periods. The remaining retail outlets and Café are anticipated generate, at most, three (3) arivals (estimated maximum vehicle size Class 3 - 4 tonne pantechs) during the commuter peak periods.

A maximum of five (5) arrivals in an hour are anticipated at the loading dock during the morning and evenng peak traffic periods.

No queueing of vehicles in the loading dock driveway, prior to entering the loading dock, will be permitted. Delivery scheduling is the sole responsibility of each *Tenant* and it must be maintained that schedules for competing usage of the dock must allow sufficient time to deliver and clear the dock.

The 14m rigid trucks are to unload from the rear, after reversing to the flush dock located on the southern wall of the loading dock area.

Smaller, vehicles must have a designated loading/unloading areas within the loading dock. This area may be defined by pavement parking or symbol. These smaller delivery or service vehicles must park within their designated areas and leave the loading dock area via the Well Street exit upon completion.

A designated emergency vehicle space must be clearly defined, within the loading dock, by pavement marking, sign or symbol. This space must remain free of obstruction and be available at all times, with the exception of emergency use.

Lighting

The loading dock, arrival and departure areas must be well lit during the hours of operation. The maintenance of all lighting will be the responsibility of the building supervisor.

It is the responsibility of each *Tenant* or delegated staff member to notify the building services manager of any failure in the lighting system.

Security

The loading dock will be secured by use of an electronic roller shutter at both the entry on Church Street and exit on Well Street outside of the stated operating hours.

Access to the loading dock outside the normal operating hours will be logged electronically by the entry system and will be made available to each *Tenant* to undertake the appropriate action, as deemed necessary.

Should access be required outside the normal operating hours, each *Tenant* must be notified in writing and permission sought for any such action.

If entry is granted outside of the normal operating hours, all responsibility will be on the *Tenant* or delegated staff to ensure no unauthorised entry. Upon leaving, the roller shutters are to be closed.

Cleaning and Maintenance

It is the responsibility of each *Tenant*, upon finalising delivery, to ensure the loading dock area is clean and free of obstruction.

Any maintenance issues must be logged and reported to the building supervisor for rectification.

High Visibility Clothing

All persons moving or working within the loading dock are required at all times to wear a high-visibility jacket in order to minimise risks associated with plant and/or vehicle movements.

This clothing can be in the form of high-visibility vests and must meet the requirements of AS/ NZS 4602.1. Specifically, it is the *Tenant's* responsibility to ensure that high-visibility clothing is worn at all times within the loading dock.

With one exception, the above requirements must be observed by the *Tenant's* staff, contractors and service personnel. Entries by the general public, whether by vehicle or foot are exempt.

Six (6) high visibility jackets, conforming to Australian and New Zealand Standards, must be situated in a convenient location within the loading dock for use by any *Tenant* or delegated staff.

Smoking Zones

Smoking is only to be permitted within any designated smoking areas and not within 4m of the loading zone or any materials being handled.

Work place safety is not only crutial ensuring the health of persons utilising the warehouse facility but equally important to the economic viability of operations.

For further information and guidelines regarding Risk Management and Codes of Practice please reference the following...

safe work australia

Safe Work Australia Contact Information
Phone 1300 551 832 | Email info@swa.gov.au | Web www.swa.gov.au

WORKCOVER NSW WorkCover NSW www.workcover.nsw.gov.au

8 PUBLIC TRANSPORT

The Metropolitan Strategy, under the auspices of '*Draft SEPP 66 – Integration of Land Use and Transport*', prescribes guiding provisions that aim to ensure the urban structure, building forms, land use locations, development design, subdivision and street layouts to help achieve the following planning objectives...

- *Improving accessibility to housing, employment and services by walking, bicycling and public transport,*
- *Improving the choice of transport and reducing the dependancy on private vehicle usage,*
- *Moderating growth in the demand for travel and the distances travelled, especially by car,*
- *Support the efficient and viable operation of public transport services, and*
- *Providing for the efficient movement of freight.*

The provision seeks to influence mode choice made by both community and business.

The State Government's has invested in 300 new buses across the state, which has resulted in 400 new jobs for bus drivers and 150 jobs in bus construction.

Rail

Meadowbank Railway Station is located near the corner of Railway Road and Constitution Road, some 1.2km from the development. The railway station is approximately 13.5 minutes walk utilising the Underdale Lane pedestrian link from Nancarrow Avenue. This time extends to 15-16 minutes when travelling on Constitution Road.

The railway station is located on the Northern Line, approximately mid-way between Strathfield and Hornsby Railway Stations. The Northern Line operates on a loop comprising Hornsby, the City Circle and Strathfield, via the Epping-Chatswood rail link.

Weekday train services operate every 15 minutes during weekday commuter peak periods, and every 30 minutes outside peak periods. Weekend services also operate every 30 minutes.

Figure 28 **Meadowbank Railway Station Entry Promenade**
Source *Google Street View, 2017*

Meadowbank Railway Station is located four stops south of Epping Station, a major bus rail interchange with connecting rail services to the City via Macquarie University, Chatswood and North Sydney, and connecting bus services to the Hills District.

To the south Meadowbank Railway Station is located four stops from Strathfield Station, a major bus rail interchange with connections to the North Shore and Western Line, the South Line (to Campbelltown), the Inner West Line between the City Circle and Liverpool, as well as most intercity rail services (ie. to Newcastle, Lithgow and Southern Highlands).

Buses

Bus services through the *MEA* are operated by *Sydney* Buses with weekday services operating every 30 minutes and additional services during the commuter peak periods.

Weekend services generally operate every 60 minutes. Bus stops are located at regular intervals along both sides of Bowden Street and Constitution Road, as well as along Church Street and Victoria Road.

While rail provision is some 1.2km from the Stage A development site, frequent bus services are readily available on Church Street and Belmore Street providing access to the principle centres such as Sydney CBD, Parramatta CBD, Macquarie Park and Strathfield and Chatswood. It is considered that buses will afford residents of Stage A convenient public transport opportunity and the best chance to reduce dependancy on private vehicle usage.

Route No.	Nearest Bus Stop	Service Route
507	Constitution Road	Meadowbank Station to Sydney CBD & Macquarie University
513	Bowden Street	Meadowbank Wharf to Carlingford Court
533	Church Street	Chatswood to Olympic Park
458	Church Street	Burwood Station to Top Ryde
459	Church Street	Strathfield Station to Macquarie University
534	Victoria Road	West Ryde Station to Chatswood Station
520	Victoria Road	Parramatta Station to Sydney CBD
524	Victoria Road	Parramatta Station to Top Ryde

Table 10 **Bus Services**
Source *Transport NSW, 2018*

Ferry

Current ferry services during the morning commuter peak, stopping at the Meadowbank wharf, exhibit a spare capacity of some 20 -30 passengers over the hour.

To promote this transport mode, residents will be directed to the www.Transportnsw.info web site to plan their trip and how they can utilise the complimentary Opal Card provided in the '*Welcome Pack*'.

It will be promoted by the Body Corporate/Corporate Executive at the AGMs that ferries provide a relaxing means of travel for both recreational and JTW trips. Given the close proximity of the Meadowbank Ferry Wharf, the transport mode is a viable and efficient means to travel.

Operator	Mode	Key	Route Name	Frequency	
NSW Transport Sydney Ferries			Parramatta River Ferry	1-2 per hour	Every Day
Operator	Mode	Key	Route Name	Frequency	

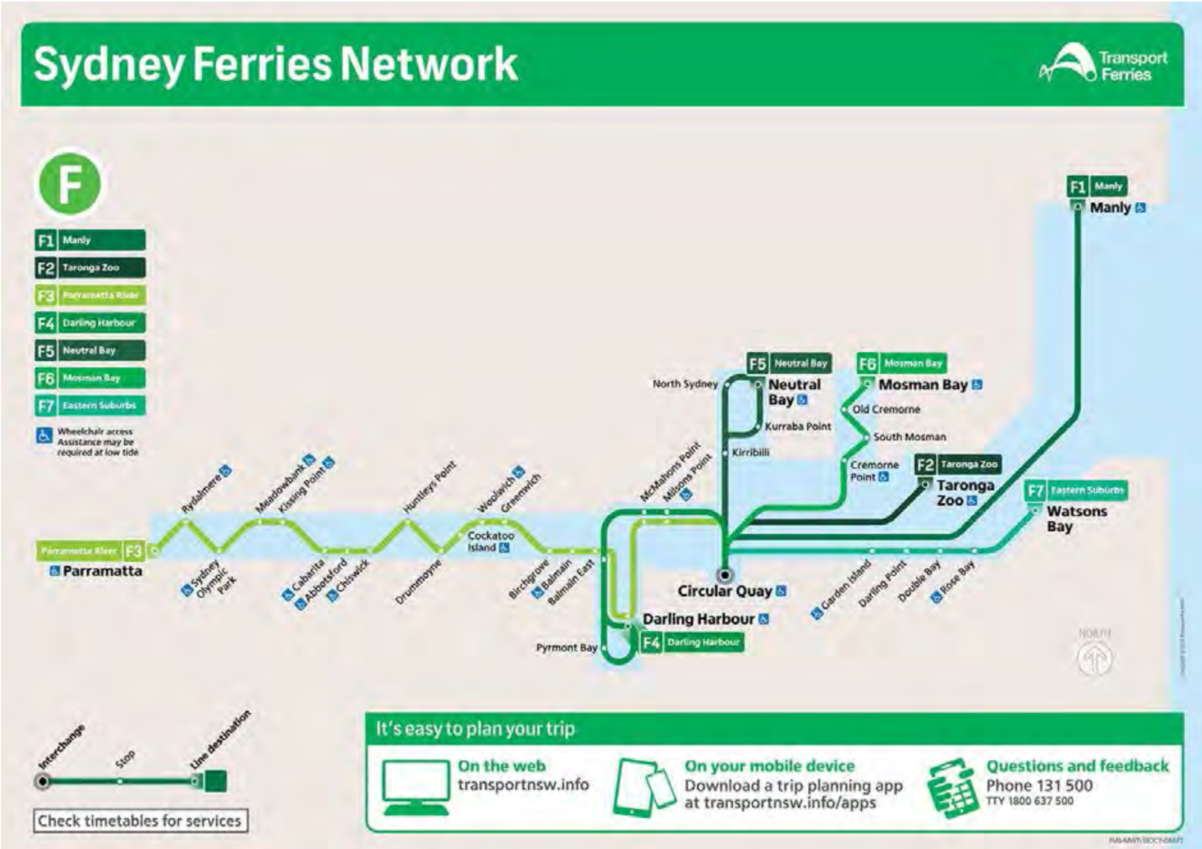


Figure 29 **Sydney Ferries Network**

Source *Transport NSW, 2018*

9 PEDESTRIAN AND BICYCLE PLAN

Planning to enable pedestrians, bicyclists, and motorists to travel safely and conveniently is a balancing placing a high priority on planning methods and policies that favor alternative modes of travel.

There are a number of cycleways and shared pedestrian paths providing convenient access to and from the Shepherds Bay development for those residents who do not wish to drive or use public transport for JTW and recreational activities.

Bicycle parking facilities are to be provided at the rate of one (1) bicycle space per eight (8) residential apartments.

Studies have shown that in Sydney, over 50% of trips are less than 5km. Such trips are ideally suited to walking or cycling.

The nearby, shared, off-road pedestrian and cycleway path which is located along the foreshore continues towards the west to Parramatta and towards the east to the City, using a combination of on and off-road cycleways and pedestrian paths.

An on-road cycleway connects with the foreshore shared pedestrian and cycleway path and follows a generally north-south alignment along Bowden Street and Angus Street to connect with West Ryde Railway Station and other on-road cycleways which extend further to the north. A shared pedestrian and cycleway path also extends southward across Ryde Bridge to the Rhodes peninsula where it connects to other on and off-road cycleways that extend to the south to Concord and Olympic Park.

The Shepherds Bay development will enhance the options available to residents for walking and cycling through the provision of three (3) new east-west cycle links between Bowden Street and Belmore Road. The improved permeability for pedestrians and cyclists offered by these links will provide more direct links for the majorty of residents, including Stage A, when walking or cycling to nearby facilities such as the local primary school, TAFE College, local shops and railway station.

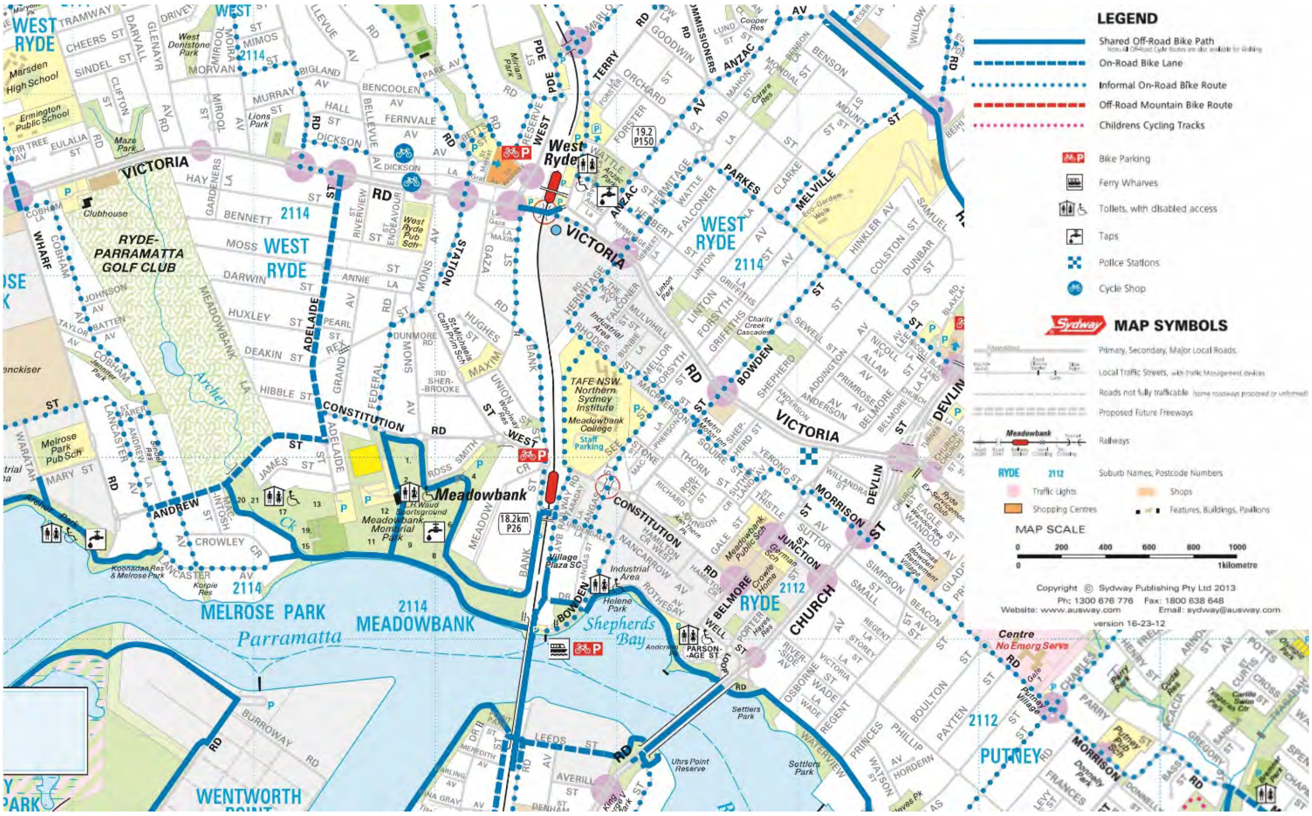


Figure 30 **Bicycle Path Network Ryde**
Source *Ryde City Council, 2018*

Improved pedestrian links will be provided along all east-west and north-south road links, with additional mid-block pedestrian links to be provided generally following a north-south alignment. The improved pedestrian links will significantly enhance the accessibility to bus services for residents.

Travel surveys have shown the median walk distance to a bus stop in heavily built up areas of Sydney and Melbourne is some 500 metres, with only 25% electing to walk more than 800 metres. The data suggests that a small percentage of train travellers may infrequently elect to walk more than 800 metres if the prevailing pedestrian environment is condusive.

This may offer some relief from commuter traffic generation associated with Stage A but it is considered negliable in this instance. The distance of 1.2km between the site and Meadowbank Railway Station will invariably deter pedestrians from walking to the station.

The *BTS* report bicycle to train, as a two mode JTW travel trip throughout the metro Area is slowly on the increase. If bicycle parking provisions were to cater for a greater number at Meadowbank Railway Station, it is not unforseeable that a small number of residents may choose to ride to the station as part of their JTW trip.

Proposed Pedestrian and Bicycle Infrastructure

The preparation of the pedestrian and bicycle management plan endeavoured to establish a framework of measures to provide safe and efficient connectivity between the site and adjoining facilities.

To promote pedestrian and bicycle access to Stage A, three (3) significant treatments are proposed…

- *Construction of a pedestrian refuge and kerb ramps in Well Street, some 127m west of Church Street,*
- *Construction of a pedestrian refuge and kerb ramps in the Loop Road, to the immediate east of the Parsonage Street roundabout, and*
- *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

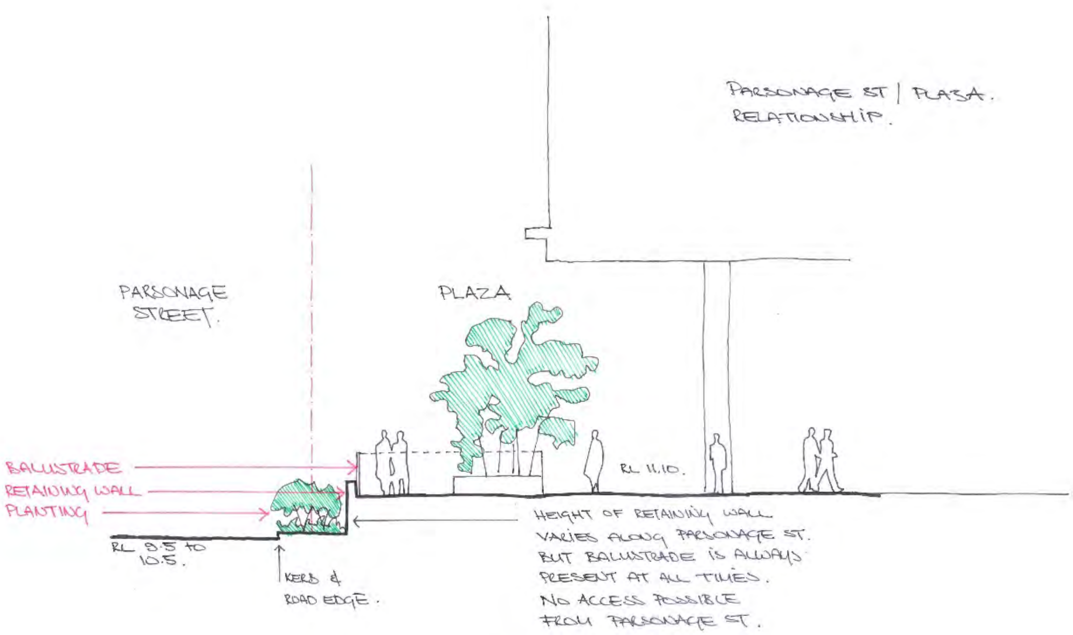


Figure 31 **Podium Treatment**
Source *Cox/Kennedy, 2018*

Projected vehicular traffic volumes in Well Street and Parsonage Street proved prohibitive to the introduction of a marked foot crossing. The width of Parsonage Street and a subsequent walking time of some 1.5m per second would incur significant delay to vehicles and pose the threat of causing queue lengths for southbound motorists extending back onto Church Street.

The pedestrian refuge proposed in Well Street will predominently service the residential community to the north of the site.

The Loop Road pedestrian refuge will provide the majority of pedestrians from the west and foreshore areas access to the site. The location was selected given the lower volume of vehicular traffic on the Loop Road and the close proximity to the foreshore shared path.

The installation of traffic signals replacing the Loop Road roundabout were considered as the best and safest option for pedestrian movements.

Three (3) signifcant issues were raised during the assessment of traffic signals at the Loop Road intersection with Parsonage Street…

- → *SIDRA modelling indicated significant queues, in excess of 200m in the Parsonage Street approach, southbound,*
- → *The right turn movement from the Loop Road would need to be banned, and*
- → *The RMS warrant for traffic signals could not be met.*

To efectively install traffic signals, the site would require significant reconstruction to generally, facilitate two (2) lane approaches, as shown in the following figure. Banning of the right turn movement from the Loop Road would hinder access to Stage A by sending motorists into Belmore Street and back down Porter Street. This would impact the introduction of the proposed dedicated left turn lane to the Stage A car park and necessitate a significant dedication of land from the site which would adversly affect the development FSR.

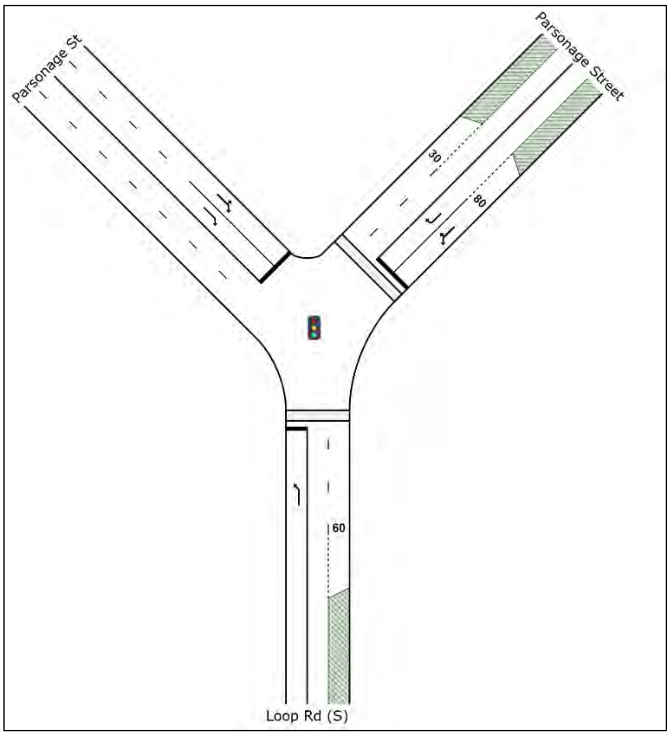


Figure 32 Considered Traffic Signals – Parsonage Street and Loop Road
Source Road Deay Solutions, 2018

The modelling undertaken for the assessed traffic signals adopted a conservative pedestrian demand on each approach of 100 persons per hour. This is considered excessive, particularly during the AM peak commuter period but with the exception of the inherent delays to vehicle traffic, resulted in a pedestrian level of service ‘B’ on all approaches.

It is considered that the JTW pedestrian demand from Stage A, given the distance to the Meadowbank Railway Station, will be relatively low. The dominent pedestrian demand will be for the retail operations and the Café.

It was for the above reasons the possible installation of traffic signals at the intersection of Parsonage Street and The Loop Road was dismissed, at this time.

The proposed treatments under this application were based on the pedestrian demand peaks occuring outside the commuter peak periods with maximum demand anticipated during recreational activities, on weekends.

The modification of the kerb return from Church Street into Well Street should reduce the speed of vehicles entring the precinct and provide sufficient vehicular gaps during off peak periods to allow pedestrians to cross. Sight distances are good and clear for both motorists and pedestrians. To retain this aspect, any proposed landscaping along Well Street should be kept to very low vegetation such as grasses or the equivalent.

The proposed Loop Road pedestrian refuge must incorporate advance warning signposting to ensure the preparedness of motorists. The distance of the refuge from the roundabout is to be determined in consultation with Council. The horizontal alignment of the Loop Road approach to the crossing meets current sight line requirements but is heavily vegetated along the northern kerb. It is recommended that the vegetation within 2m of the kerb be removed and low plantings such as grasses be instated.

Current bus and pedestrian provisions on Church Street are satisfactory to afford significant opportunity for public transport usage for both JTW and recreational activities.

Bus stops in Belmore Street, north of Constitution Road provide further accessibility to locations within the precinct. Direct, sealed pathways provide accessibility between the bus stops and the Stage A site.

It was considered that train travel and pedestrian movement to the Meadowbank railway station might be adversely impacted by the distance of some 1.2km from the site.

A significant pedestrian demand from the site will invariably be genrated by retail and recreational activities. This created the need to facilitate direct connections between the adjoining residential catchments and planned pedestrian/shared paths to the site.

Pedestrian provisions were considered in Parsonage Street, between Well Street and the Loop Road, but given the distance of any pedestrian crossing and the volume of anticipated vehicle traffic it was considered that any such treatment may result in queueing back onto Church Street.

Pedestrian refuges in both Well Street and the Loop Road are recommended to faciliatate pedestrian access to the site while minimising the impact on vehicle movements.

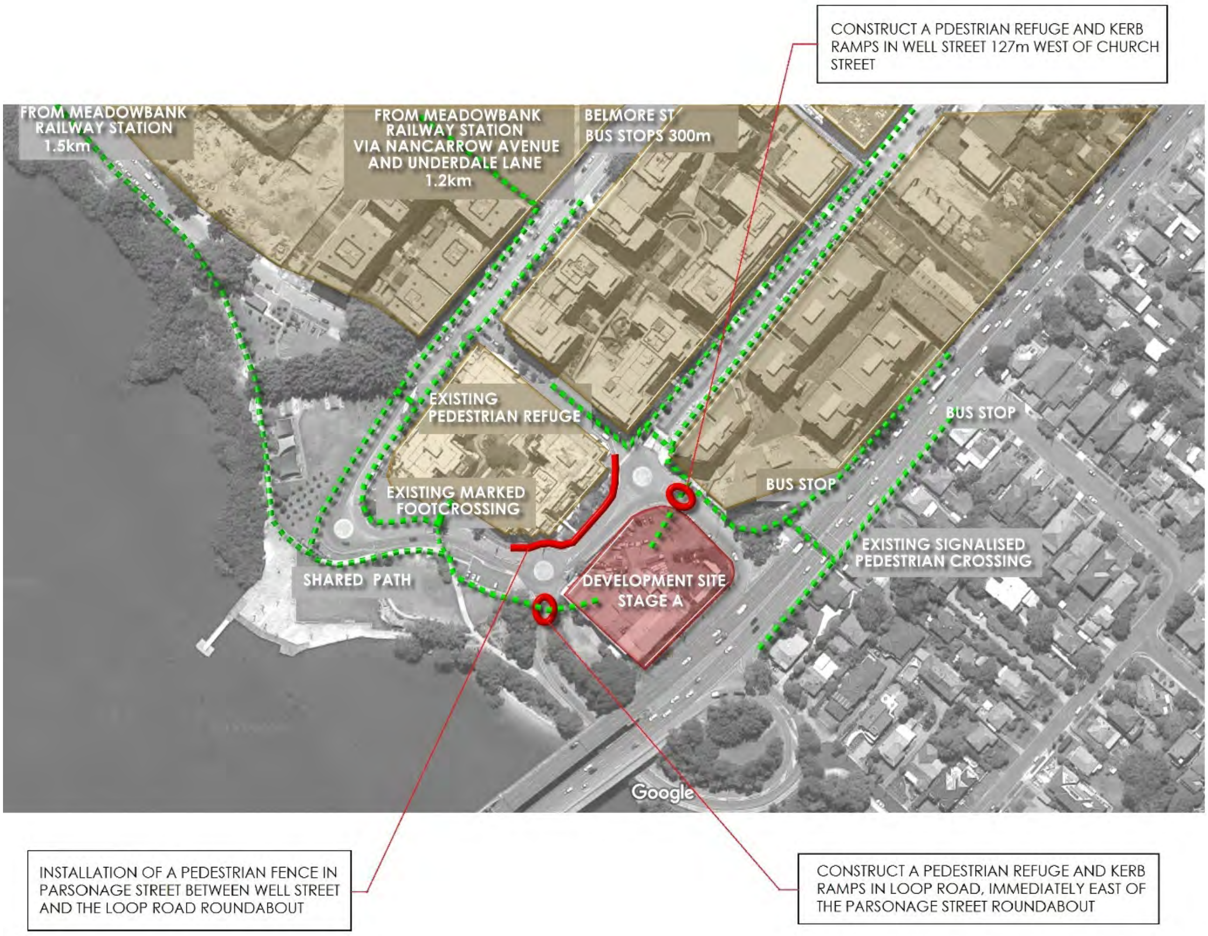


Figure 33 **Pedestrian Cyclist Management Plan**
Source *Road Delay Solutions, 2018*

Figure 34 **Typical Pedestrian Refuge Treatment**
Source *Road Delay Solutions, 2018*

10 CONCLUSION

This report, commisioned by *Holdmark* and undertaken by *Road Delay Solutions*, supports the Section 75W Application for Stage A of the Shepherds Bay Development.

Formerly, comptuer based road network modelling, accompanying the original Concept Application for the full Shepherds Bay Development, including Stage A, was predicated upon...

- → *3,000 residential apartments,*
- → *10,000m² of Commercial Floor Space,*
- → *A vehicle generation rate of 0.32vph per apartment,*
- → *The addition of 90 vehicle trips associated with supplimentary retail and recreational activities, and*
- → *A total vehicle generation of 1,250vph.*

The input parameters for the former Stage A concept model comprised...

- → *10,000m² of commercial floor space,*
- → *A peak hour vehicle generation rate of 2 trips per 100m² of GLFA,*
- → *Passenger vehicle entry via Well Street, and*
- → *Passenger vehicle exit onto Parsonage Street.*

No loading dock provision was modelled during the former preparation of the concept application.

This Section 75W Application applies specifically to Stage A Mod 3, proposing under a 10 storey envelope, the following likely changes (subject to DA)...

- → *8,176m² of floor space for serviced apartments or 42 serviced apartments, and*
- → *4,008m² of floor space for residential apartments or 42 apartments, being...*
  - o *Twelve (12) 1 bedders,*
  - o *Twenty four (24) 2 bedders, and*
  - o *Six (6) 3 bedders.*

Therefore, the traffic generating land uses proposed under the Stage A, 10 storey envelope, are…

- *42 residential apartments,*
- *42 serviced apartments.*
- *A Supermarket with a GFA of 2,928m^2 and a calculated (80% of GFA) GLFA of 2,342m^2 excluding common areas, walkways, garbage rooms and shared loading dock,*
- *Specialty shops with a GFA of 1,128m^2 and a calculated GLFA of 903m^2, and*
- *A Café with a GFA of 100m^2.*

Stage A, under this Section 75W Application is to provide for…

- *A total vehicle generation of 443vph during each commuter peak,*
- *Loading dock access from a dedicated entry lane adjacent to the deceleration lane, northbound in Church Street,*
- *Passenger vehicle access from a dedicated left turn lane, southbound in Parsonage Street,*
- *Construction of pedestrian refuges in Well Street and Parsonage Street, and*
- *Raising of the Stage A podium level, generally 1.5m above the surrounding surface level fronting Parsonage Street, and employing dense, low height plantings between the kerb line and the face of the podium to deter pedestrian movement and access.*

This report has assessed the committed infrastructure necessary to sustain the level of development, in accordance with the *Department of Planning & Infrastructure Concept Approval*, MP09_0216 and proposes the relavent timimg for each.

This assessment further provides a rationale for the recommended infrastructure and treatments associated with the development of Shepherds Bay Stage A.

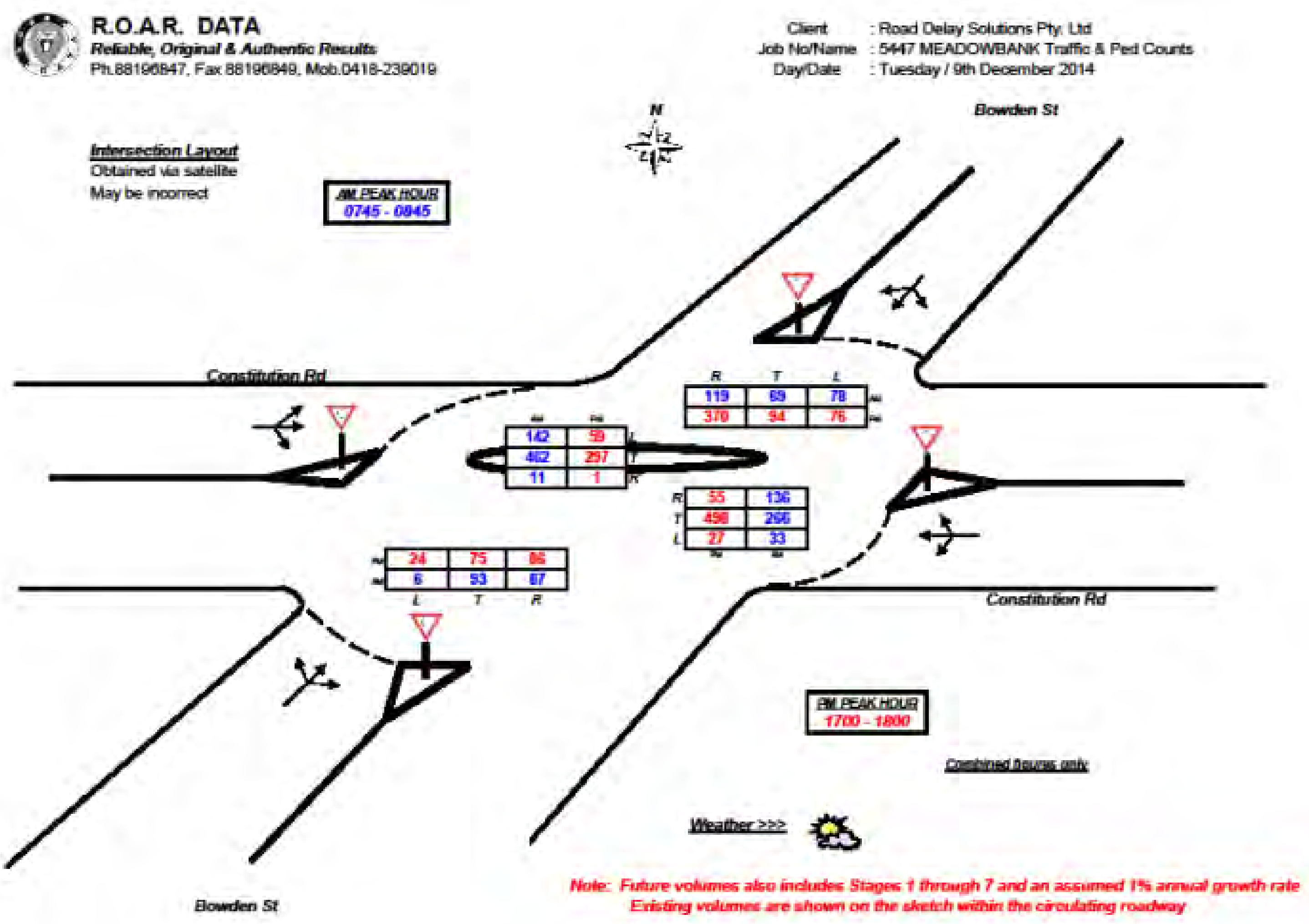
In support of the Section 75W Application and the Stage A Development, as proposed, the following is considered relevant…

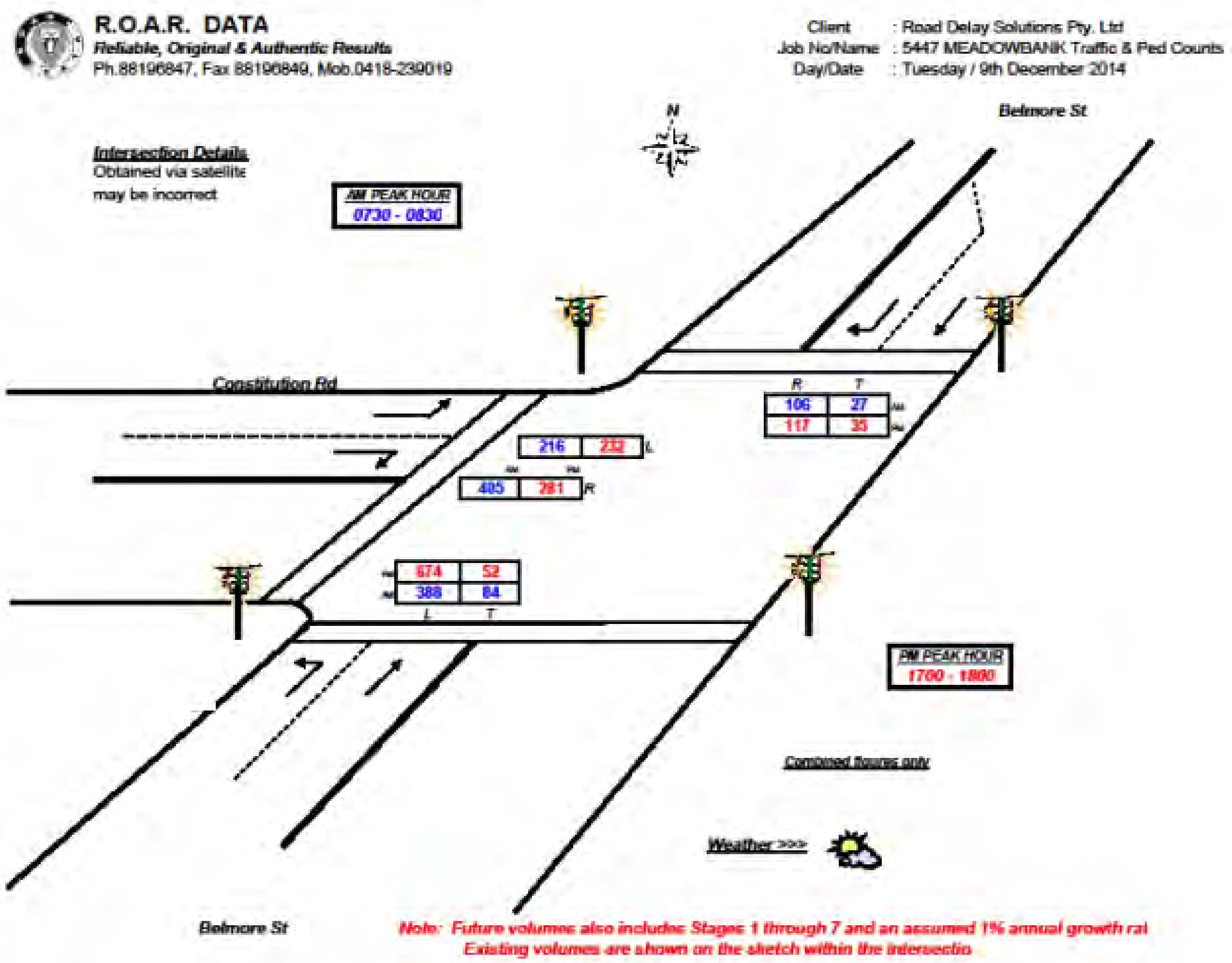
- *This assessment has diligently considered all aspects of vehicle generation and the impacts on the road network.*
- *The peak commuter travel periods within the MEA precinct are 7:30am till 8:30 am and 4:45pm till 5:45pm.*

- *Mesoscopic Netanal modelling and operational Sidra modelling has been undertaken and confirm that the MEA road network is capable, with the implementation of the recommended and committed infrastructure upgrades, of sustaining the projected vehicle growth associated with an average 9.4% background growth to year 2026 and the the vehicle generations calculated for the Shepherds Bay Urban Renewal development.*
- *No consideration has been given to promote increased traffic through the 'gateways' of Well Street, Loop Road or the rail overbridge on Railway Road to encourage further cross regional traffic flow through the precinct.*
- *The site provides public transport opportunity with frequent and convenient bus services on Church Street and Belmore Street, some 50m and 250m from the site, respectively, to regional centres such as the Sydney CBD, Parramatta CBD, Macquarie Park and Strathfield.*
- *The Pedestrian and Bicycle Plan provides the neccessary access to the site for residents, retail and recreational users, particularly during off peak periods.*
- *The site is located immediately north of a shared pedestrian and bicycle path with links to Parramatta and the Sydney CBD.*
- *No warrant exists for the signalisation of the marked foot crossing in Railway Road, at this time. Future monitoring of the site is recommended following the occupancy of Stage 9 and with the commercial activities associated with the development.*

APPENDIX A – TRAFFIC COUNTS

Road Delay Solutions has previously commissioned *ROAR Data* to annually count key intersections within the *MEA*, in particular the intersections of Constitution Road with both Bowden Sreet and Belmore Street and the pedestrian mid block crossing in Railway Road. These counts have been collected in or around November of each year from 2011 to 2014, inclusive.


R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019
Client : Road Delay Solutions Pty Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014
Intersection Layout
Obtained via satellite
May be incorrect
AM PEAK HOUR
0745 - 0845
N
Bowden St
Constitution Rd
R
T
L
119
69
78
370
94
76
142
59
402
297
11
1
R
55
136
T
458
296
L
27
33
24
75
86
6
53
87
L
T
R
Constitution Rd
PM PEAK HOUR
1700 - 1800
Combined figures only
Weather >>>
Bowden St
Note: Future volumes also includes Stages 1 through 7 and an assumed 1% annual growth rate
Existing volumes are shown on the sketch within the circulating roadway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Day/Date : Tuesday / 9th December 2014
Intersection Details
Obtained via satellite
may be incorrect
AM PEAK HOUR
0730 - 0830
N
Belmore St
Constitution Rd
R T
106 27 AM
117 35 PM
216 232 L
AM PM
405 281 R
674 52
388 84
L T
PM PEAK HOUR
1700 - 1800
Combined figures only
Weather >>>
Belmore St
Note: Future volumes also includes Stages 1 through 7 and an assumed 1% annual growth rat
Existing volumes are shown on the sketch within the intersectio

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Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014

AM

	Railway Rd *Light Vehicles*		
Time Per	Northbound	Southbound	TOT
0700 - 0715	130	53	183
0715 - 0730	147	75	222
0730 - 0745	156	85	241
0745 - 0800	152	88	240
0800 - 0815	152	96	248
0815 - 0830	161	108	269
0830 - 0845	190	93	283
0845 - 0900	144	87	231
Period End	1232	685	1917

	Railway Rd *Heavy Vehicles*		
Time Per	Northbound	Southbound	TOT
0700 - 0715	0	1	1
0715 - 0730	0	0	0
0730 - 0745	0	0	0
0745 - 0800	0	0	0
0800 - 0815	0	0	0
0815 - 0830	0	1	1
0830 - 0845	0	0	0
0845 - 0900	0	0	0
Period End	0	2	2

PM

	Railway Rd *Light Vehicles*		
Time Per	Northbound	Southbound	TOT
1600 - 1615	85	230	315
1615 - 1630	73	200	273
1630 - 1645	96	222	318
1645 - 1700	72	250	322
1700 - 1715	76	236	312
1715 - 1730	91	210	301
1730 - 1745	103	205	308
1745 - 1800	65	210	275
Period End	661	1763	2424

	Railway Rd *Heavy Vehicles*		
Time Per	Northbound	Southbound	TOT
1600 - 1615	0	0	0
1615 - 1630	1	0	1
1630 - 1645	0	0	0
1645 - 1700	0	0	0
1700 - 1715	0	0	0
1715 - 1730	0	0	0
1730 - 1745	0	0	0
1745 - 1800	0	0	0
Period End	1	0	1

	Railway Rd *Light Vehicles*		
Peak Per	Northbound	Southbound	TOT
0700 - 0800	585	301	886
0715 - 0815	607	344	951
0730 - 0830	621	377	998
0745 - 0845	655	385	1040
0800 - 0900	647	384	1031
PEAK HR	655	385	1040

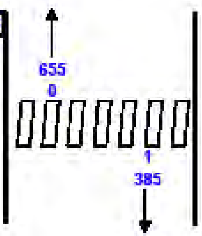
	Railway Rd *Heavy Vehicles*		
Peak Per	Northbound	Southbound	TOT
0700 - 0800	0	1	1
0715 - 0815	0	0	0
0730 - 0830	0	1	1
0745 - 0845	0	1	1
0800 - 0900	0	1	1
PEAK HR	0	1	1

	Railway Rd *Light Vehicles*		
Peak Per	Northbound	Southbound	TOT
1600 - 1700	326	902	1228
1615 - 1715	317	908	1225
1630 - 1730	335	918	1253
1645 - 1745	342	901	1243
1700 - 1800	335	861	1196
PEAK HR	335	918	1253

	Railway Rd *Heavy Vehicles*		
Peak Per	Northbound	Southbound	TOT
1600 - 1700	1	0	1
1615 - 1715	1	0	1
1630 - 1730	0	0	0
1645 - 1745	0	0	0
1700 - 1800	0	0	0
PEAK HR	0	0	0

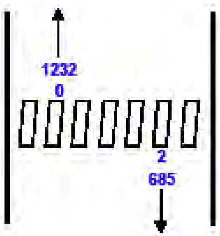
Railway Rd

Peak Hour
0745 - 0845



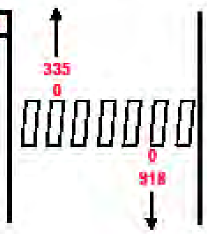
Railway Rd

TOTAL VOLUMES



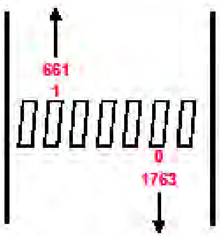
Railway Rd

Peak Hour
1630 - 1730



Railway Rd

TOTAL VOLUMES



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AM

Time Per	Railway Rd Light Vehicles Northbound	Railway Rd Light Vehicles Southbound	TOT
0700 - 0715	130	53	**183**
0715 - 0730	147	75	**222**
0730 - 0745	156	85	**241**
0745 - 0800	152	88	**240**
0800 - 0815	152	96	**248**
0815 - 0830	161	108	**269**
0830 - 0845	190	93	**283**
0845 - 0900	144	87	**231**
Period End	**1232**	**685**	**1917**

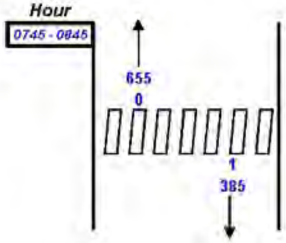
Time Per	Railway Rd Heavy Vehicles Northbound	Railway Rd Heavy Vehicles Southbound	TOT
0700 - 0715	0	1	**1**
0715 - 0730	0	0	**0**
0730 - 0745	0	0	**0**
0745 - 0800	0	0	**0**
0800 - 0815	0	0	**0**
0815 - 0830	0	1	**1**
0830 - 0845	0	0	**0**
0845 - 0900	0	0	**0**
Period End	**0**	**2**	**2**

Peak Per	Railway Rd Light Vehicles Northbound	Railway Rd Light Vehicles Southbound	TOT
0700 - 0800	585	301	**886**
0715 - 0815	607	344	**951**
0730 - 0830	621	377	**998**
0745 - 0845	655	385	**1040**
0800 - 0900	647	384	**1031**
PEAK HR	**655**	**385**	**1040**

Peak Per	Railway Rd Heavy Vehicles Northbound	Railway Rd Heavy Vehicles Southbound	TOT
0700 - 0800	0	1	**1**
0715 - 0815	0	0	**0**
0730 - 0830	0	1	**1**
0745 - 0845	0	1	**1**
0800 - 0900	0	1	**1**
PEAK HR	**0**	**1**	**1**

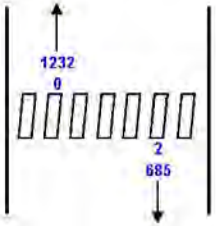
Peak Hour

Railway Rd



TOTAL VOLUMES

Railway Rd



PM

Time Per	Railway Rd Light Vehicles Northbound	Railway Rd Light Vehicles Southbound	TOT
1600 - 1615	85	230	**315**
1615 - 1630	73	200	**273**
1630 - 1645	96	222	**318**
1645 - 1700	72	250	**322**
1700 - 1715	76	236	**312**
1715 - 1730	91	210	**301**
1730 - 1745	103	205	**308**
1745 - 1800	65	210	**275**
Period End	**661**	**1763**	**2424**

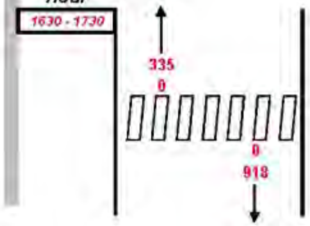
Time Per	Railway Rd Heavy Vehicles Northbound	Railway Rd Heavy Vehicles Southbound	TOT
1600 - 1615	0	0	**0**
1615 - 1630	1	0	**1**
1630 - 1645	0	0	**0**
1645 - 1700	0	0	**0**
1700 - 1715	0	0	**0**
1715 - 1730	0	0	**0**
1730 - 1745	0	0	**0**
1745 - 1800	0	0	**0**
Period End	**1**	**0**	**1**

Peak Per	Railway Rd Light Vehicles Northbound	Railway Rd Light Vehicles Southbound	TOT
1600 - 1700	326	902	**1228**
1615 - 1715	317	908	**1225**
1630 - 1730	335	918	**1253**
1645 - 1745	342	901	**1243**
1700 - 1800	335	861	**1196**
PEAK HR	**335**	**918**	**1253**

Peak Per	Railway Rd Heavy Vehicles Northbound	Railway Rd Heavy Vehicles Southbound	TOT
1600 - 1700	1	0	**1**
1615 - 1715	1	0	**1**
1630 - 1730	0	0	**0**
1645 - 1745	0	0	**0**
1700 - 1800	0	0	**0**
PEAK HR	**0**	**0**	**0**

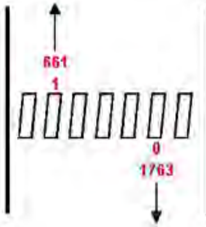
Peak Hour

Railway Rd



TOTAL VOLUMES

Railway Rd



R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014

Time Per	Railway Rd Peds Crossing Eastbound	Railway Rd Peds Crossing Westbound	TOT
0700 - 0715	18	35	**53**
0715 - 0730	10	48	**58**
0730 - 0745	16	86	**102**
0745 - 0800	16	68	**84**
0800 - 0815	10	88	**98**
0815 - 0830	18	48	**66**
0830 - 0845	10	42	**52**
0845 - 0900	5	37	**42**
Period End	**103**	**452**	**555**

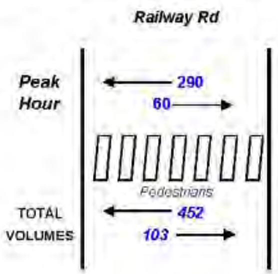
Time Per	Railway Rd Peds Crossing Eastbound	Railway Rd Peds Crossing Westbound	TOT
1600 - 1615	34	17	**51**
1615 - 1630	26	13	**39**
1630 - 1645	23	24	**47**
1645 - 1700	27	13	**40**
1700 - 1715	30	19	**49**
1715 - 1730	30	12	**42**
1730 - 1745	62	31	**93**
1745 - 1800	60	16	**76**
Period End	**292**	**145**	**437**

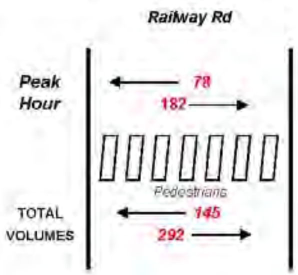
AM PEAK HOUR
0730 - 0830

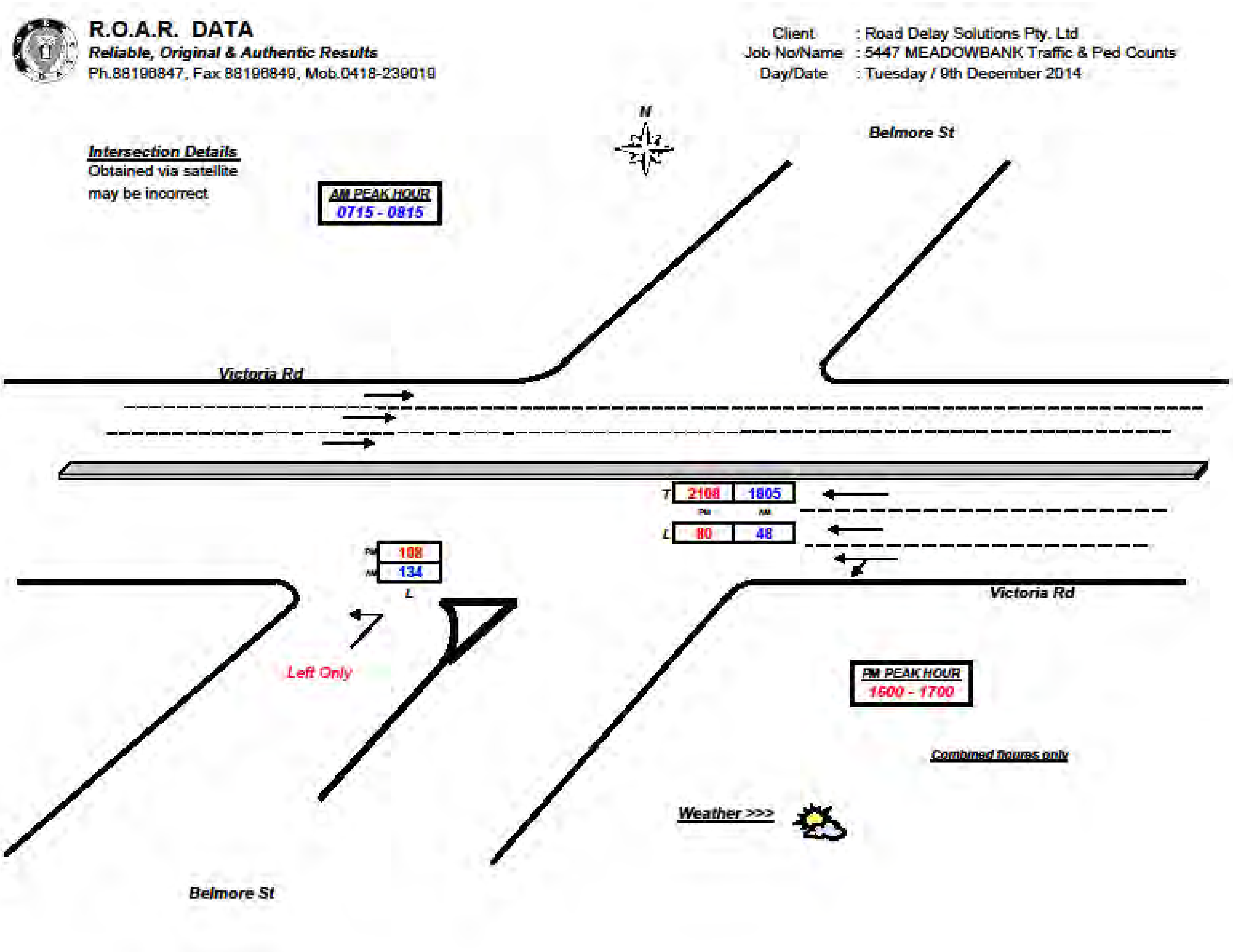
PM PEAK HOUR
1700 - 1800

Peak Per	Railway Rd Peds Crossing Eastbound	Railway Rd Peds Crossing Westbound	TOT
0700 - 0800	60	237	**297**
0715 - 0815	52	290	**342**
0730 - 0830	60	290	**350**
0745 - 0845	54	246	**300**
0800 - 0900	43	215	**258**
PEAK HR	**60**	**290**	**350**

Peak Per	Railway Rd Peds Crossing Eastbound	Railway Rd Peds Crossing Westbound	TOT
1600 - 1700	110	67	**177**
1615 - 1715	106	69	**175**
1630 - 1730	110	68	**178**
1645 - 1745	149	75	**224**
1700 - 1800	182	78	**260**
PEAK HR	**182**	**78**	**260**



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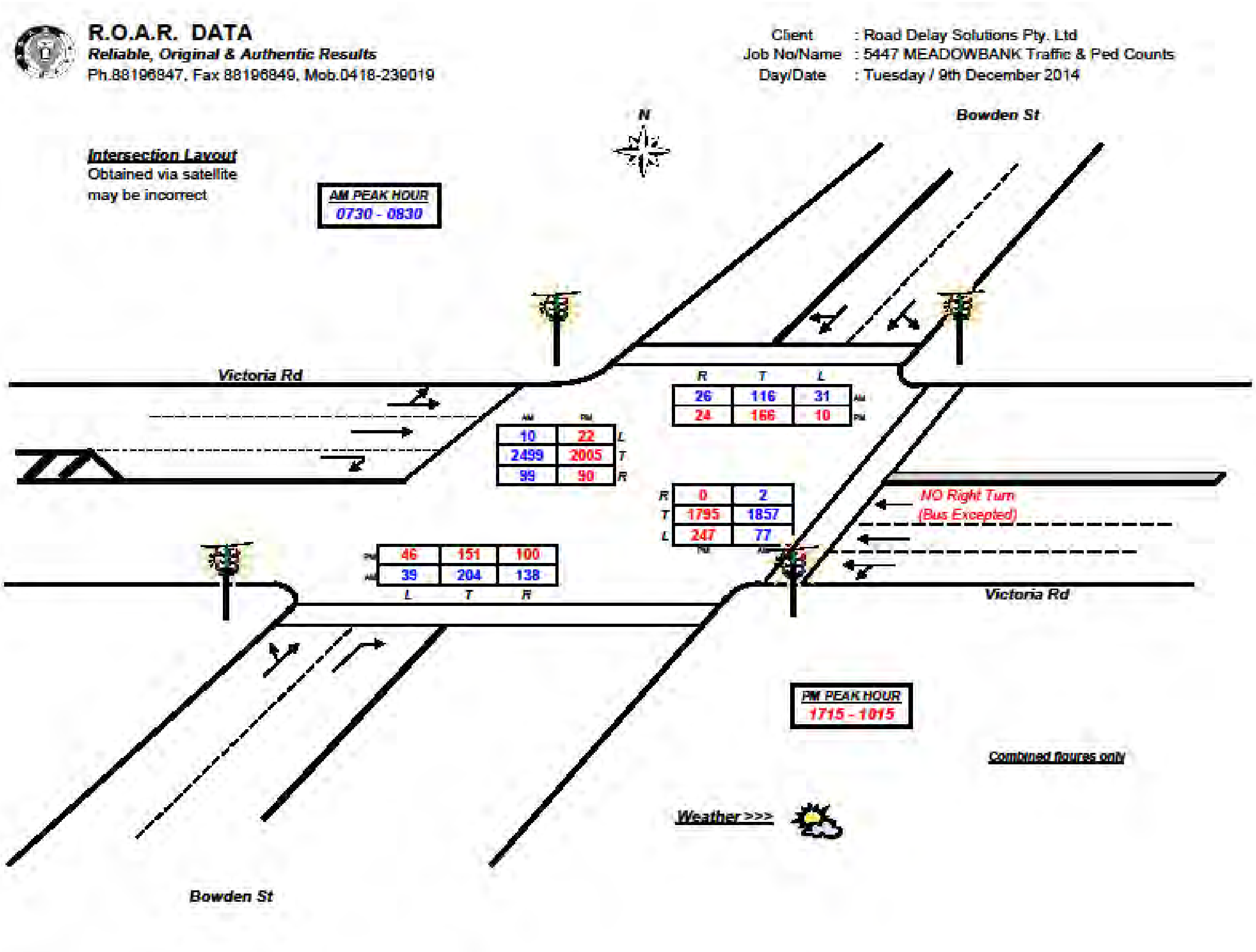
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014
N
Belmore St
Intersection Details
Obtained via satellite
may be incorrect
AM PEAK HOUR
0715 - 0815
Victoria Rd
T
2108
1805
PM
AM
L
80
48
PM 108
AM 134
L
Left Only
Victoria Rd
PM PEAK HOUR
1600 - 1700
Combined figures only
Weather >>>
Belmore St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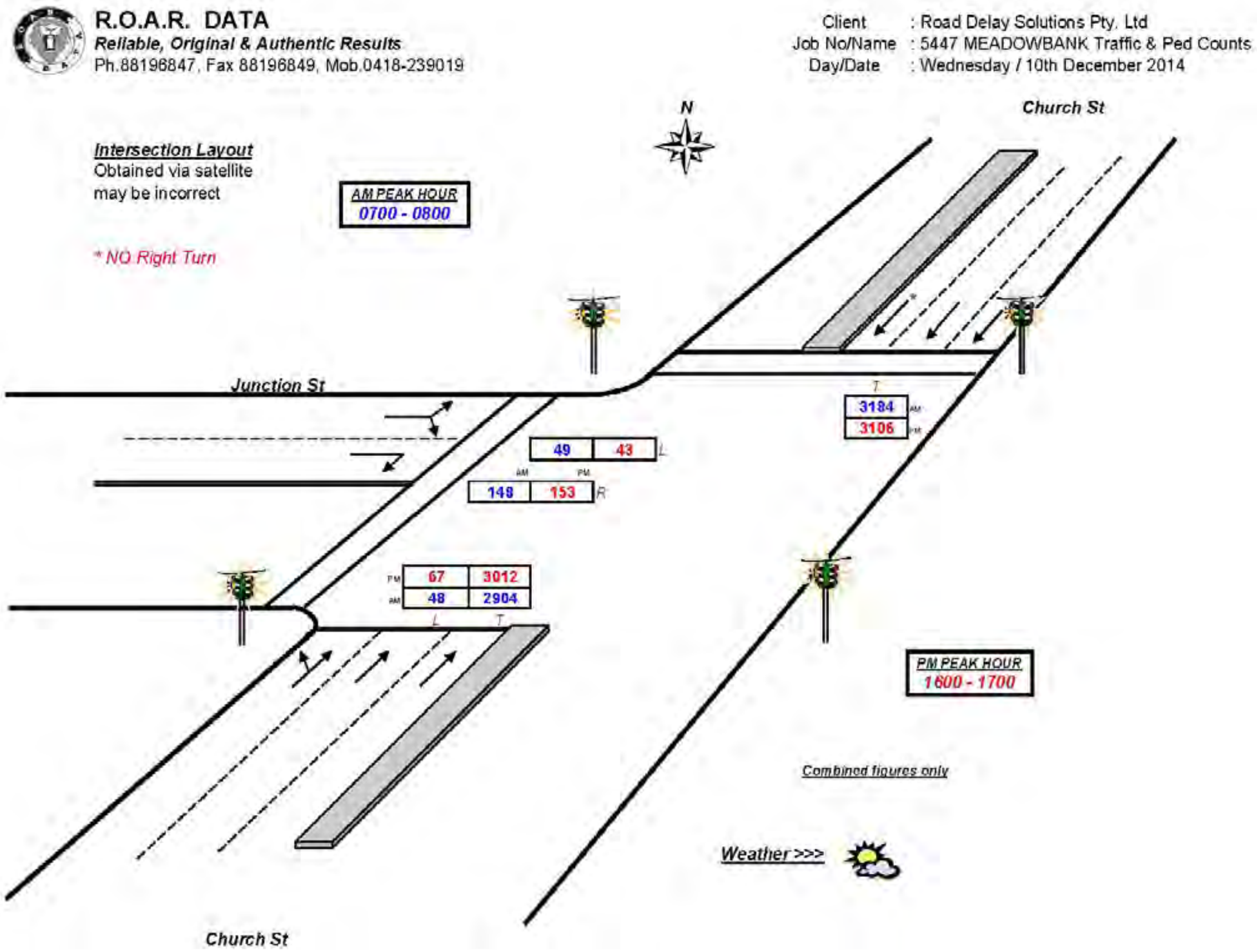
Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014
N
Bowden St
Intersection Layout
Obtained via satellite
may be incorrect
AM PEAK HOUR
0730 - 0830
Victoria Rd
R T L
26 116 31 AM
24 166 10 PM
AM PM
10 22 L
2499 2005 T
99 90 R
R 0 2
T 1795 1857
L 247 77
PM AM
NO Right Turn
(Bus Excepted)
PM 46 151 100
AM 39 204 138
L T R
Victoria Rd
PM PEAK HOUR
1715 - 1815
Combined figures only
Weather >>>
Bowden St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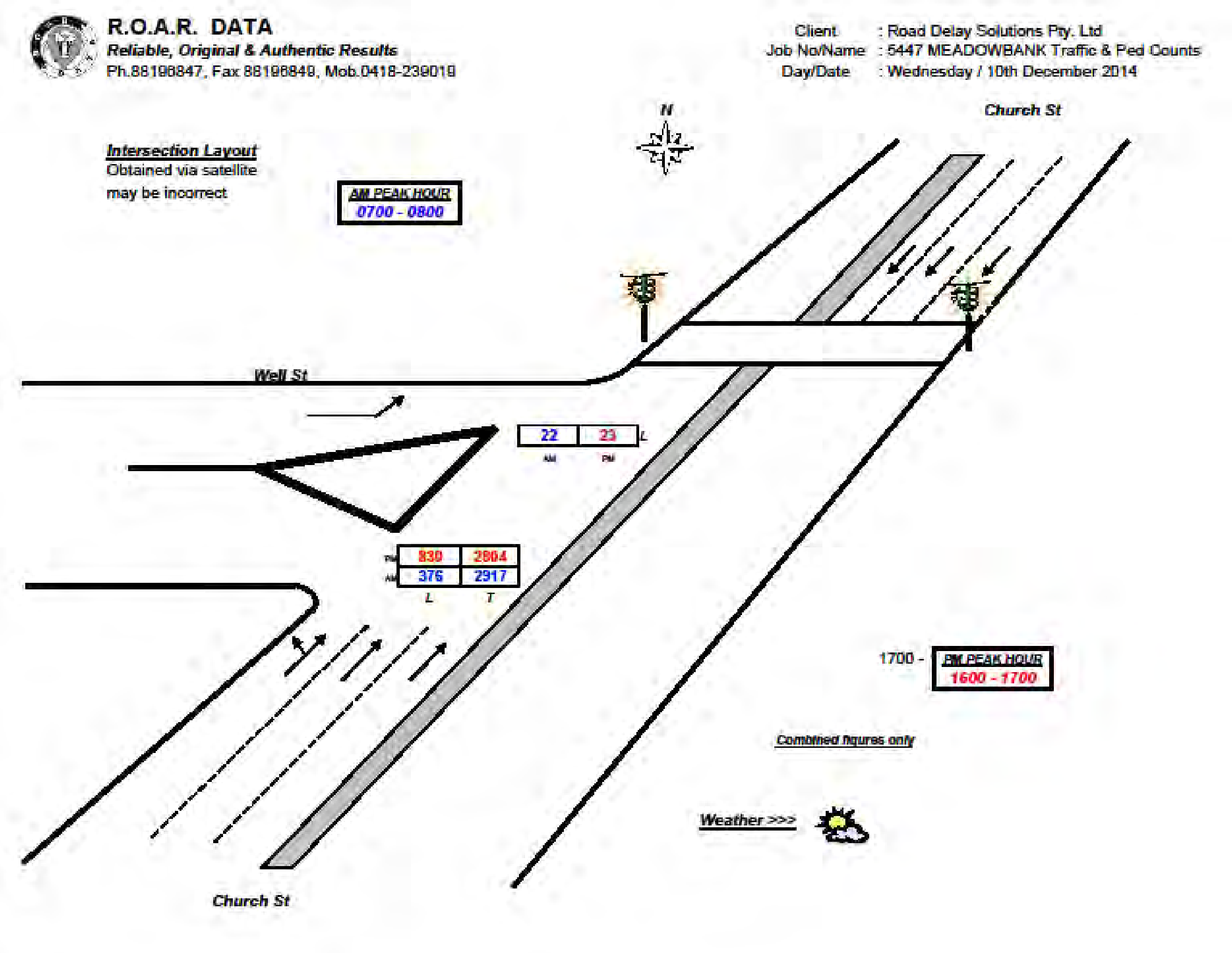
Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Wednesday / 10th December 2014
Intersection Layout
Obtained via satellite
may be incorrect
* NO Right Turn
AM PEAK HOUR
0700 - 0800
N
Church St
Junction St
3184
3106
49
43
L
148
153
R
AM
PM
67
3012
48
2904
L
T
PM PEAK HOUR
1600 - 1700
Combined figures only
Weather >>>
Church St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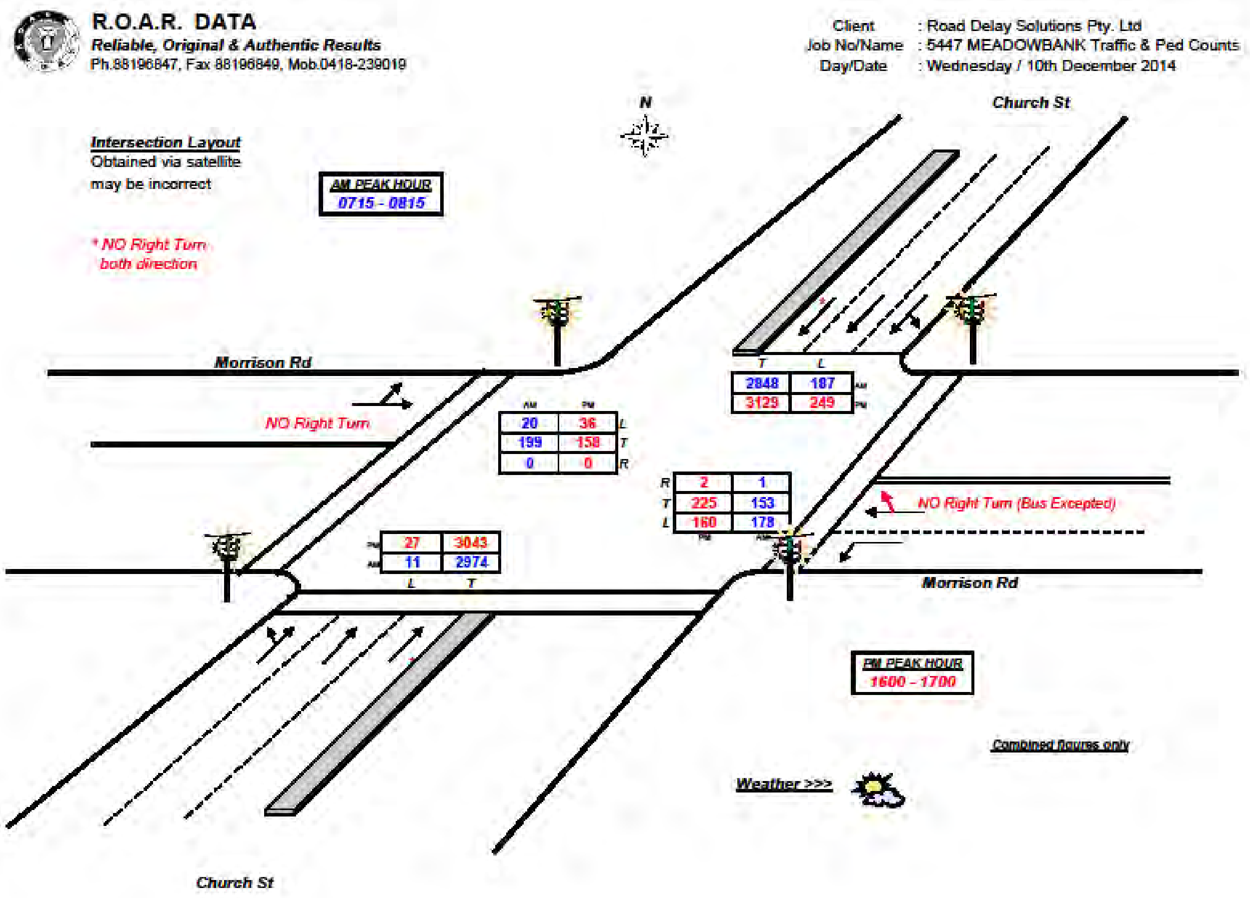
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Wednesday / 10th December 2014
N
Church St
Intersection Layout
Obtained via satellite
may be incorrect
AM PEAK HOUR
0700 - 0800
Well St
22
23
L
AM
PM
830
2804
376
2917
L
T
1700 -
PM PEAK HOUR
1600 - 1700
Combined figures only
Weather >>>
Church St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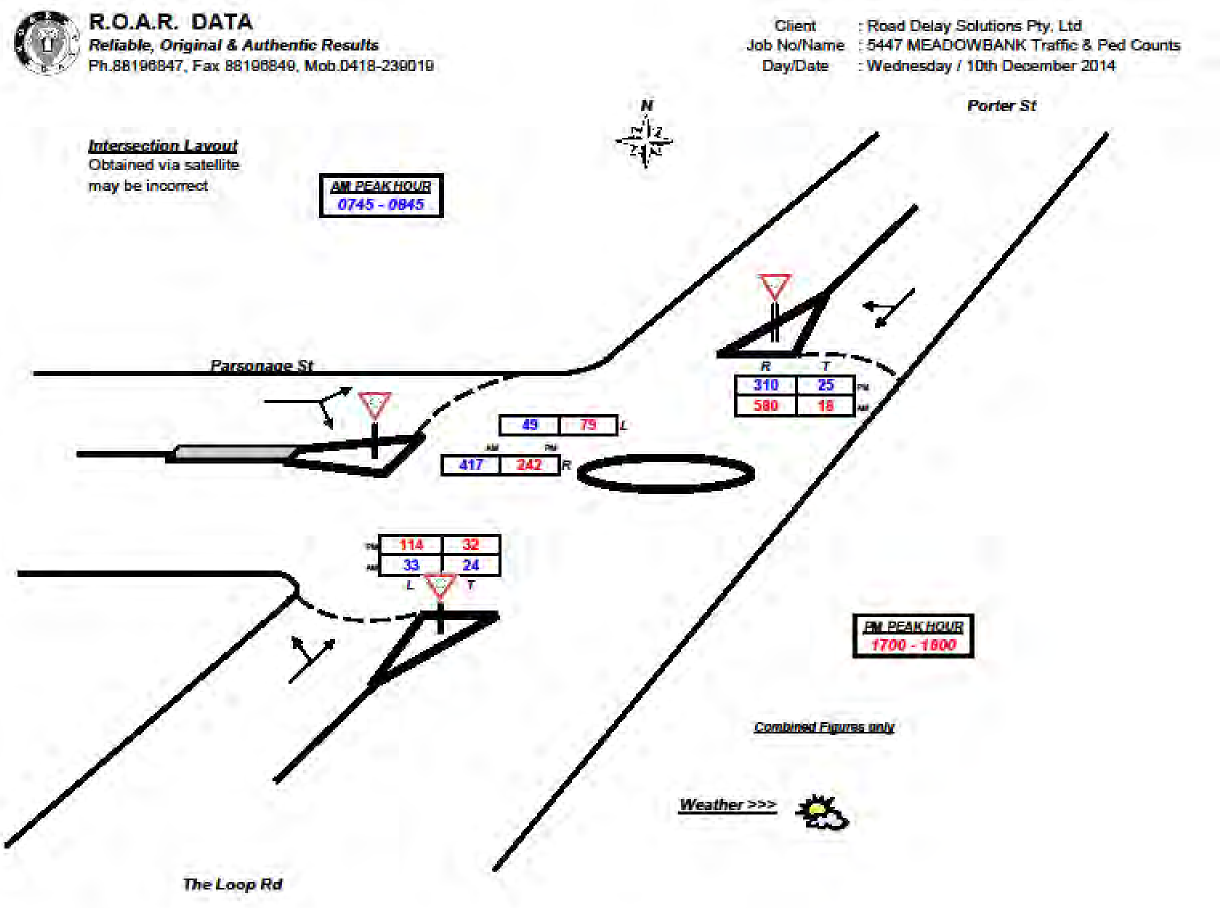
Ph.88196847, Fax 88196849, Mob.0418-239019
Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Wednesday / 10th December 2014
N
Church St
Intersection Layout
Obtained via satellite
may be incorrect
AM PEAK HOUR
0715 - 0815
* NO Right Turn
both direction
Morrison Rd
NO Right Turn
T L
2848 187 AM
3129 249 PM
AM PM
20 36 L
199 158 T
0 0 R
R 2 1
T 225 153
L 160 178
NO Right Turn (Bus Excepted)
PM 27 3043
AM 11 2974
L T
Morrison Rd
PM PEAK HOUR
1600 - 1700
Combined figures only
Weather >>>
Church St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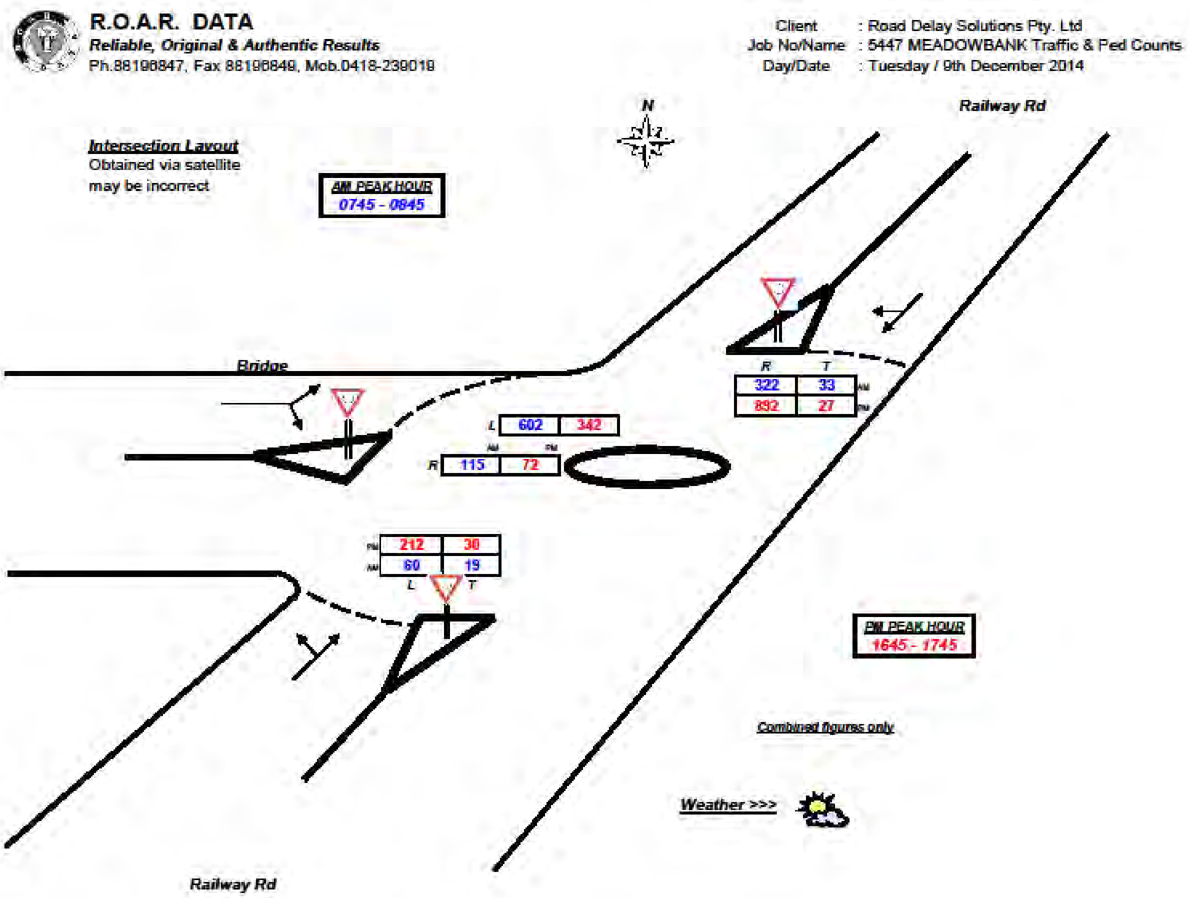
Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Wednesday / 10th December 2014
Intersection Layout
Obtained via satellite
may be incorrect
AM PEAK HOUR
0745 - 0845
N
Porter St
Parsonage St
R
T
310
25
580
18
49
79
L
417
242
R
114
32
33
24
L
T
PM PEAK HOUR
1700 - 1800
Combined Figures only
Weather >>>
The Loop Rd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Ph.88196847, Fax 88196849, Mob.0418-239019
Client : Road Delay Solutions Pty. Ltd
Job No/Name : 5447 MEADOWBANK Traffic & Ped Counts
Day/Date : Tuesday / 9th December 2014
N
Railway Rd
Intersection Layout
Obtained via satellite
may be incorrect
AM PEAK HOUR
0745 - 0845
Bridge
R T
322 33 AM
892 27 PM
L 602 342
AM PM
R 115 72
PM 212 30
AM 60 19
L T
PM PEAK HOUR
1645 - 1745
Combined figures only
Weather >>>
Railway Rd

APPENDIX B – PERFORMANCE INDICATORS

General

Intersection performance is best measured by the indicators of Level of Service (LoS), Average Vehicle Delay (AVD) and the Degree of Saturation (DS) during peak hours.

This is defined as the assessment of a qualitative effect of factors influencing vehicle movement through the intersection. Factors such as speed, traffic volume, geometric layout, delay and capacity are qualified and applied to the specific intersection control mode, as shown in Table 1.

The measure of average delay assessed for traffic signal operation is over all movements. For roundabouts and priority controlled intersections, the critical criterion for assessment is the movement with the highest delay per vehicle.

Table A1: Performance Indicators by Control Method

Intersection Control	Performance Measure [Unit]
Sign or Priority Control	→ Delay of critical movement(s) [seconds/vehicle] → Average Vehicle Delay [seconds/vehicle] → Queue length of critical movement(s) [metres]
Traffic Signal Control	→ Delay of critical movement(s) [seconds/vehicle] → Degree of Saturation [ratio of vehicles to capacity] → Average Vehicle Delay [seconds/vehicle] → Cycle Length [seconds] → Queue length of critical movement(s) [metres]
Roundabout Control	→ Delay of critical movement(s) [seconds/vehicle] → Degree of Saturation[ratio of vehicles to capacity] → Average Vehicle Delay [seconds/vehicle] → Queue length of critical movement(s) [metres]

Average Vehicle Delay (AVD)

The AVD is a measure of the operational performance of a road network or an intersection.

AVD is determined globally over a road network or within a cordon during an assignment model run. The AVD exhibited on comparable network models, for analogous peak periods, forms the basis of comparing the operational performance of the road network.

AVD is used in the determination of intersection Level of Service. Generally, the total delay incurred by vehicles through an intersection is averaged to give an indicative delay on any specific approach. Longer delays do occur but only the average over the peak hour period is reported.

Degree of Saturation (DS)

The DS of an intersection is usually taken as the highest ratio of traffic volume on an approach to the intersection compared with its theoretical capacity, and is a measure of the utilisation of available green time. The DS reported is generally of a critical movement through the intersection rather than the DS of the intersection unless equal saturation occurs on all approaches.

For intersections controlled by traffic signals, generally both queue length and delay increase rapidly as DS approaches 1.0. An intersection operates satisfactorily when its DS is kept below 0.875. When the DS exceeds 0.9, extensive queues can be expected.

Table A2: Qualified Level of Service by Control Method

LOS	AVD secs	Traffic Signals and Roundabout	Give Way and Stop Sign Priority Control
A	1 to 14	Good operation.	Good operation
B	14 to 28	Good operation with acceptable delays and spare capacity.	Good operation with acceptable delays and spare capacity.
C	28 to 42	Satisfactory.	Satisfactory but accident study and operational analysis required.
D	42 to 56	Operating near capacity.	Near capacity. Accident study and operational analysis required.
E	56 to 70	Unsatisfactory. Traffic signals incidence will cause excessive delays. Requires additional capacity. Roundabouts require alternative control mode.	At capacity. Requires alternative control mode.
F	>70	Unsatisfactory. Over capacity and unstable operation.	Over capacity. Unstable and unsafe operation.

APPENDIX C – SIDRA MOVEMENT SUMMARIES

MOVEMENT SUMMARY

Site: 2026 AM Base Well St, Parsonage St and Porter St

Well Street and Porter Street
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Well Street											
4a	L1	437	1.0	0.326	4.6	LOS A	2.4	16.9	0.19	0.49	54.1
6b	R3	39	0.0	0.326	8.9	LOS A	2.4	16.9	0.19	0.49	54.3
Approach		476	0.9	0.326	4.9	LOS A	2.4	16.9	0.19	0.49	54.1
NorthEast: Porter Street											
24b	L3	25	0.0	0.072	8.1	LOS A	0.4	2.6	0.59	0.66	51.4
25	T1	35	0.0	0.072	7.8	LOS A	0.4	2.6	0.59	0.66	52.5
Approach		60	0.0	0.072	7.9	LOS A	0.4	2.6	0.59	0.66	52.1
SouthWest: Parsonage Street											
31	T1	2	0.0	0.367	5.0	LOS A	2.5	17.7	0.19	0.60	52.7
32a	R1	533	1.0	0.367	7.3	LOS A	2.5	17.7	0.19	0.60	52.0
Approach		535	1.0	0.367	7.3	LOS A	2.5	17.7	0.19	0.60	52.0
All Vehicles		1071	0.9	0.367	6.3	LOS A	2.5	17.7	0.21	0.55	52.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 PM Base Well St, Parsonage St and Porter St

Well Street and Porter Street
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Well Street											
4a	L1	702	1.0	0.736	6.1	LOS A	9.2	64.6	0.75	0.62	52.0
6b	R3	195	0.0	0.736	10.4	LOS A	9.2	64.6	0.75	0.62	52.2
Approach		897	0.8	0.736	7.1	LOS A	9.2	64.6	0.75	0.62	52.1
NorthEast: Porter Street											
24b	L3	95	0.0	0.348	9.5	LOS A	2.3	16.3	0.78	0.83	50.5
25	T1	153	0.0	0.348	9.2	LOS A	2.3	16.3	0.78	0.83	51.5
Approach		247	0.0	0.348	9.3	LOS A	2.3	16.3	0.78	0.83	51.1
SouthWest: Parsonage Street											
31	T1	12	0.0	0.557	6.4	LOS A	5.0	35.0	0.62	0.67	51.5
32a	R1	616	1.0	0.557	8.7	LOS A	5.0	35.0	0.62	0.67	50.9
Approach		627	1.0	0.557	8.7	LOS A	5.0	35.0	0.62	0.67	50.9
All Vehicles		1772	0.7	0.736	8.0	LOS A	9.2	64.6	0.71	0.67	51.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Existing AM 2014

Constitution Rd & Bowden St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	33	7.8	0.399	5.4	LOS A	2.9	20.7	0.53	0.60	45.0
22	T1	266	1.0	0.399	5.1	LOS A	2.9	20.7	0.53	0.60	45.8
23	R2	136	0.6	0.399	8.1	LOS A	2.9	20.7	0.53	0.60	45.6
Approach		435	1.4	0.399	6.1	LOS A	2.9	20.7	0.53	0.60	45.7
NorthEast: Bowden St (NE)											
24	L2	78	0.0	0.358	7.8	LOS A	2.4	17.0	0.76	0.82	43.9
25	T1	69	4.3	0.358	7.8	LOS A	2.4	17.0	0.76	0.82	44.5
26	R2	119	3.5	0.358	10.8	LOS B	2.4	17.0	0.76	0.82	44.3
Approach		266	2.7	0.358	9.2	LOS A	2.4	17.0	0.76	0.82	44.2
NorthWest: Constitution Rd (NW)											
27	L2	142	2.5	0.615	7.7	LOS A	5.8	41.0	0.74	0.76	44.7
28	T1	462	0.6	0.615	7.4	LOS A	5.8	41.0	0.74	0.76	45.4
29	R2	11	0.0	0.615	10.4	LOS B	5.8	41.0	0.74	0.76	45.2
Approach		615	1.0	0.615	7.5	LOS A	5.8	41.0	0.74	0.76	45.2
SouthWest: Bowden St (SW)											
30	L2	6	0.0	0.234	7.2	LOS A	1.4	10.0	0.66	0.75	44.2
31	T1	93	3.7	0.234	7.2	LOS A	1.4	10.0	0.66	0.75	44.8
32	R2	87	3.6	0.234	10.2	LOS B	1.4	10.0	0.66	0.75	44.6
Approach		186	3.5	0.234	8.6	LOS A	1.4	10.0	0.66	0.75	44.7
All Vehicles		1502	1.7	0.615	7.5	LOS A	5.8	41.0	0.67	0.72	45.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: Existing PM 2014

Constitution Rd & Bowden St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	27	0.0	0.689	8.2	LOS A	8.0	56.4	0.91	0.99	42.8
22	T1	498	0.9	0.689	11.1	LOS B	8.0	56.4	0.91	0.99	43.4
23	R2	55	1.4	0.689	14.1	LOS B	8.0	56.4	0.91	0.99	43.2
Approach		580	0.9	0.689	11.2	LOS B	8.0	56.4	0.91	0.99	43.4
NorthEast: Bowden St (NE)											
24	L2	76	0.0	0.583	8.1	LOS A	5.2	36.5	0.76	0.83	43.4
25	T1	94	1.2	0.583	8.0	LOS A	5.2	36.5	0.76	0.83	44.0
26	R2	370	0.4	0.583	11.0	LOS B	5.2	36.5	0.76	0.83	43.9
Approach		540	0.5	0.583	10.1	LOS B	5.2	36.5	0.76	0.83	43.8
NorthWest: Constitution Rd (NW)											
27	L2	59	2.7	0.336	5.4	LOS A	2.3	16.1	0.52	0.57	45.5
28	T1	297	0.4	0.336	5.1	LOS A	2.3	16.1	0.52	0.57	46.2
29	R2	1	12.5	0.336	8.4	LOS A	2.3	16.1	0.52	0.57	45.8
Approach		357	0.8	0.336	5.2	LOS A	2.3	16.1	0.52	0.57	46.1
SouthWest: Bowden St (SW)											
30	L2	24	0.0	0.365	12.1	LOS B	2.6	17.9	0.91	0.96	41.8
31	T1	75	1.0	0.365	12.0	LOS B	2.6	17.9	0.91	0.96	42.4
32	R2	86	0.0	0.365	14.9	LOS B	2.6	17.9	0.91	0.96	42.2
Approach		185	0.4	0.365	13.4	LOS B	2.6	17.9	0.91	0.96	42.2
All Vehicles		1662	0.7	0.689	9.8	LOS A	8.0	56.4	0.78	0.84	43.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 27 April 2016 10:58:23 AM
Project: D:\Documents\Meadowbank\Sidra Models\2014 Constitution and Bowden Intersection.sip6

MOVEMENT SUMMARY

Site: 2026 AM Well St, Parsonage St and Porter St

Well Street and Porter Street
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Well Street											
4a	L1	631	1.0	0.641	7.8	LOS A	6.4	45.2	0.74	0.74	52.2
6b	R3	36	0.0	0.641	12.0	LOS A	6.4	45.2	0.74	0.74	52.4
Approach		666	0.9	0.641	8.0	LOS A	6.4	45.2	0.74	0.74	52.2
NorthEast: Porter Street											
24b	L3	25	0.0	0.300	11.6	LOS A	1.9	13.3	0.81	0.86	49.1
25	T1	163	0.0	0.300	11.3	LOS A	1.9	13.3	0.81	0.86	50.1
Approach		188	0.0	0.300	11.3	LOS A	1.9	13.3	0.81	0.86	50.0
SouthWest: Parsonage Street											
31	T1	13	0.0	0.556	5.1	LOS A	6.0	42.2	0.28	0.58	52.2
32a	R1	706	1.0	0.556	7.4	LOS A	6.0	42.2	0.28	0.58	51.6
32u	U	116	0.0	0.556	9.8	LOS A	6.0	42.2	0.28	0.58	52.4
Approach		835	0.8	0.556	7.7	LOS A	6.0	42.2	0.28	0.58	51.7
All Vehicles		1689	0.8	0.641	8.2	LOS A	6.4	45.2	0.52	0.67	51.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 27 April 2016 8:32:25 AM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 PM Well St, Parsonage St and Porter St

Well Street and Porter Street
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Well Street											
4a	L1	623	0.0	0.807	12.6	LOS A	12.9	90.5	0.96	0.98	48.5
6b	R3	176	0.0	0.807	16.9	LOS B	12.9	90.5	0.96	0.98	48.6
Approach		799	0.0	0.807	13.5	LOS A	12.9	90.5	0.96	0.98	48.5
NorthEast: Porter Street											
24b	L3	90	0.0	0.670	24.6	LOS B	6.9	48.3	1.00	1.17	41.8
25	T1	172	0.0	0.670	24.2	LOS B	6.9	48.3	1.00	1.17	42.5
Approach		262	0.0	0.670	24.3	LOS B	6.9	48.3	1.00	1.17	42.3
SouthWest: Parsonage Street											
31	T1	24	0.0	0.837	9.0	LOS A	15.3	106.8	0.96	0.71	49.9
32a	R1	800	0.0	0.837	11.3	LOS A	15.3	106.8	0.96	0.71	49.4
32u	U	165	0.0	0.837	13.7	LOS A	15.3	106.8	0.96	0.71	50.1
Approach		989	0.0	0.837	11.7	LOS A	15.3	106.8	0.96	0.71	49.5
All Vehicles		2050	0.0	0.837	14.0	LOS A	15.3	106.8	0.97	0.87	48.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 27 April 2016 8:35:23 AM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 Base AM Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	17	1.0	0.094	6.7	LOS A	0.5	3.6	0.56	0.70	51.2
23	R2	65	1.0	0.094	10.2	LOS B	0.5	3.6	0.56	0.70	51.1
Approach		82	1.0	0.094	9.5	LOS A	0.5	3.6	0.56	0.70	51.1
NorthEast: Parsonage Street											
24	L2	33	1.0	0.330	6.0	LOS A	2.2	15.6	0.50	0.66	51.0
26a	R1	415	1.0	0.330	8.4	LOS A	2.2	15.6	0.50	0.66	51.3
Approach		448	1.0	0.330	8.2	LOS A	2.2	15.6	0.50	0.66	51.3
West: Parsonage Street											
10a	L1	443	1.0	0.521	4.9	LOS A	4.8	34.1	0.35	0.53	53.1
12a	R1	284	1.0	0.521	7.6	LOS A	4.8	34.1	0.35	0.53	52.7
Approach		727	1.0	0.521	5.9	LOS A	4.8	34.1	0.35	0.53	53.0
All Vehicles		1257	1.0	0.521	7.0	LOS A	4.8	34.1	0.42	0.59	52.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Tuesday, 26 April 2016 10:25:16 AM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2014 AM Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	33	1.0	0.078	7.8	LOS A	0.5	3.2	0.67	0.72	51.3
23	R2	24	1.0	0.078	11.3	LOS B	0.5	3.2	0.67	0.72	51.2
Approach		57	1.0	0.078	9.3	LOS A	0.5	3.2	0.67	0.72	51.3
NorthEast: Parsonage Street											
24	L2	18	1.0	0.473	7.0	LOS A	3.5	24.4	0.64	0.74	50.6
26a	R1	580	1.0	0.473	9.4	LOS A	3.5	24.4	0.64	0.74	50.9
Approach		598	1.0	0.473	9.3	LOS A	3.5	24.4	0.64	0.74	50.9
West: Parsonage Street											
10a	L1	49	1.0	0.310	4.5	LOS A	2.3	16.4	0.16	0.59	52.7
12a	R1	417	1.0	0.310	7.2	LOS A	2.3	16.4	0.16	0.59	52.3
Approach		466	1.0	0.310	6.9	LOS A	2.3	16.4	0.16	0.59	52.4
All Vehicles		1121	1.0	0.473	8.3	LOS A	3.5	24.4	0.44	0.67	51.5

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 20 April 2016 2:40:21 PM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 Base PM Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	51	1.0	0.195	8.9	LOS A	1.1	8.0	0.70	0.80	50.0
23	R2	91	1.0	0.195	12.4	LOS B	1.1	8.0	0.70	0.80	49.9
Approach		142	1.0	0.195	11.1	LOS B	1.1	8.0	0.70	0.80	50.0
NorthEast: Parsonage Street											
24	L2	145	1.0	0.478	5.0	LOS A	4.0	28.5	0.26	0.58	51.9
26a	R1	667	1.0	0.478	7.4	LOS A	4.0	28.5	0.26	0.58	52.1
Approach		812	1.0	0.478	7.0	LOS A	4.0	28.5	0.26	0.58	52.1
West: Parsonage Street											
10a	L1	505	1.0	0.430	5.0	LOS A	3.5	24.9	0.38	0.51	53.5
12a	R1	55	1.0	0.430	7.7	LOS A	3.5	24.9	0.38	0.51	53.1
Approach		560	1.0	0.430	5.3	LOS A	3.5	24.9	0.38	0.51	53.5
All Vehicles		1514	1.0	0.478	6.7	LOS A	4.0	28.5	0.35	0.58	52.4

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Tuesday, 26 April 2016 10:26:52 AM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2014 PM Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	114	1.0	0.151	6.2	LOS A	0.8	5.8	0.50	0.63	52.8
23	R2	32	1.0	0.151	9.7	LOS A	0.8	5.8	0.50	0.63	52.6
Approach		146	1.0	0.151	6.9	LOS A	0.8	5.8	0.50	0.63	52.8
NorthEast: Parsonage Street											
24	L2	25	1.0	0.238	5.7	LOS A	1.4	9.8	0.41	0.64	51.3
26a	R1	310	1.0	0.238	8.1	LOS A	1.4	9.8	0.41	0.64	51.6
Approach		335	1.0	0.238	7.9	LOS A	1.4	9.8	0.41	0.64	51.5
West: Parsonage Street											
10a	L1	79	1.0	0.224	4.5	LOS A	1.4	10.1	0.16	0.58	53.0
12a	R1	242	1.0	0.224	7.2	LOS A	1.4	10.1	0.16	0.58	52.6
Approach		321	1.0	0.224	6.6	LOS A	1.4	10.1	0.16	0.58	52.7
All Vehicles		802	1.0	0.238	7.2	LOS A	1.4	10.1	0.33	0.61	52.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 20 April 2016 2:43:31 PM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 Stage A PM Revised Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	75	1.0	0.519	16.8	LOS B	4.4	31.1	0.92	1.08	45.0
23	R2	211	1.0	0.519	20.3	LOS C	4.4	31.1	0.92	1.08	44.9
23b	R3	1	0.0	0.519	21.0	LOS C	4.4	31.1	0.92	1.08	45.1
Approach		287	1.0	0.519	19.4	LOS B	4.4	31.1	0.92	1.08	45.0
East: Stage A Egress											
4b	L3	14	0.0	0.519	15.4	LOS B	4.4	30.5	0.89	1.06	45.2
5	T1	71	0.0	0.519	15.1	LOS B	4.4	30.5	0.89	1.06	46.0
6b	R3	235	0.0	0.519	19.0	LOS B	4.4	30.5	0.89	1.06	46.0
Approach		320	0.0	0.519	18.0	LOS B	4.4	30.5	0.89	1.06	45.9
NorthEast: Parsonage Street											
24b	L3	255	0.0	0.151	4.3	LOS A	0.0	0.0	0.00	0.54	54.6
24	L2	160	1.0	0.427	4.4	LOS A	4.0	27.9	0.29	0.57	52.3
26a	R1	623	1.0	0.427	7.3	LOS A	4.0	27.9	0.29	0.57	52.2
Approach		1038	0.8	0.427	6.1	LOS A	4.0	27.9	0.22	0.56	52.8
West: Parsonage Street											
10a	L1	543	1.0	0.699	11.9	LOS B	8.1	57.5	0.89	0.98	49.3
11	T1	1	0.0	0.699	12.2	LOS B	8.1	57.5	0.89	0.98	49.6
12a	R1	59	1.0	0.699	14.6	LOS B	8.1	57.5	0.89	0.98	49.0
Approach		603	1.0	0.699	12.1	LOS B	8.1	57.5	0.89	0.98	49.3
All Vehicles		2248	0.7	0.699	11.1	LOS B	8.1	57.5	0.58	0.81	49.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Wednesday, 27 April 2016 8:25:13 AM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: 2026 Stage A AM Revised Single Lane Parsonage St and Loop Rd

Loop Rd & Parsonage St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Loop Road											
21a	L1	27	1.0	0.191	8.6	LOS A	1.1	7.9	0.70	0.80	49.8
23	R2	112	1.0	0.191	12.1	LOS B	1.1	7.9	0.70	0.80	49.7
23b	R3	1	0.0	0.191	12.9	LOS B	1.1	7.9	0.70	0.80	50.0
Approach		140	1.0	0.191	11.5	LOS B	1.1	7.9	0.70	0.80	49.7
East: Stage A Egress											
4b	L3	16	0.0	0.407	12.2	LOS B	2.9	20.0	0.85	0.95	47.2
5	T1	68	0.0	0.407	11.9	LOS B	2.9	20.0	0.85	0.95	48.1
6b	R3	171	0.0	0.407	15.8	LOS B	2.9	20.0	0.85	0.95	48.0
Approach		255	0.0	0.407	14.6	LOS B	2.9	20.0	0.85	0.95	48.0
NorthEast: Parsonage Street											
24b	L3	321	0.0	0.191	4.3	LOS A	0.0	0.0	0.00	0.54	54.6
24	L2	151	1.0	0.346	5.0	LOS A	2.7	19.4	0.51	0.62	51.8
26a	R1	403	1.0	0.346	8.0	LOS A	2.7	19.4	0.51	0.62	51.8
Approach		875	0.6	0.346	6.1	LOS A	2.7	19.4	0.33	0.59	52.8
West: Parsonage Street											
10a	L1	505	1.0	0.722	9.2	LOS A	9.0	63.6	0.83	0.81	50.7
11	T1	1	0.0	0.722	9.5	LOS A	9.0	63.6	0.83	0.81	51.0
12a	R1	244	1.0	0.722	11.9	LOS B	9.0	63.6	0.83	0.81	50.4
Approach		750	1.0	0.722	10.1	LOS B	9.0	63.6	0.83	0.81	50.6
All Vehicles		2020	0.7	0.722	9.0	LOS A	9.0	63.6	0.60	0.73	51.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: ROAD DELAY SOLUTIONS PTY LTD | Processed: Tuesday, 26 April 2016 12:06:18 PM
Project: D:\Documents\Meadowbank\Sidra Models\2026 Parsonage and Loop Road Stage A.sip6

MOVEMENT SUMMARY

Site: Existing AM 2014 Constitution and Belmore

Belmore St & Constitution Rd
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Belmore St (NE)											
25	T1	27	0.0	0.042	28.6	LOS C	1.0	7.3	0.70	0.52	36.0
26	R2	106	1.6	0.385	55.1	LOS E	5.7	40.6	0.95	0.78	28.3
Approach		133	1.3	0.385	49.8	LOS D	5.7	40.6	0.90	0.73	29.6
NorthWest: Constitution Rd (NW)											
27	L2	216	1.5	0.154	8.5	LOS A	3.3	23.1	0.28	0.62	44.4
29	R2	405	0.7	0.387	19.8	LOS B	12.9	91.1	0.60	0.74	39.0
Approach		621	1.0	0.387	15.9	LOS B	12.9	91.1	0.49	0.70	40.7
SouthWest: Belmore St (SW)											
30	L2	388	0.1	0.287	9.6	LOS A	7.1	49.5	0.34	0.65	43.8
31	T1	84	0.0	0.323	51.8	LOS D	4.5	31.8	0.95	0.74	29.3
Approach		472	0.1	0.323	17.1	LOS B	7.1	49.5	0.45	0.67	40.3
All Vehicles		1226	0.7	0.387	20.0	LOS C	12.9	91.1	0.52	0.69	39.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P6	NorthEast Full Crossing	3	16.0	LOS B	0.0	0.0	0.52	0.52
P7	NorthWest Full Crossing	2	54.2	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		5	31.3	LOS D			0.69	0.69

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: Existing PM 2014 Constitution and Belmore

Belmore St & Constitution Rd
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Belmore St (NE)											
25	T1	35	0.0	0.057	30.2	LOS C	1.4	9.8	0.73	0.54	35.4
26	R2	117	2.4	0.481	57.9	LOS E	6.5	46.6	0.97	0.79	27.7
Approach		152	1.8	0.481	51.5	LOS D	6.5	46.6	0.92	0.73	29.2
NorthWest: Constitution Rd (NW)											
27	L2	232	0.5	0.164	8.5	LOS A	3.5	24.8	0.29	0.62	44.4
29	R2	281	0.0	0.259	17.5	LOS B	7.9	55.4	0.52	0.70	40.0
Approach		513	0.2	0.259	13.4	LOS B	7.9	55.4	0.42	0.67	41.9
SouthWest: Belmore St (SW)											
30	L2	674	0.2	0.489	10.1	LOS B	14.4	101.1	0.40	0.68	43.6
31	T1	52	0.0	0.200	50.7	LOS D	2.8	19.3	0.93	0.70	29.5
Approach		726	0.2	0.489	13.0	LOS B	14.4	101.1	0.44	0.69	42.1
All Vehicles		1391	0.4	0.489	17.4	LOS B	14.4	101.1	0.48	0.68	40.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P6	NorthEast Full Crossing	3	15.0	LOS B	0.0	0.0	0.50	0.50
P7	NorthWest Full Crossing	2	54.2	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		5	30.7	LOS D			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 AM Base Constitution and Belmore

Belmore St & Constitution Rd
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Belmore St (NE)											
25	T1	45	1.0	0.048	17.2	LOS B	1.4	9.6	0.55	0.43	40.5
26	R2	404	1.6	0.733	45.8	LOS D	21.5	152.4	0.96	0.86	30.6
Approach		449	1.5	0.733	42.9	LOS D	21.5	152.4	0.92	0.82	31.3
NorthWest: Constitution Rd (NW)											
27	L2	644	1.0	0.458	9.9	LOS A	13.3	93.6	0.39	0.68	43.7
29	R2	560	1.0	0.729	36.0	LOS D	27.3	192.8	0.90	0.86	33.3
Approach		1204	1.0	0.729	22.0	LOS C	27.3	192.8	0.63	0.76	38.1
SouthWest: Belmore St (SW)											
30	L2	308	1.0	0.287	16.8	LOS B	8.6	60.4	0.52	0.70	40.3
31	T1	143	0.0	0.550	53.7	LOS D	8.0	56.3	0.98	0.79	28.8
Approach		451	0.7	0.550	28.5	LOS C	8.6	60.4	0.67	0.73	35.8
All Vehicles		2104	1.0	0.733	27.9	LOS C	27.3	192.8	0.70	0.77	36.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P6	NorthEast Full Crossing	3	26.7	LOS C	0.0	0.0	0.67	0.67
P7	NorthWest Full Crossing	2	54.2	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		5	37.7	LOS D			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 PM Base Constitution and Belmore

Belmore St & Constitution Rd
Signals - Fixed Time Isolated   Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Belmore St (NE)											
25	T1	58	1.0	0.046	9.2	LOS A	1.4	9.9	0.37	0.29	44.4
26	R2	797	1.0	0.859	41.2	LOS D	50.9	359.3	0.95	0.92	31.8
Approach		855	1.0	0.859	39.0	LOS D	50.9	359.3	0.91	0.87	32.4
NorthWest: Constitution Rd (NW)											
27	L2	451	1.0	0.305	8.3	LOS A	7.9	56.0	0.28	0.63	44.5
29	R2	408	1.0	0.844	65.6	LOS E	29.5	208.5	1.00	0.93	26.2
Approach		859	1.0	0.844	35.5	LOS D	29.5	208.5	0.62	0.77	33.4
SouthWest: Belmore St (SW)											
30	L2	498	1.0	0.673	41.3	LOS D	28.3	199.9	0.87	0.85	31.7
31	T1	31	0.0	0.144	63.5	LOS E	2.0	14.1	0.94	0.69	26.8
Approach		529	0.9	0.673	42.6	LOS D	28.3	199.9	0.88	0.84	31.4
All Vehicles		2243	1.0	0.859	38.5	LOS D	50.9	359.3	0.79	0.83	32.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P6	NorthEast Full Crossing	3	47.2	LOS E	0.0	0.0	0.81	0.81
P7	NorthWest Full Crossing	2	66.6	LOS F	0.0	0.0	0.96	0.96
All Pedestrians		5	55.0	LOS E			0.87	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 PM Stage A Constitution and Belmore

Belmore St & Constitution Rd
Signals - Fixed Time Isolated   Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Belmore St (NE)											
25	T1	50	1.0	0.041	10.7	LOS B	1.3	9.2	0.40	0.31	43.6
26	R2	754	1.0	0.859	44.4	LOS D	49.4	348.5	0.96	0.92	30.9
Approach		804	1.0	0.859	42.3	LOS D	49.4	348.5	0.93	0.88	31.5
NorthWest: Constitution Rd (NW)											
27	L2	438	1.0	0.296	8.3	LOS A	7.6	53.9	0.27	0.63	44.5
29	R2	453	1.0	0.848	63.1	LOS E	32.6	229.9	1.00	0.93	26.7
Approach		891	1.0	0.848	36.1	LOS D	32.6	229.9	0.64	0.78	33.2
SouthWest: Belmore St (SW)											
30	L2	515	1.0	0.652	38.3	LOS D	28.2	199.2	0.84	0.84	32.6
31	T1	35	0.0	0.163	63.7	LOS E	2.3	15.9	0.94	0.69	26.7
Approach		550	0.9	0.652	39.9	LOS D	28.2	199.2	0.85	0.83	32.1
All Vehicles		2245	1.0	0.859	39.3	LOS D	49.4	348.5	0.80	0.83	32.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P6	NorthEast Full Crossing	3	44.0	LOS E	0.0	0.0	0.78	0.78
P7	NorthWest Full Crossing	2	66.6	LOS F	0.0	0.0	0.96	0.96
All Pedestrians		5	53.1	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: Existing AM 2014

Constitution Rd & Bowden St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	33	7.8	0.399	5.4	LOS A	2.9	20.7	0.53	0.60	45.0
22	T1	266	1.0	0.399	5.1	LOS A	2.9	20.7	0.53	0.60	45.8
23	R2	136	0.6	0.399	8.1	LOS A	2.9	20.7	0.53	0.60	45.6
Approach		435	1.4	0.399	6.1	LOS A	2.9	20.7	0.53	0.60	45.7
NorthEast: Bowden St (NE)											
24	L2	78	0.0	0.358	7.8	LOS A	2.4	17.0	0.76	0.82	43.9
25	T1	69	4.3	0.358	7.8	LOS A	2.4	17.0	0.76	0.82	44.5
26	R2	119	3.5	0.358	10.8	LOS B	2.4	17.0	0.76	0.82	44.3
Approach		266	2.7	0.358	9.2	LOS A	2.4	17.0	0.76	0.82	44.2
NorthWest: Constitution Rd (NW)											
27	L2	142	2.5	0.615	7.7	LOS A	5.8	41.0	0.74	0.76	44.7
28	T1	462	0.6	0.615	7.4	LOS A	5.8	41.0	0.74	0.76	45.4
29	R2	11	0.0	0.615	10.4	LOS B	5.8	41.0	0.74	0.76	45.2
Approach		615	1.0	0.615	7.5	LOS A	5.8	41.0	0.74	0.76	45.2
SouthWest: Bowden St (SW)											
30	L2	6	0.0	0.234	7.2	LOS A	1.4	10.0	0.66	0.75	44.2
31	T1	93	3.7	0.234	7.2	LOS A	1.4	10.0	0.66	0.75	44.8
32	R2	87	3.6	0.234	10.2	LOS B	1.4	10.0	0.66	0.75	44.6
Approach		186	3.5	0.234	8.6	LOS A	1.4	10.0	0.66	0.75	44.7
All Vehicles		1502	1.7	0.615	7.5	LOS A	5.8	41.0	0.67	0.72	45.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: Existing PM 2014

Constitution Rd & Bowden St
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	27	0.0	0.689	8.2	LOS A	8.0	56.4	0.91	0.99	42.8
22	T1	498	0.9	0.689	11.1	LOS B	8.0	56.4	0.91	0.99	43.4
23	R2	55	1.4	0.689	14.1	LOS B	8.0	56.4	0.91	0.99	43.2
Approach		580	0.9	0.689	11.2	LOS B	8.0	56.4	0.91	0.99	43.4
NorthEast: Bowden St (NE)											
24	L2	76	0.0	0.583	8.1	LOS A	5.2	36.5	0.76	0.83	43.4
25	T1	94	1.2	0.583	8.0	LOS A	5.2	36.5	0.76	0.83	44.0
26	R2	370	0.4	0.583	11.0	LOS B	5.2	36.5	0.76	0.83	43.9
Approach		540	0.5	0.583	10.1	LOS B	5.2	36.5	0.76	0.83	43.8
NorthWest: Constitution Rd (NW)											
27	L2	59	2.7	0.336	5.4	LOS A	2.3	16.1	0.52	0.57	45.5
28	T1	297	0.4	0.336	5.1	LOS A	2.3	16.1	0.52	0.57	46.2
29	R2	1	12.5	0.336	8.4	LOS A	2.3	16.1	0.52	0.57	45.8
Approach		357	0.8	0.336	5.2	LOS A	2.3	16.1	0.52	0.57	46.1
SouthWest: Bowden St (SW)											
30	L2	24	0.0	0.365	12.1	LOS B	2.6	17.9	0.91	0.96	41.8
31	T1	75	1.0	0.365	12.0	LOS B	2.6	17.9	0.91	0.96	42.4
32	R2	86	0.0	0.365	14.9	LOS B	2.6	17.9	0.91	0.96	42.2
Approach		185	0.4	0.365	13.4	LOS B	2.6	17.9	0.91	0.96	42.2
All Vehicles		1662	0.7	0.689	9.8	LOS A	8.0	56.4	0.78	0.84	43.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 2026 AM Base

Constitution Rd & Bowden St
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	21	1.0	0.137	14.1	LOS B	4.7	33.4	0.39	0.37	43.6
22	T1	632	2.0	0.358	11.0	LOS B	14.7	104.5	0.45	0.41	43.4
23	R2	43	1.0	0.241	48.9	LOS D	2.3	16.2	0.96	0.73	29.9
Approach		696	1.9	0.358	13.4	LOS B	14.7	104.5	0.48	0.43	42.3
NorthEast: Bowden St (NE)											
24	L2	265	1.0	0.884	74.1	LOS E	26.0	183.7	0.99	0.97	24.9
25	T1	72	1.0	0.884	69.5	LOS E	26.0	183.7	0.99	0.97	25.0
26	R2	107	1.0	1.072	174.1	LOS F	12.6	89.1	1.00	1.28	14.9
Approach		444	1.0	1.072	97.5	LOS F	26.0	183.7	0.99	1.04	21.4
NorthWest: Constitution Rd (NW)											
27	L2	180	1.0	0.300	20.9	LOS C	12.2	86.4	0.54	0.60	39.5
28	T1	896	2.0	0.788	20.4	LOS C	34.4	245.1	0.68	0.64	38.9
29	R2	96	1.0	0.942	101.1	LOS F	8.3	58.6	1.00	1.05	21.0
Approach		1172	1.8	0.942	27.1	LOS C	34.4	245.1	0.68	0.67	36.5
SouthWest: Bowden St (SW)											
30	L2	206	1.0	0.425	54.8	LOS D	12.6	88.7	0.89	0.80	28.4
31	T1	170	1.0	0.810	70.3	LOS E	15.9	112.5	1.00	0.94	25.4
32	R2	44	1.0	0.810	74.8	LOS E	15.9	112.5	1.00	0.94	25.4
Approach		420	1.0	0.810	63.2	LOS E	15.9	112.5	0.94	0.87	26.8
All Vehicles		2732	1.6	1.072	40.6	LOS D	34.4	245.1	0.72	0.70	32.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	67.4	LOS F	0.2	0.2	0.95	0.95
P6	NorthEast Full Crossing	53	18.3	LOS B	0.1	0.1	0.49	0.49
P7	NorthWest Full Crossing	53	67.4	LOS F	0.2	0.2	0.95	0.95
P8	SouthWest Full Crossing	53	12.8	LOS B	0.1	0.1	0.41	0.41
All Pedestrians		211	41.5	LOS E			0.70	0.70

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 PM Base

Constitution Rd & Bowden St
Signals - Fixed Time Isolated   Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	34	1.0	0.340	22.7	LOS C	8.5	60.5	0.71	0.62	39.5
22	T1	903	2.0	0.893	31.9	LOS C	30.8	219.1	0.85	0.90	34.8
23	R2	143	1.0	0.421	23.5	LOS C	3.0	21.0	0.93	0.77	37.8
Approach		1080	1.8	0.893	30.5	LOS C	30.8	219.1	0.85	0.87	35.3
NorthEast: Bowden St (NE)											
24	L2	333	1.0	0.864	41.7	LOS D	24.0	169.2	0.94	0.98	32.1
25	T1	182	1.0	0.864	37.1	LOS D	24.0	169.2	0.94	0.98	32.3
26	R2	158	1.0	0.484	37.0	LOS D	6.2	43.4	0.91	0.79	33.3
Approach		673	1.0	0.864	39.3	LOS D	24.0	169.2	0.93	0.94	32.5
NorthWest: Constitution Rd (NW)											
27	L2	73	1.0	0.317	32.5	LOS C	6.1	42.9	0.84	0.72	35.3
28	T1	492	2.0	0.832	36.2	LOS D	17.7	125.8	0.93	0.92	33.4
29	R2	151	1.0	0.889	59.6	LOS E	7.8	55.1	1.00	1.09	27.5
Approach		716	1.7	0.889	40.7	LOS D	17.7	125.8	0.94	0.94	32.1
SouthWest: Bowden St (SW)											
30	L2	83	1.0	0.100	20.6	LOS C	2.1	15.1	0.62	0.69	38.7
31	T1	100	1.0	0.264	27.5	LOS C	4.6	32.5	0.82	0.69	36.0
32	R2	33	1.0	0.264	32.1	LOS C	4.6	32.5	0.82	0.69	36.0
Approach		216	1.0	0.264	25.6	LOS C	4.6	32.5	0.74	0.69	37.0
All Vehicles		2685	1.5	0.893	35.1	LOS D	30.8	219.1	0.89	0.89	33.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	50	36.5	LOS D	0.1	0.1	0.90	0.90
P6	NorthEast Full Crossing	50	33.0	LOS D	0.1	0.1	0.86	0.86
P7	NorthWest Full Crossing	50	36.5	LOS D	0.1	0.1	0.90	0.90
P8	SouthWest Full Crossing	50	22.1	LOS C	0.1	0.1	0.70	0.70
All Pedestrians		200	32.0	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 AM Stage A

Constitution Rd & Bowden St
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	15	1.0	0.179	14.4	LOS B	6.4	45.4	0.40	0.37	43.5
22	T1	786	2.0	0.470	11.5	LOS B	18.6	132.7	0.47	0.43	43.2
23	R2	48	1.0	0.269	49.1	LOS D	2.6	18.2	0.97	0.73	29.9
Approach		849	1.9	0.470	13.7	LOS B	18.6	132.7	0.50	0.44	42.1
NorthEast: Bowden St (NE)											
24	L2	283	1.0	0.904	79.1	LOS E	28.8	203.6	0.99	1.01	24.1
25	T1	72	1.0	0.904	74.5	LOS E	28.8	203.6	0.99	1.01	24.2
26	R2	103	1.0	1.090	270.1	LOS F	16.2	114.4	1.00	1.59	10.7
Approach		458	1.0	1.090	121.3	LOS F	28.8	203.6	1.00	1.14	18.8
NorthWest: Constitution Rd (NW)											
27	L2	183	1.0	0.296	20.8	LOS C	12.0	84.7	0.54	0.61	39.5
28	T1	873	2.0	0.776	20.3	LOS C	33.4	237.5	0.67	0.63	39.0
29	R2	89	1.0	0.873	92.1	LOS F	7.3	51.3	1.00	0.99	22.1
Approach		1145	1.8	0.873	25.9	LOS C	33.4	237.5	0.68	0.66	36.9
SouthWest: Bowden St (SW)											
30	L2	221	1.0	0.456	55.2	LOS E	13.6	96.0	0.90	0.81	28.3
31	T1	170	1.0	0.798	69.5	LOS E	15.7	110.6	1.00	0.93	25.6
32	R2	42	1.0	0.798	74.1	LOS E	15.7	110.6	1.00	0.93	25.6
Approach		433	1.0	0.798	62.7	LOS E	15.7	110.6	0.95	0.87	26.9
All Vehicles		2885	1.6	1.090	43.0	LOS D	33.4	237.5	0.72	0.70	31.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
The results of iterative calculations indicate a somewhat unstable solution. See the Diagnostics section in the Detailed Output report.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	50	67.4	LOS F	0.2	0.2	0.95	0.95
P6	NorthEast Full Crossing	50	12.8	LOS B	0.1	0.1	0.41	0.41
P7	NorthWest Full Crossing	50	67.4	LOS F	0.2	0.2	0.95	0.95
P8	SouthWest Full Crossing	50	12.8	LOS B	0.1	0.1	0.41	0.41
All Pedestrians		200	40.1	LOS E			0.68	0.68

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 2026 PM Stage A

Constitution Rd & Bowden St
Signals - Fixed Time Isolated   Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Constitution Rd (SE)											
21	L2	122	1.0	0.339	22.7	LOS C	8.4	59.3	0.71	0.67	38.9
22	T1	809	2.0	0.890	33.1	LOS C	30.4	216.8	0.86	0.94	34.3
23	R2	141	1.0	0.511	25.3	LOS C	3.2	22.3	0.97	0.78	37.0
Approach		1072	1.8	0.890	30.9	LOS C	30.4	216.8	0.86	0.88	35.1
NorthEast: Bowden St (NE)											
24	L2	346	1.0	0.882	44.0	LOS D	25.9	182.8	0.94	1.01	31.5
25	T1	189	1.0	0.882	39.4	LOS D	25.9	182.8	0.94	1.01	31.7
26	R2	158	1.0	0.465	36.0	LOS D	6.1	42.7	0.89	0.79	33.6
Approach		693	1.0	0.882	40.9	LOS D	25.9	182.8	0.93	0.96	32.0
NorthWest: Constitution Rd (NW)											
27	L2	73	1.0	0.305	30.8	LOS C	6.1	43.3	0.81	0.71	35.9
28	T1	512	2.0	0.800	32.6	LOS C	17.2	122.7	0.91	0.87	34.5
29	R2	134	1.0	0.901	61.5	LOS E	7.0	49.6	1.00	1.11	27.1
Approach		719	1.7	0.901	37.8	LOS D	17.2	122.7	0.92	0.90	32.9
SouthWest: Bowden St (SW)											
30	L2	83	1.0	0.100	20.6	LOS C	2.1	15.1	0.62	0.69	38.7
31	T1	100	1.0	0.254	26.6	LOS C	4.5	31.9	0.81	0.68	36.3
32	R2	33	1.0	0.254	31.2	LOS C	4.5	31.9	0.81	0.68	36.3
Approach		216	1.0	0.254	25.0	LOS C	4.5	31.9	0.74	0.68	37.2
All Vehicles		2700	1.5	0.901	34.8	LOS C	30.4	216.8	0.88	0.89	33.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	50	35.6	LOS D	0.1	0.1	0.89	0.89
P6	NorthEast Full Crossing	50	31.3	LOS D	0.1	0.1	0.84	0.84
P7	NorthWest Full Crossing	50	35.6	LOS D	0.1	0.1	0.89	0.89
P8	SouthWest Full Crossing	50	22.1	LOS C	0.1	0.1	0.70	0.70
All Pedestrians		200	31.2	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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