



# **WATERLOO METRO QUARTER OVERSTATION DEVELOPMENT**

## **Environmental Impact Statement Appendix I - Transport, Traffic and Parking Impact Assessment**

### **SSD-10441 Amending Concept DA**

State Significant Development,  
Development Application

Prepared for **WL Developer Pty Ltd**

30 September 2020

Reference	Description
Applicable SSD Applications	SSD - 10441 Amending Concept DA
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## 1. Glossary and abbreviations

Reference	Description
ACHAR	Aboriginal Cultural Heritage Assessment Report
ADG	Apartment Design Guide
AHD	Australian height datum
AQIA	Air Quality Impact Assessment
BC Act	Biodiversity Conservation Act 2016
BCA	Building Code of Australia
BC Reg	Biodiversity Conservation Regulation 2017
BDAR	Biodiversity Development Assessment Report
CEEC	critically endangered ecological community
CIV	capital investment value
CMP	Construction Management Plan
Concept DA	A concept DA is a staged application often referred to as a 'Stage 1' DA. The subject application constitutes a detailed subsequent stage application to an approved concept DA (SSD 9393) lodged under section 4.22 of the EP&A Act.
Council	City of Sydney Council
CPTED	Crime Prevention Through Environmental Design
CSSI approval	critical State significant infrastructure approval
CTMP	Construction Traffic Management Plan
DA	development application
DPIE	NSW Department of Planning, Industry and Environment
DRP	Design Review Panel
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	NSW Environment Protection Authority
EPA Regulation	Environmental Planning and Assessment Regulation 2000

Reference	Description
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	ecologically sustainable design
FSMP	Freight and Servicing Management Plan
GANSW	NSW Government Architect's Office
GFA	gross floor area
HIA	Heritage Impact Assessment
IAP	Interchange Access Plan
LGA	Local Government Area
NCC	National Construction Code
OSD	over station development
PIR	Preferred Infrastructure Report
POM	Plan of Management
PSI	Preliminary Site Investigation
RMS	Roads and Maritime Services
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEPP 55	State Environmental Planning Policy No 55—Remediation of Land
SEPP 65	State Environmental Planning Policy No. 65 - Design Quality of Residential Apartment Development
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2009
SREP Sydney Harbour	State Regional Environmental Plan (Sydney Harbour Catchment) 2005
SSD	State significant development
SSD DA	State significant development application
SLEP	Sydney Local Environmental Plan 2012

Reference	Description
Transport for NSW	Transport for New South Wales
TIA	Traffic Impact Assessment
The proposal	The proposed development which is the subject of the detailed SSD DA
The site	The site which is the subject of the detailed SSD DA
TTPIA	Transport, Traffic and Parking Impact Assessment
VIA	Visual Impact Assessment
WMQ	Waterloo Metro Quarter
WMP	Waste Management Plan
WSUD	water sensitive urban design

## 2. Executive summary

This report has been prepared by **ptc.** to accompany a concept State significant development (SSD) development application (DA) for the Waterloo Metro Quarter over station development (OSD). This concept SSD DA is submitted as an 'amending DA', that modifies the previously approved concept SSD DA issued for the site (SSD 9393). The modifications contained within the amending DA relate to the northern precinct and central building only. No change is proposed to the original concept SSD DA as it relates to the southern precinct of the Waterloo Metro Quarter site.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the amending concept SSD DA (SSD 10441).

This report concludes that the proposed amending concept DA for the Waterloo Metro Quarter OSD is suitable and warrants approval.

This Amending DA Traffic Impact Assessment has been prepared concurrently with 4 (no.) Detailed Development Application's across the precinct. The provision for parking contemplated in these Detailed DA's (the reference scheme) has been utilised to demonstrate the benefits associated with the proposed Amendment. This Amending DA demonstrates that the proposed amended will improve the traffic outcome associated with the site whilst maintaining the permissible parking rates approved in the Concept Approval SDD9393.

The change in floor areas and yield within the amended scheme results in a reduction in the maximum permissible parking provision from 380 spaces in the approved concept DA to 272 under the amended scheme. High level design of the basement indicates a provision of approximately 150 spaces, which is a further improvement over the maximum permissible parking provision.

The traffic assessment supporting the approved concept concluded that the site would generate 98 vehicle trips during the peak periods with no relationship to the parking provision. However, this did not include an allowance for the non-residential areas within the development. In order to provide a comparison based on the proposed changes to the yield sought by this application, it has been assessed that the total yield of the approved concept would generate 292 peak hour vehicle trips. The amending DA will be subject to a limited parking provision (maintaining the permissible parking rates approved in the Concept Approval SDD9393), which will act to constrain the traffic activity.

Parking will be provided within the shared Basement car park with access via Cope Street and the proposed Church Square shared zone. The proposed overall parking provision comprises:

- 150 car parking spaces;
- 5 courier service vehicle bays;
- 13 motorcycle spaces;
- 638 bicycle parking spaces; and
- End of trip facilities including 300 lockers and 34 shower/change cubicles.

The estimated traffic generation associated with the amended development is approximately 57 trips in the peak hour, which compares with the Concept Approval traffic generation of 98 peak hour trips. This represents a reduction of 41 trips as a result of the changes to the yield and the proposed parking provision.

A SIDRA traffic modelling assessment of the estimated traffic generation associated with the Amending Concept SSD DA has been undertaken for the following key intersections surrounding the Waterloo Metro Quarter site:

- Henderson Road and Wyndham Street (4 arm signalised intersection)
- Botany Road, Henderson Road and Raglan Street (4 arm signalised intersection)
- Raglan Street and Cope Street (4 arm roundabout)
- Cope Street and Wellington Street (4 arm roundabout) and
- Botany Road, Buckland Street and Wellington Street (4 arm signalised intersection).

Traffic modelling has been undertaken for the proposed development, including growth to 2036. The modelling indicates that the external road network will operate at acceptable levels of service, or perform at a level of service better than that of the approved development SSD 9393.

Vehicle access to the development is proposed from Botany Road, Cope Street (via the Church Square shred zone) and Wellington Street, which is consistent with the concept approved layout within SSD 9393.

### 3. Introduction

This report has been prepared to accompany a concept SSD DA for the over station development (OSD) at the Waterloo Metro Quarter site. The concept DA seeks consent for an amended building envelope and description of development for the northern precinct and central building of the Waterloo Quarter site approved under SSD 9393. For clarity, this concept DA (formerly referred to as a 'Stage 1' DA) is made under Section 4.22 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Minister for Planning, or their delegate, is the consent authority for the SSD DA and this application is lodged with the NSW Department of Planning, Industry and Environment (DPIE) for assessment.

The concept DA seeks to modify the approved building envelope for the northern precinct (previously comprising 'Building A', 'Building B', 'Building C' and 'Building D' under SSD 9393) through:

- increasing the maximum building height for the southern portion of the building envelope from RL56.2 to RL72.60
- removing the 'tower component' of the northern precinct, reducing the overall height of the tower envelope from RL116.9 to RL90.40, to enable the redistribution of floor space to commercial office floor plates
- amending the description of development to refer to a mid-rise (approximately 17 storey) commercial office building, comprising approximately 34,125sqm of commercial office floor space within the northern portion of the site, rather than a third residential tower.

The concept DA seeks to modify the central building approved building envelope (previously comprising 'Building E' under SSD 9393) through:

- modifying the eastern extent of the podium envelope.

This proposal will not exceed the permissible building height for the site under the Sydney Local Environmental Plan 2012 (SLEP) or the maximum height approved under SSD 9393. Separate detailed SSD DA (s) will be lodged concurrently for the detailed design, construction and operation of the northern precinct and central building. No changes are proposed to the original concept DA as it relates to the southern precinct.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 9 April 2020 and issued for the detailed SSD DA. Specifically, this report has been prepared to respond to the SEARs requirements summarised below.



Item	Description of Requirement	Section Reference (this report)
8	<b>Traffic, parking and access</b> The EIS shall:	
	Include a traffic, public transport, point to point transport, pedestrian, bicycle parking, freight, servicing and access assessment	Section 7, Section 8, Section 9, Section 10, Section 11, Section 12
	Identify any changes or additional impacts of the Amending Concept Proposal on the traffic and transport network and pedestrian and cyclist safety and amenity when compared to the existing approved Concept Approval (SSD 9393). Any associated mitigation / management measures are to be included in the EIS.	Section 7, Section 8, Section 9, Section 10, Section 11, Section 12

**Table 1 - SEARs Requirements (SSD 10441)**

### 3.1 Conditions of Concept Approval (SSD 9393)

Item	Description of Requirement	Section Reference (this report)
B8	Future development applications shall reduce total car parking provision to reduce private car ownership and promote use of active and public transport. Future development applications must demonstrate compliance with:	
(a)	The maximum number of car spaces to be provided for all residential accommodation within the development is limited to 170 spaces, including residents' spaces and residential car share spaces but excluding visitor spaces and service vehicle spaces.	Section 8.2
(b)	The allocation of residential car parking spaces, up to the maximum of 170 spaces must not exceed the following maximum rates: <ul style="list-style-type: none"> <li>(i) 0.1 space per studio dwelling</li> <li>(ii) 0.3 parking spaces per 1 bedroom dwelling</li> <li>(iii) 0.7 parking spaces per 2 bedroom dwelling</li> <li>(iv) 1 parking space per 3 bedroom or more dwelling</li> <li>(v) Residential car share parking rate of 1 space per 50 residential car parking spaces provided</li> </ul>	Section 8.2
(c)	Non-residential car parking to be provided in accordance with the following:	Section 8.2

Item	Description of Requirement	Section Reference (this report)
	(i) A maximum of 1 space for 435m <sup>2</sup> of GFA for any commercial uses	
	(ii) A maximum of 2 spaces for use of the Waterloo Congregational Church	
	(iii) Non-residential car share parking at rate of 1 space per 30 non-residential car parking spaces.	

***Table 2 - Conditions of Concept Approval (SSD 9393)***

#### 4. The site

The site is located within the City of Sydney Local Government Area (LGA). The site is situated approximately 3.3 kilometres south of Sydney CBD and approximately 8 kilometres northeast of Sydney International Airport within the suburb of Waterloo.

The Waterloo Metro Quarter site (the site) comprises land to the west of Cope Street, east of Botany Road, south of Raglan Street and north of Wellington Street (refer to Figure 1). The heritage listed Waterloo Congregational Church located at 103-105 Botany Road is within this street block but does not form part of the site.

The site is a rectangular shaped allotment with an overall site area of approximately 1.287 hectares.

The site comprises the following allotments and legal description. Following consolidation by Sydney Metro (the Principal) the land will be set out in deposited plan DP1257150.

- 1368 Raglan Street (Lot 4 DP 215751)
- 59 Botany Road (Lot 5 DP 215751)
- 65 Botany Road (Lot 1 DP 814205)
- 67 Botany Road (Lot 1 DP 228641)
- 124-128 Cope Street (Lot 2 DP 228641)
- 69-83 Botany Road (Lot 1, DP 1084919)
- 130-134 Cope Street (Lot 12 DP 399757)
- 136-144 Cope Street (Lots A-E DP 108312)
- 85 Botany Road (Lot 1 DP 27454)
- 87 Botany Road (Lot 2 DP 27454)
- 89-91 Botany Road (Lot 1 DP 996765)
- 93-101 Botany Road (Lot 1 DP 433969 and Lot 1 DP 738891)
- 119 Botany Road (Lot 1 DP 205942 and Lot 1 DP 436831)
- 156-160 Cope Street (Lot 31 DP 805384)
- 107-117A Botany Road (Lot 32 DP 805384 and Lot A DP 408116)
- 170-174 Cope Street (Lot 2 DP 205942).

The boundaries of the site are identified in Figure 5.1. The site is reasonably flat with a slight fall to the south. and previously accommodated three to five storey commercial, light industrial and shop top housing buildings. All structures except for an office building at the corner of Botany Road and Wellington Street have been demolished to facilitate construction of the new Sydney Metro Waterloo station and as such, the site is predominately a construction site.



Construction of the Sydney metro is currently underway on site in accordance with critical State significant infrastructure approval (CSSI 7400).



**Figure 1 - Aerial of the site**  
Source: Urbis

The area surrounding the site consists of commercial premises to the north, light industrial and mixed-use development to the south, residential development to the east and predominantly commercial and light industry uses to the west.

## 5. Background

### 5.1 About Sydney Metro

Sydney metro is Australia's biggest public transport project. Services started in May 2019 in the city's North-west with a train every four minutes in the peak. A new standalone railway, this 21st century network will revolutionise the way Sydney travels. There are four core components:

#### 5.1.1 Sydney Metro North West

This project is now complete and passenger services commenced in May 2019 between Rouse Hill and Chatswood, with a metro train every four minutes in the peak. The project was delivered on time and \$1 billion under budget.

#### 5.1.2 Sydney Metro City & Southwest

Sydney Metro City & Southwest project includes a new 30km metro line extending metro rail from the end of Metro Northwest at Chatswood, under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the ultimate capacity to run a metro train every two minutes each way through the centre of Sydney.

Sydney Metro City & Southwest will deliver new metro stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and new underground metro platforms at Central Station. In addition, it will upgrade and convert all 11 stations between Sydenham and Bankstown to metro standards.

#### 5.1.3 Sydney Metro West

Sydney Metro West is a new underground railway connecting Greater Parramatta and the Sydney CBD. This once-in-a-century infrastructure investment will transform Sydney for generations to come, doubling rail capacity between these two areas, linking new communities to rail services and supporting employment growth and housing supply between the two CBDs.

The locations of seven proposed metro stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays.

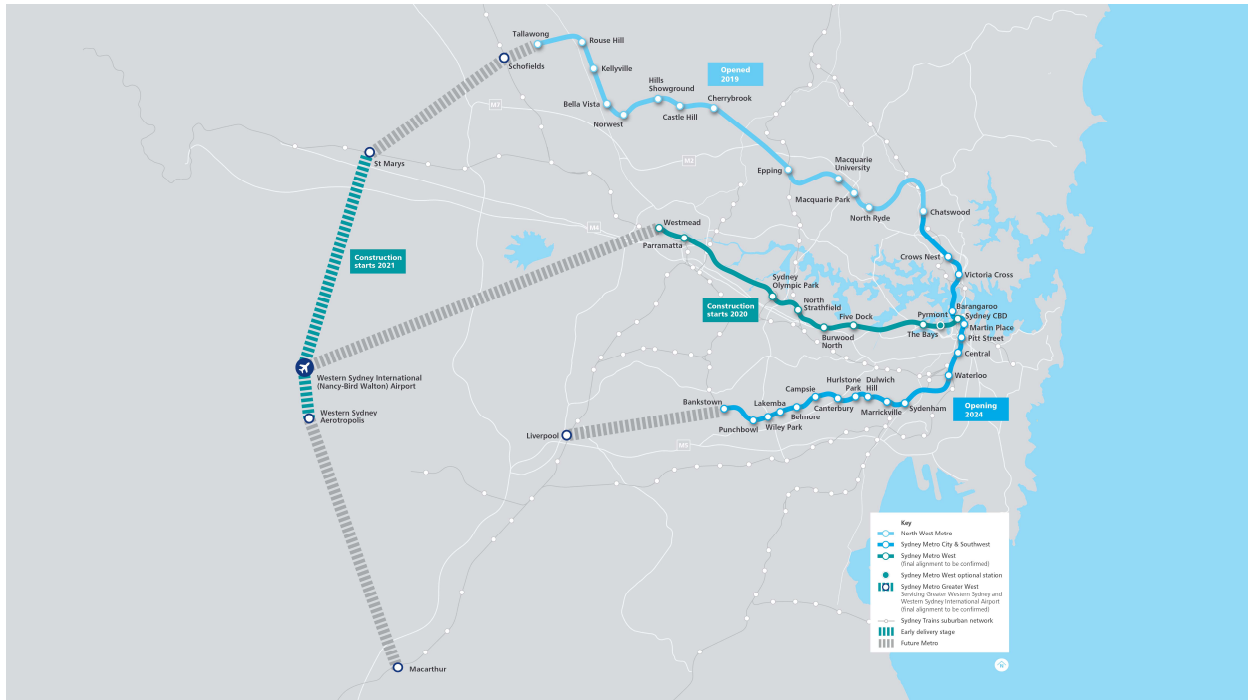
The NSW Government is assessing an optional station at Pyrmont and further planning is underway to determine the location of a new metro station in the Sydney CBD.

#### 5.1.4 Sydney Metro Greater West

Metro rail will also service Greater Western Sydney and the new Western Sydney International (Nancy Bird Walton) Airport. The new railway line will become the transport spine for the Western Parkland City's growth for generations to come, connecting communities and travellers with the rest of Sydney's public transport system with a fast, safe and easy metro service. The Australian and NSW governments are equal partners in the delivery of this new railway.

The Sydney Metro project is illustrated in Figure 2.





**Figure 2 - Sydney Metro alignment map**  
**Source: Sydney Metro**

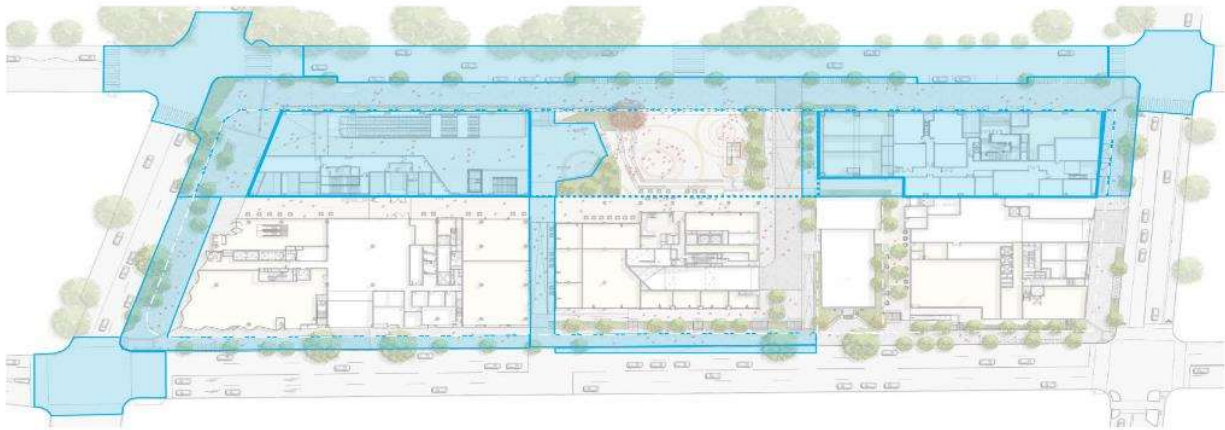
## 5.2 Sydney Metro CSSI Approval (SSI 7400)

On 9 January 2017, the Minister for Planning approved the Sydney Metro City & Southwest - Chatswood to Sydenham project as a critical State significant infrastructure (CSSI) project (reference SSI 7400) (CSSI approval). The terms of the CSSI approval includes all works required to construct the Sydney Metro Waterloo Station. The CSSI approval also includes the construction of below and above ground works within the metro station structure for appropriate integration with the OSD.

With regards to CSSI related works, any changes to the 'metro station box' envelope and public domain will be pursued in satisfaction of the CSSI conditions of approval and do not form part of the scope of the concept SSD DA or detailed SSD DA for the OSD.

Except to the extent described in the EIS or Preferred Infrastructure Report (PIR) submitted with the CSSI application, any OSD buildings and uses do not form part of the CSSI approval and will be subject to the relevant assessment pathway prescribed by the EP&A Act.

The delineation between the approved Sydney metro works, generally described as within the two 'metro station boxes' and surrounding public domain works, and the OSD elements are illustrated in Figure 3.



**Figure 3 - CSSI Approval scope of works**  
**Source: WL Developer Pty Ltd**

### 5.3 Concept Approval (SSD 9393)

As per the requirements of clause 7.20 of the *Sydney Local Environmental Plan 2012* (SLEP), as the OSD exceeds a height of 25 metres above ground level (among other triggers), development consent is first required to be issued in a concept DA (formerly known as Stage 1 DA).

Development consent was granted on 10 December 2019 for the concept SSD DA (SSD 9393) for the Waterloo Metro Quarter OSD including:

- a maximum building envelope for podium, mid-rise and tower buildings
- a maximum gross floor area of 68,750sqm, excluding station floor space
- conceptual land use for non-residential and residential floor space
- minimum 12,000sqm of non-residential gross floor area including a minimum of 2,000sqm of community facilities
- minimum 5% residential gross floor area as affordable housing dwellings
- 70 social housing dwellings
- basement car parking, motorcycle parking, bicycle parking, and service vehicle spaces.

This concept DA has been prepared and submitted to the DPIE and proposes to make modifications to the approved building envelopes at the northern precinct and central building. This amending concept SSD DA does not impact the proposed development within the southern precinct.

A concurrent detailed SSD DA will seek development consent for the OSD located within the Southern Precinct, Basement Car Park, Central Precinct and Northern Precinct of the site, consistent with the parameters of the original concept approval. Separate SSD DAs have been prepared and will be submitted for the northern precinct, central building, and basement proposed across the Waterloo Metro Quarter site consistent with the amending concept DA.

## 6. Proposed development

The amending concept DA seeks consent for an amended building envelope and description of development for the northern precinct of the Waterloo Metro Quarter site approved under SSD 9393. Specifically, the proposal seeks to modify the approved building envelope for the northern precinct (previously comprising 'Building A', 'Building B', 'Building C' and 'Building D' under SSD 9393) through:

- increasing the maximum building height for the southern portion of the Northern Precinct from RL56.2 to RL72.60
- removing the 'tower component' of the Northern Precinct, reducing the overall height of the tower envelope from RL116.9 to RL90.40, to enable the redistribution of floor space to commercial office floor plates
- amending the description of development to refer to a mid-rise (approximately 17 storey) commercial office building, comprising approximately 34,125sqm of commercial office floor space within the northern portion of the site, rather than a third residential tower.

The concept DA seeks to modify the central building approved building envelope (previously comprising 'Building E' under SSD 9393) through:

- modifying the eastern extent of the podium envelope.

The modification of the approved concept SSD DA will enable the detailed design of a new commercial building (comprising office and retail premises) to be pursued on the site, significantly increasing the proportion of employment generating floor space on the Waterloo Metro Quarter site. This new commercial building is proposed in replacement of four building envelopes approved under SSD 9393, which comprised one residential tower, and three mid-rise residential buildings.

This proposal will not exceed the permissible building height for the site under the SLEP or the maximum height approved under SSD 9393. As noted above, separate detailed SSD DA(s) will be lodged concurrently for the detailed design, construction and operation of the northern precinct, and central building.

This amending concept DA does not propose to amend the original concept approval as it relates to the southern precinct.



An overview of the amended concept SSD DA is provided below:

User Type	Units / GFA
Market Residential and Affordable Units	150 Units
Residential - Social Housing	70 Units
Residential - Student Accommodation	435 rooms (474 student beds)
Commercial	33,843 m <sup>2</sup>
Retail	2,785m <sup>2</sup> GFA
Child Care	2,220m <sup>2</sup> GFA

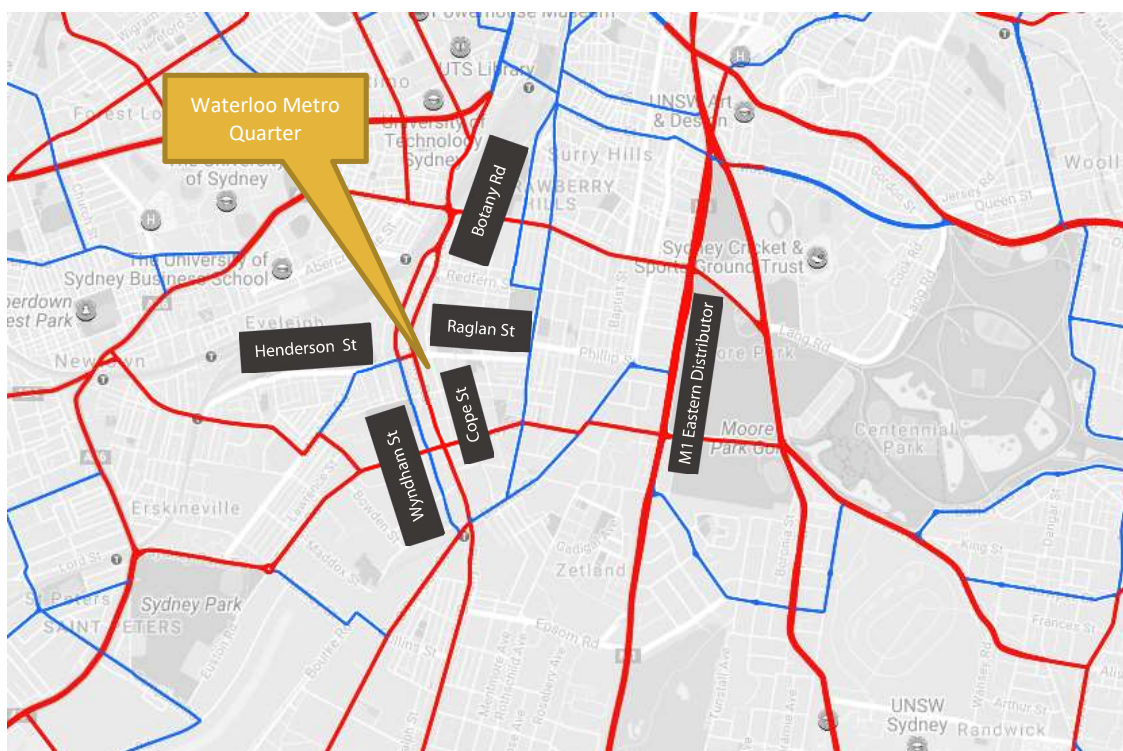
*Table 3 - Summary of Amended SSD DA (SSD 10441)*

## 7. Existing Transport Facilities

The following section describes the existing transport environment and facilities that serve the site and is presented to satisfy SEARs (SSD 10441), Item 8.

### 7.1 Road Hierarchy

The subject site is located in the suburb of Waterloo and is primarily serviced by Botany Road which is classified as a State Road. The road network servicing the area comprises a number of State Roads, making the site easily accessible from different regions of the metropolitan area. The road network in this area also comprises several local streets providing direct access to the surrounding retail, commercial and residential land-uses.



**Figure 4 - Road Hierarchy**

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- |                  |  |
|------------------|--|
| • State Roads    | Freeways and Primary Arterials (RMS Managed)                           |
| • Regional Roads | Secondary or sub arterials (Council Managed, Part funded by the State) |
| • Local Roads    | Collector and local access roads (Council Managed)                     |

A summary of the existing road network is shown in the following tables and figures.

Botany Road	
Road Classification	State Road
Alignment	North - South
Number of Lanes	2 lanes in each direction
Carriageway Type	Undivided
Carriageway width	12m (6m in each direction)
Speed Limit	50 km/hr
School Zone	Yes, north of the Botany Road / Bourke Street intersection
Parking Controls	Time restricted on-street parking, with clearways in operation during peak periods
Forms Site Frontage	Yes

**Table 4 - Existing Road Network - Botany Road**



**Figure 5 - Botany Road (south bound from Henderson Street)**

Cope Street	
Road Classification	Local Road
Alignment	North - South
Number of Lanes	1 lane in each direction
Carriageway Type	Undivided
Carriageway width	12m (6m in each direction)
Speed Limit	50 km/hr
School Zone	No
Parking Controls	Typically unrestricted parking along site frontage
Forms Site Frontage	Yes

**Table 5 - Existing Road Network - Cope Street**



**Figure 6 - Cope Street (south bound from Raglan Street)**



Raglan Street	
Road Classification	Local Road
Alignment	East-west
Number of Lanes	2 lanes in each direction
Carriageway Type	Undivided
Carriageway width	12m (6m in each direction)
Speed Limit	60km/hr
School Zone	No
Parking Controls	Typically, 1P parking along site frontage; Loading Zone on northern side of carriageway
Forms Site Frontage	Yes

**Table 6 - Existing Road Network - Raglan Street**



**Figure 7 - Raglan Street (west bound from Cope Street)**

Wellington Street	
Road Classification	Local Road
Alignment	East - West
Number of Lanes	1 lane in each direction
Carriageway Type	Divided
Carriageway Width	12m (6m in each direction)
Speed Limit	50 km/hr
School Zone	No
Parking Controls	Typically varies between unrestricted parking, '1P', and 'Loading Zone'.
Forms Site Frontage	Yes

**Table 7 - Existing Road Network - Wellington Street**



**Figure 8 - Wellington Street (west bound from Cope Street)**

## 7.2 Public Transport

The subject site was assessed for its potential accessibility via modes of existing public transport likely to be utilised by prospective residents, employees and visitors of the proposed development. When defining accessibility, the NSW Guidelines to Walking & Cycling (2004) suggest that 400m-800m is a comfortable walking distance.

### 7.2.1 Metro

With reference to Section 5.1, the Waterloo Metro Station is expected to commence operation in 2024 which will provide a convenient public transport option for prospective residents, employees and visitors of Waterloo Metro Quarter.

Once completed, Sydney Metro will have the ultimate capacity for a metro train every two minutes in each direction under the city, a level of service never seen before in Sydney.

### 7.2.2 Trains

The development site is located less than 650 metres walking distance from Redfern Station, to the north and 900 meters from Green Square Station, to the south.

These stations operate the following services:

Line	Coverage
T1 - North Shore & Western Line	North Shore, Western and Richmond
T2 - Inner West & Leppington Line	City, Inner West and Leppington
T3 - Bankston Line	City, Liverpool and Lidcombe
T4 - Eastern Suburbs & Illawarra Line	Eastern Suburbs, Illawarra and Cronulla
T8 - Airport & South Line	City and South
T9 - Northern Line	Gordon and Northern

**Table 8 - Train Services Summary**

Redfern station is also served by regional lines including Blue Mountains line, Central Coast & Newcastle line and South Coast line.

### 7.2.3 Buses

A number of bus stops are located within walking distance of the site, as shown in Figure 9 and Figure 10. The Routes servicing these stops are summarised in Table 9.

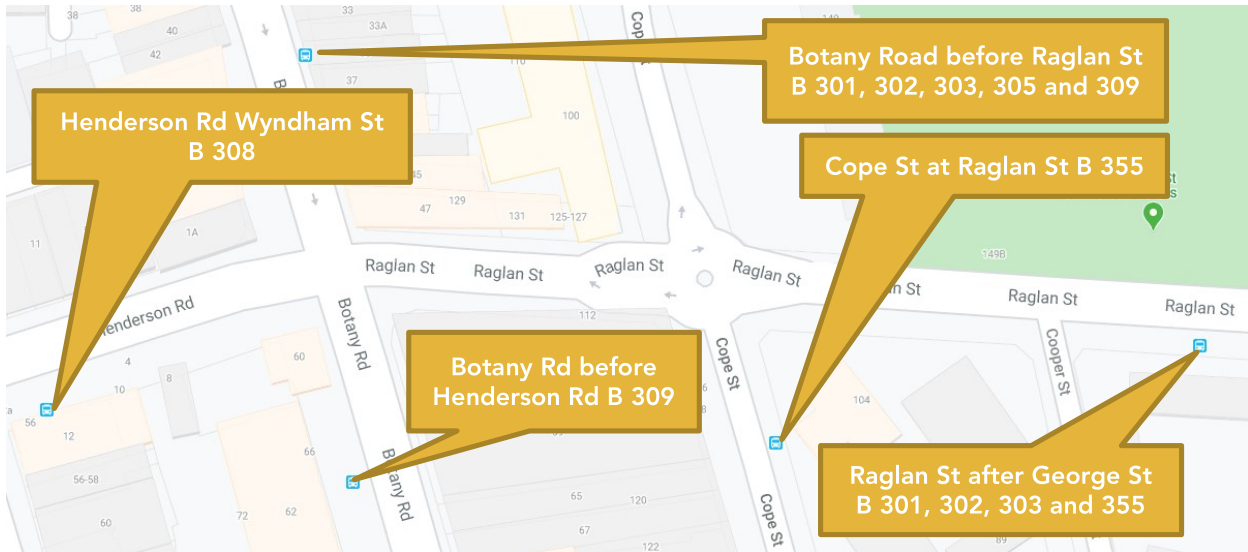


Figure 9 - Local Bus Stops



Figure 10 - Bus Network in the Vicinity of the Development



Bus Route	Coverage	Operation
301	City to Eastgardens	Operates all week. 10 minute peak headway, 20-30minute off-peak headway.
302	City to Eastgardens	Operates all week. 60 minute headway.
303	City to Sans Souci	Operates all week. 5-10 minute peak headway, 20-30minute off-peak headway.
305	Railway Square to Mascot	Weekday-only service with a 20 minute headway in the peak direction.
308	Marrickville Metro to Central Eddy Ave via Redfern (Loop Service)	Operates all week. 15 minute peak headways.
309	Railway Square to Port Botany	Operates all week. 10 minute peak headways.
355	Bondi Junction to Marrickville Metro	Operates all week. Typical 30 minute headway.

**Table 9 - Bus Services Summary**

In consideration of the number of existing public transport options, their combined coverage throughout the Sydney metropolitan region and medium to high frequency headways, the site is very well placed in the context of public transport, with the potential to significantly reduce travel by private vehicles.

## 7.3 Active Travel

### 7.3.1 Bicycle Network

The regional cycle network surrounding Waterloo is shown in Figure 19.

The cycle network currently provides access to a range of key destinations including the University of Sydney, Redfern Station, Sydney CBD, Newtown and Moore Park. East-west movement is constrained by the existing heavy rail corridor to the west, which limits access to the north of the rail line and to Carriageworks and the University of Sydney (USYD). There are limited and sparsely located crossing opportunities, including Lawson Street at Redfern Station.

City of Sydney Council, as part of its cycle network strategy, has identified 10 priority cycle routes across the inner city including through Waterloo Precinct. Key routes include:

- City North to Green Square: Running north-south through Waterloo Precinct, complete as far as Green Square with a separated cycleway on George Street, Waterloo. This route would be the most direct north-south connection to the Waterloo Station
- Sydney Park to Central Park: Running east-west through Waterloo Precinct, upgrades are identified on Buckland, Wellington, Morehead and Phillip Streets, Waterloo. This route would be the most direct east-west connection to the Waterloo Station

- Newtown to Bondi Junction: Running east-west through Redfern on Wells and Turner Streets, upgrades currently in progress
- USYD to University of New South Wales: Running east west through Alexandria
- Sydney Harbour to Botany Bay: Running north-south along Bourke Street, complete with separated cycleway for much of its length.

As part of the Alexandria to Moore Park Connectivity Upgrade, a shared path is proposed along the northern side of McEvoy Street west of George Street, continuing on the southern side of McEvoy Street east of George Street. Cyclists would be required to cross McEvoy Street at its intersection with George Street. If approved, the upgrade would facilitate east-west movements to and from the Waterloo Precinct.



**Figure 11 - Existing and Planned Cycle Network**

### 7.3.2 Proposed Public Transport Upgrades

In addition to the development of the Waterloo Metro Station, as outlined in Section 5.1.2, as part of the development of the nearby Green Square Town Centre (GSTC), the Green Square Urban Renewal Area (GSURA) Transport Management & Accessibility Plan (TMAP Volume 2, 2008) identifies a number of measures intended to increase public transport usage as part of the vision to achieve a “no car growth” scenario over the next 25 years. It is acknowledged that a draft TMAP was produced in 2012, and is yet to be publicly released, however, it is assumed that the following major upgrades are still relevant:

- Action plans to progress the goal of establishing/improving a number of transit corridors, including the Botany Road Transit Corridor and the new Eastern Transit corridor, with the intention of establishing the “Green Loop” to connect Green Square with Redfern Station, Central Station and Surry Hills through high frequency services via dedicated buses (short term), which are to be eventually replaced by a new light rail service (see Figure 12 );
- Upgrades to Green Square Train Station capacity, to achieve 20 trains/hour/way during peak commuter hours. This will be largely controlled by the progress of the Sydney Metro project;
- Forecasting and implementation of additional bus services and route changes to manage population growth; and
- Fleet upgrades.

The TMAP has identified that in the context of the overall GSURA, the GSTC has the potential to instigate significant shifts towards non-car mode shares. This potential arises from low-density industrial and manufacturing employment areas being redeveloped into high-density commercial and retail precincts, providing greater opportunities for public transport.

It is understood that many of the upgrades identified within the TMAP (2008) have not yet been implemented, but that a Green Square Transport Working Group (chaired by CoS) and Green Square Steering Committee (chaired by UrbanGrowth NSW) has been established to provide cross-agency coordination in the planning and implementation of these upgrades.



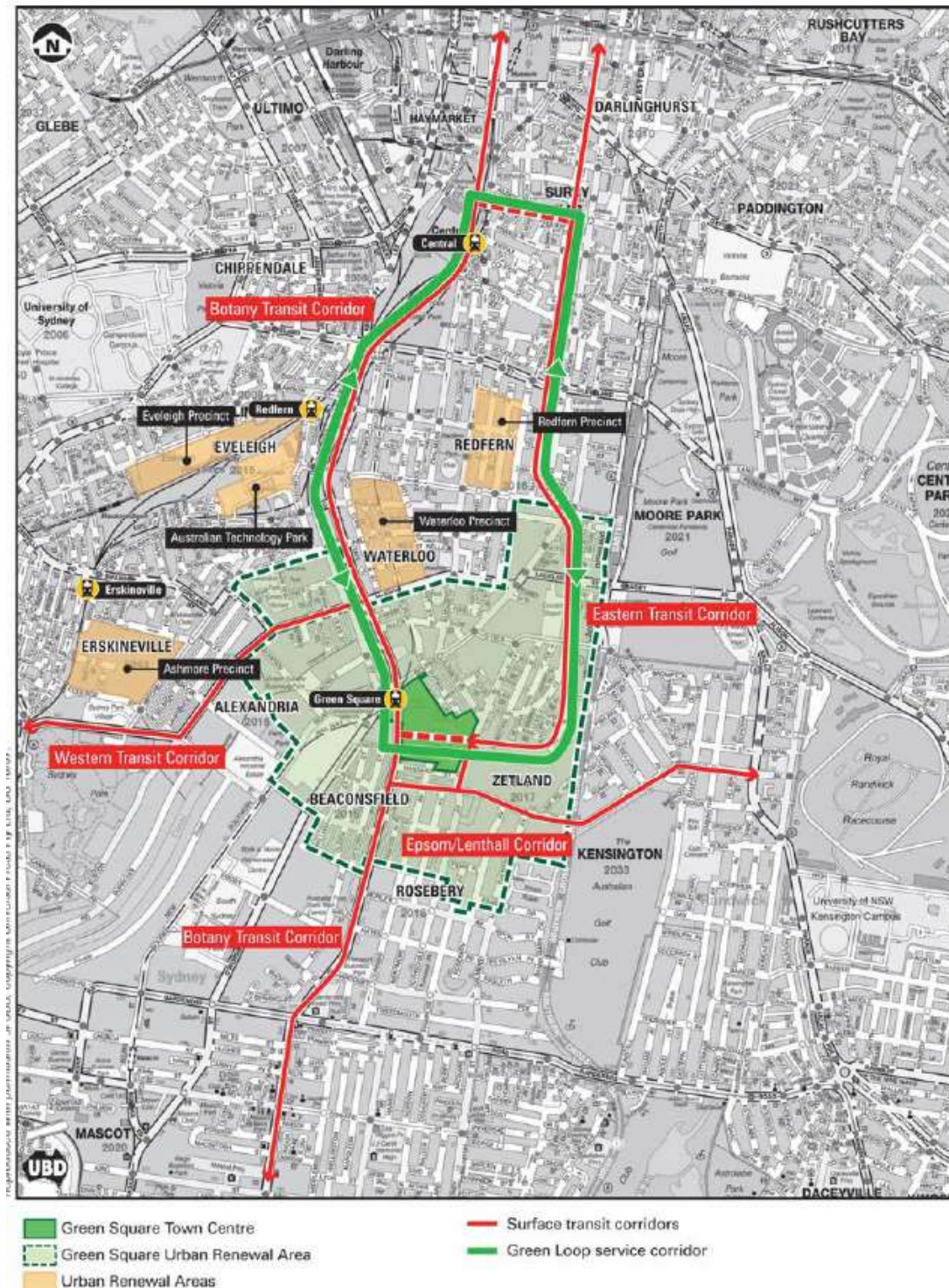


Figure 12 - Potential Transport Network

#### 7.4 Existing Travel Mode Share

An assessment of the existing travel modal split within Waterloo has been undertaken in relation to the following:

- Travel to work, Waterloo as a place of work
- Travel to work, Waterloo as a place of residence

The data has been collected from the Australian Bureau of Statistics 2016 Census and is summarised in Table 10 and Table 11:

Travel to Work (Waterloo as a place of work) - 2016	
Mode of Travel	Percentage (%)
Train	17.18%
Bus	5.96%
Ferry	0.05%
Tram	0.02%
Car (as driver)	55.91%
Car (as passenger)	3.43%
Bicycle	1.51%
Walked only	5.53%
Other mode	0.42%
Worked at home	3.66%
Did not go to work	5.66%
Not stated	0.84%

*Table 10 - Existing Travel Mode Share - Travel to Work, Waterloo as a place of work*

Travel to Work (Waterloo as a place of residence) - 2016	
Mode of Travel	Percentage (%)
Train	19.59%
Bus	20.92%
Ferry	0%
Tram	0.06%
Car (as driver)	32.40%
Car (as passenger)	3.63%
Bicycle	3.49%
Walked only	8.38%
Other mode	0.63%
Worked at home	3.36%
Did not go to work	6.74%
Not stated	0.80%

**Table 11 - Existing Travel Mode Share - Travel to Work, Waterloo as a place of residence**

In summary, when travelling to Waterloo as a place of work, approximately 59% of staff travel to work by car, 23% travel to work via public transport and 7% travel by an active mode of travel.

When travelling to work from Waterloo, approximately 36% travelled by car, 41% travel to work via public transport and 12% travel by an active mode of travel.

#### 7.4.1 Existing Traffic Volumes and Distribution

To determine the current traffic volumes within the vicinity of the development site, intersection surveys were conducted on Tuesday 12<sup>th</sup> March 2020, between 7.30am - 9.30am and 4.00pm - 7.00pm at the following intersections:

- Henderson Road and Wyndham Street (4 arm signalised intersection)
- Botany Road, Henderson Road and Raglan Street (4 arm signalised intersection)
- Raglan Street and Cope Street (4 arm roundabout)
- Cope Street and Wellington Street (4 arm roundabout) and
- Botany Road, Buckland Street and Wellington Street (4 arm signalised intersection).



It should be noted that the traffic surveys were undertaken prior to any restrictions placed on movement (on 22<sup>nd</sup> March 2020) by the Covid-19 outbreak.

The intersection location surveys are shown in Figure 13.



**Figure 13 - Location of Intersection Surveys**

### 7.4.2 Existing Peak Hour Traffic Volumes

The peak hour for the corresponding intersections has been determined as follows:

- Henderson Road and Wyndham Street
  - 7.45am to 8.45 am - 2812 vehicles
  - 5.15pm to 6.15pm - 2995 vehicles
- Botany Road, Henderson Road and Raglan Street
  - 7.45am to 8.45am - 3162 vehicles
  - 5.45pm to 6.45pm - 3272 vehicles
- Raglan Street and Cope Street
  - 8.15am to 9.15am - 732 vehicles
  - 5.30pm to 6.30pm - 806 vehicles
- Cope Street and Wellington Street
  - 8.30am to 9.30am - 487 vehicles
  - 5.15pm to 6.15pm - 510 vehicles
- Botany Road, Buckland Street and Wellington Street
  - 7.45am to 8.45am - 2376 vehicles
  - 5.15pm to 6.15pm - 2303 vehicles

### 7.4.3 Existing Network Operation

From the survey data, a volume analysis was performed using SIDRA Intersection 8.0 software, a micro-analytical tool for individual intersections and whole-network modelling. The models are based on the collected traffic survey data. SIDRA provides a number of performance indicators, outlined below:

- Degree of Saturation - The total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation. (e.g. 0.8=80% saturation)
- Average Delay- The average delay encountered by all vehicles passing through the intersection. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major traffic will provide an overall low average delay.
- Level of Service (LoS) - This is a categorization of average delay, intended for simple reference. The RMS adopts the following bands:
- 95% Queue Lengths (Q95) - is defined to be the queue length in metres that has only a 5-percent probability of being exceeded during the analysis time period. It transforms the average delay into measurable distance units.

Level of Service is a good indicator of overall performance for individual intersections, with each level summarised in Table 13



Level of Service	Average Delay (secs/vehicle)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity. At signals, incidents would cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Extra capacity required	Extreme delay, major treatment required

**Table 12 - Intersection Performance - Levels of Service**

The SIDRA 8.0 results for each intersection are shown in Table 13.

Intersection	Period	Level of Service	Average Delay (sec)	Degree of Saturation	95% Queue Length (m)
Henderson Street and Wyndham Street	AM	D	43.8	0.986	136.3
	PM	C	40.8	0.995	143.9
Botany Road and Raglan Street	AM	C	39.6	0.960	217.9
	PM	D	44.1	0.984	235.0
Cope Street and Raglan Street	AM	A	4.7	0.236	8.7
	PM	A	4.7	0.276	9.4
Cope Street and Wellington Street	AM	A	4.1	0.195	5.5
	PM	A	4.6	0.152	5.4
Botany Road, Wellington Street	AM	A	13.1	0.528	140.4
	PM	B	14.6	0.481	120.1

**Table 13 - Summary of Existing Intersection Modelling**

## 8. Parking Provision

Condition B8 of the Concept Approval (SSD 9393) states that:

'Future development applications shall reduce total car parking provision to reduce private car ownership and promote use of active and public transport.'

In this regard, the resulting parking provision restrains the potential traffic activity associated with the site and therefore the following section is presented ahead of the traffic assessment section of this report.

### 8.1 Approved Concept Development Parking Provision (SSD 9393)

The parking provision within the approved SSD 9393 scheme is shown in Table 14.

Residential			
Unit Type	Unit	LEP Parking Rate (maximum)	Maximum Permissible Spaces
Studio	22	0.1 spaces per unit	2
1 Bed	294	0.3 spaces per unit	88
2 Bed	314	0.7 spaces per unit	220
3 Bed +	70	1.0 spaces per unit	70
Total Permissible Spaces			380

Non - Residential			
Commercial GFA	Area of Site	Total GFA of All Buildings	Maximum Permissible Spaces
8,645m <sup>2</sup>	12,800m <sup>2</sup>	68,750m <sup>2</sup>	32

Retail GFA	Area of Site	Total GFA of All Buildings	Maximum Permissible Spaces
3,905m <sup>2</sup>	12,800m <sup>2</sup>	68,750m <sup>2</sup>	15

**Table 14 - Approved Parking Provision (SSD 9393)**

The calculation of non-residential spaces is based on City of Sydney Category D formula:  
 $M = (G \times A) / (50 \times T)$ .

## 8.2 Proposed Development Parking Provision

### 8.2.1 Planning Policy

The proposed development is subject to the parking requirements stipulated in the City of Sydney Local Environmental Plan 2012 (SLEP), City of Sydney Development Control Plan 2012, RMS Guide to Traffic Generating Developments and SSD 9393, Conditions of Consent, issued by the Department of Planning, Industry and Environment on 10th December 2019.

Reference has also been made to the Waterloo Metro Quarter Design and Amenity Guidelines, in particular Design Criteria 3O - Car Parking and Access and Criteria 3P - Service Vehicles and Waste Collection. Furthermore, the Waterloo Metro Quarter Design and Amenity Guidelines encourage the reduction of on-site parking as per the aforementioned design objectives.

In accordance with the City of Sydney Local Environmental Plan, 2012, the development site is classified as Category A for residential land uses and Category D for non-residential land uses.

### 8.2.2 Proposed Parking Provision

The proposed parking provision will be accommodated within a two-level basement, located below Northern and Central Precincts, which will be accessed off the proposed Church Square shared zone.

Two Loading docks are also proposed, one at ground level within the Northern Precinct, which will be accessed off Botany Road and one on the ground level within Southern Precinct, accessed off Wellington Street.

In accordance with City of Sydney Local Environmental Plan 2012, City of Sydney Development Control Plan 2012, RMS Guide to Traffic Generating Developments, the Waterloo Metro Quarter Design and Amenity Guidelines and SSD 9393, Conditions of Consent, issued by the Department of Planning, Industry and Environment on 10th December 2019, the following parking provisions are proposed for the development.

Use Type	Units/ GFA/ Spaces	Parking Rate <sup>1</sup>	Maximum Permissible/Required Parking Provision <sup>2</sup>	Proposed Parking Provision
Commercial	33,843 m <sup>2</sup>	1 Space per 435m <sup>2</sup> GFA	78	63
Retail	2,785m <sup>2</sup>	1 Space per 435m <sup>2</sup> GFA	6 <sup>3</sup>	0
Market Residential & Affordable Housing	150 units	1 bed - 0.3 per unit 2 bed - 0.7 per unit 3 bed - 1 space per unit	80	67
Residential - Social Housing	70 units	Studio - 0.1 space per unit 1 bed - 0.3 per unit 2 bed - 0.7 per unit 3 bed - 1 space per unit	36	8
Market Residential Visitor	-	-	-	2
Residential - Student Accommodation	435 rooms (474 beds)	0.1 space per room	44	0
Car Share - Commercial	63 spaces	1 per 30 spaces	2	4
Car Share - Residential (Combined)	77 spaces <sup>4</sup>	1 per 50 spaces	2	
Child Care	146 children	1 space per 8 children <sup>5</sup> (min)	20 (min)	1 - long term visitor space

<sup>1</sup> Parking rate is a maximum rate, unless otherwise specified.

<sup>2</sup> Parking provision is a maximum, unless otherwise specified.

<sup>3</sup> Minor variation in maximum permissible provision due to rounding when compared to summing retail provisions for each precinct

<sup>4</sup> 67 (market residential & affordable housing) + 2 (car share - market residential & affordable housing) + 8 (residential – social housing) = 77 residential spaces (combined)

<sup>5</sup> Limited in duration to no more than 30 minutes at any one time. Pick-up and set down spaces may be reduced having regard to the demand for pick-up and set down parking, accessibility by walking and public transport, the availability of convenient and safe on-street parking and potential traffic and amenity impacts.

Use Type	Units/ GFA/ Spaces	Parking Rate <sup>1</sup>	Maximum Permissible/Required Parking Provision <sup>2</sup>	Proposed Parking Provision
		1 long term visitor car parking space which is additional to all other parking requirements		
Metro			2	2
Church			2	2
Car Wash Bay				1
<b>Total Car Space Provision</b>			<b>272</b>	<b>150</b>

*Table 15 - Proposed Parking Provision (All Precincts)*

The change in floor areas and yield within the amended scheme results in a reduction in the maximum permissible parking provision from 380 spaces in the approve concept DA to 272 under the amended scheme. High level design of the basement indicates a provision of 150 spaces, which is within the permissible maximum provision.

### 8.2.3 Service Vehicle Parking

Based on the approved floor areas and yield the approved scheme required 8 service bays, with 3 provided in the northern loading dock, 1 provided in the southern loading dock and up to 4 spaces within the basement car park.

The service bay requirements relating to the amended scheme are presented in the following table:

Use Type	Units/ GFA/Spaces	Parking Rate	Maximum Permissible/Required Parking Provision	Proposed Parking Provision
Service Bays Commercial	33,843 m <sup>2</sup>	1 space per 3,300m <sup>2</sup> (min)	10 (min)	<b>Shared amongst all Uses:</b>  <b>Basement</b> 5 car/ute/small van  <b>Loading Dock Northern</b> 2 SRV and 2 MRV*  <b>Loading dock Southern</b> 1 MRV**
Market Residential, Affordable & Social Housing	220 units	1 space for 1st 50 units & 0.5 spaces per 50 units + (min)	3 (min – variation due to rounding)	
<b>Total Service Bay Provision (minimum)</b>			<b>13 (min - variation due to rounding)</b>	<b>10</b>

*\*MRV spaces are sized to accommodate City of Sydney 9.25m waste collection vehicle*

**Table 16 - Proposed Service Bay Provision (All Precincts)**

The amended scheme requires the provision of 13 service bays with 10 spaces provided, 4 in the northern dock, 1 in the southern dock and 5 within the basement.

The student accommodation rooms are offered on a furnished basis whilst also being managed by a single owner operator. The loading and servicing requirements are therefore deemed to be very low and can be adequately managed through access to the single loading dock MRV space located under Building 3. This is consistent with other similar operated facilities in the City of Sydney.

Consistent with the approved scheme, access to the loading docks is off Botany Road, Wellington Road and Cope Street (for the basement car park). It should be noted that the access to the northern loading dock, off Botany Road, is located 15m to the south of

the approved scheme, however, this should have no effect on the proposed bus provisions or the operation of the existing road network.

Use and access to the service bays will be managed by a Freight and Servicing Management Plan.



## 9. Development Traffic Assessment

### 9.1 Approved Traffic Trip Rates (SSD 9393)

Section 6.7.3 of the Traffic Impact Assessment prepared by Jacobs for SSD 9393 sets out the projected traffic activity associated with the Concept Approval.

Based on an assessment of similar developments in Redfern and Waterloo, a traffic generation rate of 0.14 per unit was approved.

It was also assumed that the proposed non-residential uses in the Metro Quarter precinct were small in scale. As such the assessment concluded that there will be limited traffic activity associated with these uses and that this activity will be outside the peak hour or undertaken as part of multi-purpose trips by residents.

The total traffic generation potential of the Metro Quarter was therefore based on the residential yield only.

Land Use	Dwellings	Peak hour traffic generation per dwelling	Total peak hour traffic generation
Residential	700	0.14	98

*Table 17 - Approved Traffic Generation (SSD 9393)*

The approved development proposed 700 dwellings and with a traffic generation rate of 0.14, the development was assessed to generate 98 trips in the peak hour.

While we agree with the concept approval that the non-residential retail uses will benefit from the relationship with the Metro station and not generate traffic activity as a new destination. However, in order to provide a comparable assessment of the approved concept and the amended scheme it is necessary to determine the total unconstrained traffic activity associated with the entire yield. In this regard the following table presents all floor areas / uses within the approved concept and the associated traffic activity adopting consistent trip generation rates applicable to both the approved and amended scheme.

Land Use	Dwellings	Peak hour traffic generation per dwelling	Total peak hour traffic generation
Residential	700	0.14	98
Non- residential - Retail	3,905m <sup>2</sup>	0.046	180
Non- residential - Commercial	8,645m <sup>2</sup>	0.0016	14
Total Trip Generation			292

The approved scheme did not define a proposed parking provision (only referring to the maximum permitted parking provision under the planning controls), therefore the projected traffic projection assumes an unconstrained parking provision.

## 9.2 Concept Approval Traffic Assessment (SSD 9393)

The approved traffic assessment was undertaken using SIDRA modelling software for the following scenarios:

- 2017 Base
- 2036 Do Minimum - Includes Waterloo Station but no Metro Quarter development
- 2036 Metro Quarter - Includes Waterloo Station and Metro Quarter development

Traffic demand for the 2036 Do Minimum scenario was derived from applying a 0.25 per cent per year growth rate to existing traffic volumes based on analysis of past growth at permanent counter locations in the area.

Intersection performance has been measured by calculating the average delay of all movements and identifying a Level of Service based on RMS criteria.

The Concept Approval traffic assessment for the development site is shown in Table 18.

Intersection		2017 Base		2036 No Development		2036 Max permissible Development	
		Ave Delay	LOS	Ave Delay	LOS	Ave Delay	LOS
Henderson Street and Wyndham Street	AM	28	C	30	C	30	C
	PM	24	B	27	C	28	C
Botany Road and Raglan Street	AM	33	C	92	F	93	F
	PM	40	D	107	F	109	F
Cope Street and Raglan Street	AM	5	A	23	C	26	C
	PM	6	A	25	C	26	C
Cope Street and Wellington Street	AM	5	A	8	A	9	A
	PM	6	A	15	B	15	B
Botany Road, Wellington Street	AM	10	A	12	A	13	A
	PM	10	A	15	B	15	B

**Table 18 - Approved Traffic Assessment (SSD 9393)**

### 9.3 Existing Site Traffic Activity

The development is proposed on land that is currently vacant (in terms of a permanent land-use) and therefore does not generate any traffic activity. However, construction works associated with the Metro project are being undertaken within the site and the traffic activity associated with construction would be captured within the traffic surveys for the development traffic assessment.

### 9.4 Amending SSD Traffic Assessment

The amended development traffic impact assessment has been undertaken with reference to the RMS Guide to Traffic Generating Developments (2002), and intersection survey data collected on Tuesday 12<sup>th</sup> March 2020.

#### 9.4.1 Proposed Traffic Generation

Typically, the traffic activity associated with a development or land-use can be derived through reference to published data, for example the RMS Guide to Traffic Generating Developments.

This form of traffic projection is useful where the development has unconstrained on-site parking provision, which provides a direct comparison with the traffic assessment associated with the Concept Approval scheme, which would have resulted in 292 trips (all land-uses and noting that the parking provision was not factored into the trip generations calculations).

However, the development proposes a restricted on-site parking provision in accordance with Condition B8, and therefore the proposed development traffic generation has been derived on the basis of unconstrained parking (as a comparison with the approved scheme) and restrained parking which reflects the real-world outcome.

#### 9.4.2 Proposed Development Traffic Generation (Unconstrained Parking)

With reference to the RMS Guide to Traffic Generating Developments (GtTGD) and the rates utilised in SSD 9393 and based on an unconstrained parking provision the maximum parking generation for the proposed development would be as set out in Table 19.

User	Units / GFA	Peak hr generation per unit	Total peak hour trip generation	Notes
Market Residential & Affordable Housing	220 units	0.14	30.8	Trip generation as per SSD 9393
Residential - Social Housing	70 units	0.14	9.8	Trip generation as per SSD 9393
Residential -	435 rooms (474) beds	0.14	60.9	Trip generation as per SSD 9393

User	Units / GFA	Peak hr generation per unit	Total peak hour trip generation	Notes
Student Accommodation				
Non- residential - Commercial	33,843m <sup>2</sup>	0.0016	54.15	Trip generation 0.16 trips per 100m <sup>2</sup> . Reference, Appendix D2 - OB1 North Sydney)
Non-residential - Retail	2,785m <sup>2</sup>	0.046	128.11	Trip generation 46 trips per 1000m <sup>2</sup> . Reference, Specialty stores - Section 3.6.1 RMS GtTGD
Non-residential - Child Care	146 Children	0.4	58.4	Trip Generation - Long Day Care - 0.4 trips per child in peak hour (Section 3.11.3 GtTGD)
Total Trip Generation			342.16	

*Table 19 - Proposed Development Traffic Generation (Unconstrained Parking)*

#### 9.4.3 Proposed Development Traffic Generation (Proposed Parking)

Reference has been made to the RMS Guide to Traffic Generating Developments (GtTGD), RMS Technical Direction 2013/04 (TD13-04a) and the rates utilised in SSD 9393. The traffic generation associated with the proposed parking provision is set out in Table 20.

User	Units / GFA / spaces	Peak hr generation per space / GFA	Total peak hour trip generation	NOTES -
Market Residential & Affordable Housing	67 spaces	0.12	8.04	Trip generation 0.12 per car space-based on Site 10 (Pymont) Appendix B3 TD13-04a
Residential - Social Housing	8 spaces	0.12	0.96	Trip generation 0.12 per car space-based on Site 10 (Pymont) Appendix B3 TD13-04a
Residential - Student Accommodation	0 spaces	0	0	Zero parking spaces therefore zero trip generation

User	Units / GFA / spaces	Peak hr generation per space / GFA	Total peak hour trip generation	NOTES -
Non- residential - Commercial	33,843m <sup>2</sup>	0.0014	47.38	Trip generation 0.14 trips per 100m <sup>2</sup> . Reference, Appendix D2 - OB1 North Sydney) & pro rata at 0.88 (providing 0.88 of allowable parking spaces)
Non-residential - Retail	0 spaces	0	0	Zero spaces therefore zero traffic generation.
Non-residential - Child Care	1 space	0	0	One space provided as a long-term visitor space.
Total Trip Generation			56.38	

**Table 20 - Proposed Development Traffic Generation (Proposed Parking)**

As shown in Table 20, the estimated traffic generation associated with the WMQ development is approximately 57 trips in the peak hour, which compares with the Concept Approval traffic generation of 98 peak hour trips. This represents a reduction of 41 trips and therefore it is concluded that the Amending SSD will result in less impact on the road network that approved under SSD 9393.



#### 9.4.1 Proposed Network Operation

The proposed traffic assessment was undertaken using SIDRA modelling software for the following scenarios:

- 2019 Base
- 2036 No Development - This includes Waterloo Station but no Metro Quarter development
- 2036 Existing Planning Proposal - This includes Waterloo Station and Approved Metro Quarter development
- 2036 Max Permissible Development - This includes Waterloo Station and the proposed development with the maximum permissible parking for the development
- 2036 Proposed Development - This includes Waterloo Station and the proposed development with the proposed parking for the development.

Table 21 shows the summary of the development scenarios, outlined above.

Intersection		2019 Base		2036 No Development		2036 Existing Planning Proposal		2036 Max Permissible Development		2036 Proposed Development	
		Ave Delay	LOS	Ave Delay	LOS	Ave Delay	LOS	Ave Delay	LOS	Ave Delay	LOS
Henderson Street and Wyndham Street	AM	43.8	D	54.3	D	54.8	D	55.1	D	54.6	D
	PM	40.8	C	50.9	D	50.9	D	50.9	D	50.9	D
Botany Road and Raglan Street	AM	39.6	C	45.3	D	47.1	E	61.3	D	45.9	D
	PM	44.1	D	57.3	E	58.3	E	62.3	E	57.9	E





Intersection		2019 Base		2036 No Development		2036 Existing Planning Proposal		2036 Max Permissible Development		2036 Proposed Development	
Cope Street and Raglan Street	AM	4.7	A	8.4*	A	8.6*	A	9.0*	A	8.5*	A
	PM	4.7	A	8.9*	A	8.7*	A	8.9*	A	8.7*	A
Cope Street and Wellington Street	AM	4.1	A	7.6*	A	7.6*	A	7.7*	A	7.6*	A
	PM	4.6	A	7.9*	A	8.0*	A	8.1*	A	7.9*	A
Botany Road, Wellington Street	AM	13.1	A	13.4	A	13.6	A	13.7	A	13.5	A
	PM	14.6	B	15.5	B	16.2	B	17.2	B	15.9	B
Cope Street, Shared Zone	AM					5.2*	A	5.4*	A	5.1*	A
	PM					5.4*	A	5.7*	A	5.2	A

**Table 21 - Summary of Intersection Modelling (All Scenarios)**

The traffic modelling undertaken, demonstrates that the proposed development, including growth to 2036, the external road network will operate at acceptable levels of service or at a level of service less than the approved development SSD 9393 and therefore, the development will have no detrimental impact on the network operation, over and above the approved scheme.

## 10. Development Pedestrian Assessment

Modelling and analysis of the existing and future pedestrian and cyclist movement, connectivity and circulation within the extent of the site and to surrounding areas having regard to any nearby approved developments in the area has been undertaken by WSP (WMQ-SITE-WSP-PD-RPT-001) and this report can be found in Appendix 2 - Pedestrian Modelling Report.

With reference to SEARs listed in Section 3, pedestrian safety and amenity has been taken into consideration in the design of the development along Raglan Street and the Church Square shared zone has been designed to prioritise pedestrian movements. Refer to separate architectural package for design details and measures to protect pedestrians entering and exiting the building and retail outlets.

This report assesses the pedestrian demand for the Waterloo Metro Quarter precinct consisting of the following four key components.

- Demand related to the proposed metro station
- Demand related to the proposed over station development
- Demand related to existing land uses in the wider area, referred to as background demand
- Demand related to the Botany Road bus stops

The report concludes that:

*The pedestrian flows for the Waterloo Metro Quarter precinct has been assessed and summarised in this document to confirm the provisions of pedestrian infrastructure within and around the precinct. A summary of the precinct performance and its compliance to project requirements is shown in Table 22. Overall, the precinct design is compliant with the project requirements.*

Location	Assessment Scenarios	
	2056 AM	2056 AM Resilience
Precinct Connectivity		
Internal Walkways	✓	✓
External Footpaths	✓	✓
Queuing at Intersections	✓	✓
Botany Road Bus Stop (southbound)		
Bus Customers (waiting)	✓	✓
Non-bus Customers (those travelling along Botany Road)	✓	✓

**Table 22 - WMQ Streetscape Performance Summary**  
Source: WMQ-SITE-WSP-PD-RPT-001

## 11. Development Cyclist Assessment

### 11.1 Existing Cyclist Demand

The existing travel mode split for cyclists are approximately 1.5% when travelling to Waterloo for work and 3.5% for travelling from Waterloo for work (refer to Section 7.4).

### 11.2 Proposed and Future Target Cycling Demand

The development proposes approximately 35,000m<sup>2</sup> of non-residential space and 655 residential units of various types.

Based on the BCA rate of 10m<sup>2</sup> per employee within the office component, it is reasonable to calculate that the non-residential uses could accommodate approximately 3,500 people and based on the existing mode split for cyclists of 1.5% this would generate 53 cycle trips.

Based on the existing travel to work (from Waterloo) mode split of 3.5%, it is calculated that the residential portion of the development would generate 23 cycle trips.

Taking into consideration the future mode share target of 5% cycle trips, outlined in Section 12, the target cycle trips would be 175 for staff and 33 trips for residents.

As outlined in Section 7.3.1, there is a substantial existing and proposed cycle network in the vicinity of the development and it is deemed that an increase in 208 (175 + 33) cycle trips would not have a detrimental impact on the operation of the cycle provisions within the vicinity of the site in the context of the existing and proposed cyclist activity.

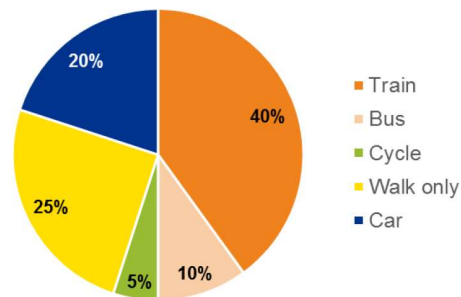
It should also be noted that the development proposes 361 residential and 309 non-residential bicycle parking spaces and that these facilities can accommodate the future mode share target bicycle trips, as outlined above.

## 12. Green Travel

### 12.1 Future Mode Share Targets

With reference to the Traffic Impact Assessment report prepared by Jacobs as part of SSD 9393 consent, an assessment of the potential future mode shares has been undertaken in consultation with TfNSW, RMS and City of Sydney and is based on existing data and the strategic opportunities for the Waterloo concept SSD.

The mode share targets agreed for the AM peak for all trip purposes are shown in Figure 14.



**Figure 14 - Future Mode Share Targets**

These targets are based on a number of factors, including:

- Proximity to Sydney Metro's Waterloo Station, which will provide access to high quality mass transit services on Sydney Metro City & Southwest
- Densely located land uses, activities and attractors as well as proximity to Sydney CBD and Green Square, enabling shorter trip lengths more conducive to walking and cycling
- Low existing traffic generation rates in recent high-density developments in Waterloo.
- Enhancements to the bus network to strengthen east-west routes, enabled by Sydney Metro City & Southwest, and improved cycling connections with key surrounding destinations.
- Consideration of Category A rates outlined in City of Sydney's DCP requirements to represent best practice in the provision of transport facilities appropriate for the development.

### 12.2 Green Travel Plan

The Green travel plan sets objectives and targets, including S.M.A.R.T mode share targets:

- outlines potential measures to encourage a modal shift away from car usage
- set key actions to align with key objectives and targets,
- set out a systematic approach to measure the impact of the travel plan, including commitment of resources to allow for implementation, monitoring, review and continual improvement of the travel plan

A Green Travel Plan will be prepared in accordance with the above criteria and will be developed during the precinct application process.

## 13. Access and Car Parking Assessment

### 13.1 Vehicular Access

Vehicle access to the development is proposed from Botany Road, Cope Street (via the Church Square shared zone) and Wellington Street, which is consistent with the concept approved layout within SSD 9393.

It should be noted that the loading dock access on Botany Road has been located approximately 15 metres further south than the approved scheme, however this has no impact on the existing parking controls or the bus zones located towards Wellington Street.

These accesses will be designed in accordance with AS2890 and relevant City of Sydney guidelines and will be subject to further development during the individual precinct application process.

### 13.2 Church Square Shared Zone

Church Square provides access and egress to the basement car park (subject to separate approval under SSD 10438) and is to be provided as a 'Shared Zone', in accordance with RMS TTD 2016/001 'Design and implementation of shared zones including provision for parking'. The Church Square shared zone connects to Cope Street (subject to separate SSD 10437).

The shared zone will be a Category 1 shared zone and is design to specifically provide non-vehicular priority in the area.

General design principles:

- The road space will be devoid of delineation and kerbs to enhance the sense of pedestrian priority.
- The entrance to the zone (at the intersection with Cope Street) will provided in the form of a 'Continuous Footpath Treatment' in accordance with RMS TD 2013/05.
- Regulatory traffic signs, in accordance with TTD 2016/001 will be provided on both sides of the entry to the zone, to enhance the change in environment and priority.
- The pavement surface will clearly distinguishable in texture, colour and material, to highlight the difference in environment, in accordance with City of Sydney requirements.



## **14. Construction Traffic & Pedestrian Management**

The construction traffic management for the amended development will follow the principles as outlined in Appendix CC of the approved scheme.

Exact vehicle routes will be assessed based on the vehicle size and their suitability to accommodate the relevant vehicles.

Construction Vehicle Management Plans will be prepared as part of the individual precinct DA and these plans associated with the construction activity of the project will aim to ensure the safety of all workers and road users within the vicinity of the construction site, with the following primary objectives:

- To minimise the impact of the construction vehicle traffic on the overall operation of the road network;
- To ensure continuous, safe and efficient movement of traffic (pedestrian and vehicular) for both the general public and construction workers;
- Installation of appropriate advance warning signs to inform users of the changed traffic conditions;
- To provide a description of the construction vehicles and the volume of these construction vehicles accessing the construction site; and
- To provide information regarding the changed access arrangements and also a description of the proposed external routes for construction vehicles accessing and exiting the site.

## 15. Conclusion

This report has been prepared by **ptc.** to accompany a concept State significant development (SSD) development application (DA) for the Waterloo Metro Quarter over station development (OSD). This concept SSD DA is submitted as an 'amending DA', that modifies the previously approved concept SSD DA issued for the site (SSD 9393). The modifications contained within the amending DA relate to the northern precinct and central building only. No change is proposed to the original concept SSD DA as it relates to the southern precinct of the Waterloo Metro Quarter site.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the amending concept SSD DA (SSD 10441).

This report concludes that the proposed amending concept DA for the Waterloo Metro Quarter OSD is suitable and warrants approval.

This Amending DA Traffic Impact Assessment has been prepared concurrently with 4 (no.) Detailed Development Application's across the precinct. The provision for parking contemplated in these Detailed DA's (the reference scheme) has been utilised to demonstrate the benefits associated with the proposed Amendment. This Amending DA demonstrates that the proposed amended will improve the traffic outcome associated with the site whilst maintaining the permissible parking rates approved in the Concept Approval SDD9393.

The change in floor areas and yield within the amended scheme results in a reduction in the maximum permissible parking provision from 380 spaces in the approved concept DA to 272 under the amended scheme. High level design of the basement indicates a provision of approximately 150 spaces, which is a further improvement over the maximum permissible parking provision.

The traffic assessment supporting the approved concept concluded that the site would generate 98 vehicle trips during the peak periods with no relationship to the parking provision. However, this did not include an allowance for the non-residential areas within the development. In order to provide a comparison based on the proposed changes to the yield sought by this application, it has been assessed that the total yield of the approved concept would generate 292 peak hour vehicle trips. The amending DA will be subject to a limited parking provision (maintaining the permissible parking rates approved in the Concept Approval SDD9393), which will act to constrain the traffic activity.

Parking will be provided within the shared Basement car park with access via Cope Street and the proposed Church Square shared zone. The proposed overall parking provision comprises:

- 150 car parking spaces;
- 5 courier service vehicle bays;
- 13 motorcycle spaces;
- 638 bicycle parking spaces; and
- End of trip facilities including 300 lockers and 34 shower/change cubicles.

The estimated traffic generation associated with the amended development is approximately 57 trips in the peak hour, which compares with the Concept Approval traffic generation of 98 peak hour trips. This represents a reduction of 41 trips as a result of the changes to the yield and the proposed parking provision.

Traffic modelling has been undertaken for the proposed development, including growth to 2036. The modelling indicates that the external road network will operate at acceptable levels of service, or perform at a level of service better than that of the approved development SSD 9393.

The change in floor areas and yield within the amended scheme results in a reduction in the maximum permissible parking provision from 380 spaces in the approved concept DA to 272 under the amended scheme. High level design of the basement indicates a provision of 150 car parking spaces, which is within the permissible maximum provision.

Vehicle access to the development is proposed from Botany Road, Cope Street (via the Church Square shred zone) and Wellington Street, which is consistent with the concept approved layout within SSD 9393.

This report concludes that the proposed amending concept DA for the Waterloo Metro Quarter OSD is suitable in relation traffic outcome and parking provision.

## **16. Appendices**

### **16.1 Appendix 1 - Traffic Modelling**

# MOVEMENT SUMMARY

 **Site: TCS055 [1. AM Existing Henderson Road / Wyndham Street]**

 **Network: N101 [AM Existing]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	13	8.3	13	8.3	0.966	88.6	LOS F	17.7	128.3	0.98	1.22	1.59	22.7
2	T1	468	7.6	468	7.6	0.966	84.2	LOS F	18.7	136.3	0.98	1.22	1.58	23.1
3	R2	3	33.3	3	33.3	0.966	88.0	LOS F	18.7	136.3	0.98	1.22	1.58	15.4
Approach		484	7.8	484	7.8	0.966	84.3	LOS F	18.7	136.3	0.98	1.22	1.58	23.1
East: Henderson Rd (E)														
4	L2	189	3.3	189	3.3	0.324	9.7	LOS A	4.3	31.2	0.22	0.41	0.22	41.8
5	T1	609	4.8	609	4.8	0.324	3.3	LOS A	4.3	31.2	0.16	0.21	0.16	45.6
6	R2	892	5.1	892	5.1	0.847	32.6	LOS C	15.7	114.2	0.96	0.92	1.12	27.5
Approach		1691	4.8	1691	4.8	0.847	19.5	LOS B	15.7	114.2	0.59	0.61	0.67	33.6
West: Henderson Rd (W)														
10	L2	506	6.7	506	6.7	0.986	90.6	LOS F	18.4	135.7	0.89	1.08	1.48	22.2
11	T1	278	3.8	278	3.8	0.470	36.1	LOS C	13.1	94.3	0.86	0.73	0.86	25.3
Approach		784	5.6	784	5.6	0.986	71.3	LOS F	18.4	135.7	0.88	0.96	1.26	22.8
All Vehicles		2959	5.5	2959	5.5	0.986	43.8	LOS D	18.7	136.3	0.73	0.80	0.98	26.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: TCS047 [2. AM Existing Base Botany Road / Raglan Street]

 Network: N101 [AM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	857	5.3	857	5.3	0.960	76.0	LOS F	37.3	271.9	1.00	1.09	1.40	9.1
Approach		857	5.3	857	5.3	0.960	76.0	LOS F	37.3	271.9	1.00	1.09	1.40	9.1
East: Raglan St (E)														
4	L2	4	0.0	4	0.0	0.787	62.9	LOS E	7.7	55.4	0.98	0.91	1.21	4.6
5	T1	258	4.1	258	4.1	0.787	58.2	LOS E	7.9	56.4	0.98	0.91	1.21	4.6
Approach		262	4.0	262	4.0	0.787	58.3	LOS E	7.9	56.4	0.98	0.91	1.21	4.6
North: Botany Rd (N)														
7	L2	59	8.9	59	8.9	0.477	11.5	LOS A	15.2	112.8	0.44	0.43	0.44	41.8
8	T1	1276	7.6	1276	7.6	0.477	5.9	LOS A	15.2	112.8	0.41	0.39	0.41	42.9
9	R2	586	5.0	586	5.0	0.631	47.4	LOS D	15.3	111.7	0.94	0.84	0.94	21.9
Approach		1921	6.8	1921	6.8	0.631	18.7	LOS B	15.3	112.8	0.58	0.53	0.58	33.3
West: Henderson Rd (W)														
11	T1	241	2.2	241	2.2	0.797	51.5	LOS D	8.9	62.5	0.96	0.79	1.00	5.4
12	R2	47	15.6	47	15.6	0.797	66.4	LOS E	7.6	56.2	1.00	0.86	1.12	4.5
Approach		288	4.4	288	4.4	0.797	53.9	LOS D	8.9	62.5	0.96	0.81	1.02	5.2
All Vehicles		3328	6.0	3328	6.0	0.960	39.6	LOS C	37.3	271.9	0.75	0.73	0.88	20.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian ped	Distance m			
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.



# MOVEMENT SUMMARY

 Site: 101 [3. AM Existing Cope Street / Raglan Street]

 Network: N101 [AM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	31	0.0	31	0.0	0.127	5.5	LOS A	0.7	3.7	0.45	0.53	0.45	29.6	
2	T1	83	1.3	83	1.3	0.127	4.0	LOS A	0.7	3.7	0.45	0.53	0.45	38.0	
3	R2	12	0.0	12	0.0	0.127	8.3	LOS A	0.7	3.7	0.45	0.53	0.45	43.3	
Approach		125	0.8	125	0.8	0.127	4.8	LOS A	0.7	3.7	0.45	0.53	0.45	37.8	
East: Raglan St (E)															
4	L2	4	75.0	4	75.0	0.187	5.2	LOS A	1.1	7.8	0.28	0.46	0.28	42.6	
5	T1	198	5.9	198	5.9	0.187	4.2	LOS A	1.1	7.8	0.28	0.46	0.28	42.6	
6	R2	27	0.0	27	0.0	0.187	6.0	LOS A	1.1	7.8	0.28	0.46	0.28	42.2	
Approach		229	6.4	229	6.4	0.187	4.4	LOS A	1.1	7.8	0.28	0.46	0.28	42.5	
North: Cope St (N)															
7	L2	14	0.0	14	0.0	0.087	5.2	LOS A	0.5	3.6	0.43	0.56	0.43	43.0	
8	T1	29	0.0	29	0.0	0.087	4.6	LOS A	0.5	3.6	0.43	0.56	0.43	40.6	
9	R2	45	4.7	45	4.7	0.087	8.3	LOS A	0.5	3.6	0.43	0.56	0.43	40.6	
Approach		88	2.4	88	2.4	0.087	6.6	LOS A	0.5	3.6	0.43	0.56	0.43	41.2	
West: Raglan St (W)															
10	L2	52	4.1	52	4.1	0.236	4.1	LOS A	1.2	8.7	0.21	0.46	0.21	44.0	
11	T1	223	3.8	223	3.8	0.236	4.1	LOS A	1.2	8.7	0.21	0.46	0.21	44.9	
12	R2	20	5.3	20	5.3	0.236	7.2	LOS A	1.2	8.7	0.21	0.46	0.21	28.0	
Approach		295	3.9	295	3.9	0.236	4.3	LOS A	1.2	8.7	0.21	0.46	0.21	44.5	
All Vehicles		738	4.0	738	4.0	0.236	4.7	LOS A	1.2	8.7	0.30	0.48	0.30	42.3	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 Site: 102 [4. AM Existing Cope Street / Wellington Street]

 Network: N101 [AM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	15	0.0	15	0.0	0.033	3.9	LOS A	0.2	0.9	0.22	0.45	0.22	40.6
2	T1	19	0.0	19	0.0	0.033	3.5	LOS A	0.2	0.9	0.22	0.45	0.22	40.6
3	R2	5	0.0	5	0.0	0.033	6.6	LOS A	0.2	0.9	0.22	0.45	0.22	43.2
Approach		39	0.0	39	0.0	0.033	4.0	LOS A	0.2	0.9	0.22	0.45	0.22	41.2
East: Wellington St (E)														
4	L2	12	0.0	12	0.0	0.064	4.2	LOS A	0.3	2.2	0.21	0.47	0.21	45.0
5	T1	45	2.3	45	2.3	0.064	3.6	LOS A	0.3	2.2	0.21	0.47	0.21	42.0
6	R2	21	0.0	21	0.0	0.064	7.1	LOS A	0.3	2.2	0.21	0.47	0.21	42.0
Approach		78	1.4	78	1.4	0.064	4.6	LOS A	0.3	2.2	0.21	0.47	0.21	42.7
North: Cope St (N)														
7	L2	13	0.0	13	0.0	0.049	4.8	LOS A	0.3	1.8	0.34	0.50	0.34	42.7
8	T1	21	0.0	21	0.0	0.049	3.6	LOS A	0.3	1.8	0.34	0.50	0.34	38.9
9	R2	20	15.8	20	15.8	0.049	7.5	LOS A	0.3	1.8	0.34	0.50	0.34	25.5
Approach		54	5.9	54	5.9	0.049	5.4	LOS A	0.3	1.8	0.34	0.50	0.34	38.4
West: Wellington St (W)														
10	L2	82	1.3	82	1.3	0.195	3.2	LOS A	0.9	5.5	0.12	0.44	0.12	27.1
11	T1	153	3.4	153	3.4	0.195	3.5	LOS A	0.9	5.5	0.12	0.44	0.12	42.4
12	R2	32	3.3	32	3.3	0.195	6.6	LOS A	0.9	5.5	0.12	0.44	0.12	43.0
Approach		266	2.8	266	2.8	0.195	3.8	LOS A	0.9	5.5	0.12	0.44	0.12	41.2
All Vehicles		437	2.7	437	2.7	0.195	4.1	LOS A	0.9	5.5	0.17	0.45	0.17	41.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 Site: TCS137 [5. AM Existing Botany Road / Wellington Street / Buckland Street]

 Network: N101 [AM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.528	11.4	LOS A	19.2	140.4	0.53	0.48	0.53	34.7
2	T1	816	5.7	816	5.7	0.528	10.4	LOS A	19.2	140.4	0.54	0.50	0.54	38.7
3	R2	78	5.4	78	5.4	0.528	20.1	LOS B	7.2	52.8	0.63	0.63	0.63	34.1
Approach		896	5.6	896	5.6	0.528	11.3	LOS A	19.2	140.4	0.55	0.52	0.55	38.2
East: Wellington St (E)														
4	L2	49	6.4	49	6.4	0.150	48.9	LOS D	2.5	17.9	0.88	0.73	0.88	22.6
5	T1	21	0.0	21	0.0	0.120	46.7	LOS D	2.1	10.6	0.89	0.69	0.89	17.8
6	R2	21	5.0	21	5.0	0.120	51.0	LOS D	2.1	10.6	0.89	0.69	0.89	4.8
Approach		92	4.6	92	4.6	0.150	48.9	LOS D	2.5	17.9	0.88	0.71	0.88	18.6
North: Botany Rd (N)														
7	L2	20	0.0	20	0.0	0.514	10.7	LOS A	11.7	87.3	0.34	0.32	0.34	36.1
8	T1	1287	8.1	1287	8.1	0.514	7.0	LOS A	13.7	102.5	0.37	0.34	0.37	44.0
9	R2	2	0.0	2	0.0	0.514	9.6	LOS A	13.7	102.5	0.40	0.36	0.40	31.8
Approach		1309	8.0	1309	8.0	0.514	7.0	LOS A	13.7	102.5	0.37	0.34	0.37	44.0
West: Buckland St (W)														
10	L2	11	0.0	11	0.0	0.333	47.9	LOS D	9.0	48.7	0.90	0.73	0.90	21.2
11	T1	171	1.2	171	1.2	0.333	43.4	LOS D	9.0	48.7	0.90	0.73	0.90	21.2
12	R2	23	18.2	23	18.2	0.089	49.1	LOS D	1.1	9.2	0.86	0.71	0.86	29.6
Approach		204	3.1	204	3.1	0.333	44.3	LOS D	9.0	48.7	0.89	0.73	0.89	22.5
All Vehicles		2501	6.6	2501	6.6	0.528	13.1	LOS A	19.2	140.4	0.49	0.45	0.49	38.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: TCS055 [1. PM Existing Henderson Road / Wyndham Street]

 Network: N101 [PM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	15	0.0	15	0.0	0.995	102.5	LOS F	19.2	134.7	0.99	1.28	1.71	21.3
2	T1	474	1.6	474	1.6	0.995	97.7	LOS F	20.6	143.9	0.99	1.28	1.70	21.4
3	R2	2	0.0	2	0.0	0.995	102.0	LOS F	20.6	143.9	0.99	1.29	1.69	13.9
Approach		491	1.5	491	1.5	0.995	97.8	LOS F	20.6	143.9	0.99	1.28	1.70	21.4
East: Henderson Rd (E)														
4	L2	159	1.3	159	1.3	0.395	16.0	LOS B	14.7	103.0	0.57	0.59	0.57	37.7
5	T1	879	1.0	879	1.0	0.395	8.4	LOS A	14.7	103.0	0.46	0.44	0.46	40.9
6	R2	818	3.5	818	3.5	0.730	19.7	LOS B	11.5	82.7	0.83	0.81	0.83	33.3
Approach		1856	2.1	1856	2.1	0.730	14.0	LOS A	14.7	103.0	0.63	0.62	0.63	36.9
West: Henderson Rd (W)														
10	L2	505	1.7	505	1.7	0.977	86.1	LOS F	17.9	126.6	0.90	1.06	1.45	22.8
11	T1	299	0.0	299	0.0	0.502	37.2	LOS C	14.4	99.3	0.88	0.75	0.88	24.9
Approach		804	1.0	804	1.0	0.977	67.9	LOS E	17.9	126.6	0.89	0.95	1.24	23.3
All Vehicles		3151	1.7	3151	1.7	0.995	40.8	LOS C	20.6	143.9	0.75	0.80	0.95	27.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: TCS047 [2. PM Existing Botany Road / Raglan Street]

 Network: N101 [PM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	805	2.9	805	2.9	0.962	81.4	LOS F	32.8	235.0	1.00	1.07	1.40	8.6
Approach		805	2.9	805	2.9	0.962	81.4	LOS F	32.8	235.0	1.00	1.07	1.40	8.6
East: Raglan St (E)														
4	L2	9	0.0	9	0.0	0.984	105.1	LOS F	11.3	78.6	0.98	1.23	1.81	2.7
5	T1	303	1.4	303	1.4	0.984	97.9	LOS F	14.0	97.4	0.97	1.22	1.76	2.8
Approach		313	1.3	313	1.3	0.984	98.2	LOS F	14.0	97.4	0.97	1.22	1.76	2.8
North: Botany Rd (N)														
7	L2	84	8.8	84	8.8	0.479	15.4	LOS B	17.2	122.8	0.54	0.52	0.54	38.1
8	T1	1180	3.2	1180	3.2	0.479	9.1	LOS A	17.2	122.8	0.50	0.47	0.50	39.8
9	R2	727	1.6	727	1.6	0.766	44.3	LOS D	22.7	159.1	0.95	0.89	1.01	22.6
Approach		1992	2.9	1992	2.9	0.766	22.2	LOS B	22.7	159.1	0.66	0.62	0.69	31.2
West: Henderson Rd (W)														
11	T1	253	0.8	253	0.8	0.617	29.6	LOS C	6.2	42.9	0.66	0.54	0.67	8.6
12	R2	36	0.0	36	0.0	0.617	56.5	LOS E	6.2	42.9	0.96	0.77	0.97	5.3
Approach		288	0.7	288	0.7	0.617	32.9	LOS C	6.2	42.9	0.70	0.57	0.70	8.0
All Vehicles		3398	2.5	3398	2.5	0.984	44.1	LOS D	32.8	235.0	0.78	0.78	0.96	18.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: 101 [3. PM Existing Cope Street / Raglan Street]

 Network: N101 [PM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles																
Mov ID	Turn	Demand		Flows		Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %			v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)																
1	L2	53	0.0	53	0.0	0.146		5.5	LOS A		0.6	3.7	0.45	0.56	0.45	30.6
2	T1	52	0.0	52	0.0	0.146		4.6	LOS A		0.6	3.7	0.45	0.56	0.45	41.2
3	R2	5	20.0	5	20.0	0.146		8.9	LOS A		0.6	3.7	0.45	0.56	0.45	43.4
Approach		109	1.0	109	1.0	0.146		5.2	LOS A		0.6	3.7	0.45	0.56	0.45	39.1
East: Raglan St (E)																
4	L2	1	100.0	1	100.0	0.276		5.9	LOS A		1.0	7.1	0.36	0.49	0.36	43.3
5	T1	189	2.2	189	2.2	0.276		4.5	LOS A		1.0	7.1	0.36	0.49	0.36	43.3
6	R2	9	0.0	9	0.0	0.276		7.3	LOS A		1.0	7.1	0.36	0.49	0.36	45.5
Approach		200	2.6	200	2.6	0.276		4.6	LOS A		1.0	7.1	0.36	0.49	0.36	43.5
North: Cope St (N)																
7	L2	23	0.0	23	0.0	0.238		4.8	LOS A		1.2	6.3	0.46	0.57	0.46	39.1
8	T1	76	1.4	76	1.4	0.238		3.7	LOS A		1.2	6.3	0.46	0.57	0.46	37.0
9	R2	89	0.0	89	0.0	0.238		8.0	LOS A		1.2	6.3	0.46	0.57	0.46	37.0
Approach		188	0.6	188	0.6	0.238		5.9	LOS A		1.2	6.3	0.46	0.57	0.46	37.4
West: Raglan St (W)																
10	L2	80	1.3	80	1.3	0.250		3.9	LOS A		1.3	9.4	0.18	0.44	0.18	43.7
11	T1	246	3.4	246	3.4	0.250		3.9	LOS A		1.3	9.4	0.18	0.44	0.18	45.0
12	R2	11	0.0	11	0.0	0.250		6.6	LOS A		1.3	9.4	0.18	0.44	0.18	28.4
Approach		337	2.8	337	2.8	0.250		4.0	LOS A		1.3	9.4	0.18	0.44	0.18	44.6
All Vehicles		835	2.0	835	2.0	0.276		4.7	LOS A		1.3	9.4	0.32	0.50	0.32	41.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSWMIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8



# MOVEMENT SUMMARY

 Site: 102 [4. PM Existing Cope Street / Wellington Street]

 Network: N101 [PM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	28	0.0	28	0.0	0.044	4.8	LOS A	0.2	1.4	0.38	0.51	0.38	41.6	
2	T1	14	0.0	14	0.0	0.044	4.3	LOS A	0.2	1.4	0.38	0.51	0.38	41.6	
3	R2	4	0.0	4	0.0	0.044	7.8	LOS A	0.2	1.4	0.38	0.51	0.38	45.2	
Approach		46	0.0	46	0.0	0.044	4.9	LOS A	0.2	1.4	0.38	0.51	0.38	42.1	
East: Wellington St (E)															
4	L2	8	0.0	8	0.0	0.152	4.2	LOS A	0.8	5.4	0.27	0.47	0.27	43.8	
5	T1	136	1.6	136	1.6	0.152	3.8	LOS A	0.8	5.4	0.27	0.47	0.27	41.6	
6	R2	41	0.0	41	0.0	0.152	7.2	LOS A	0.8	5.4	0.27	0.47	0.27	41.6	
Approach		185	1.1	185	1.1	0.152	4.6	LOS A	0.8	5.4	0.27	0.47	0.27	41.8	
North: Cope St (N)															
7	L2	15	0.0	15	0.0	0.096	4.0	LOS A	0.5	2.8	0.30	0.52	0.30	38.8	
8	T1	23	0.0	23	0.0	0.096	2.6	LOS A	0.5	2.8	0.30	0.52	0.30	34.5	
9	R2	73	2.9	73	2.9	0.096	6.3	LOS A	0.5	2.8	0.30	0.52	0.30	24.1	
Approach		111	1.9	111	1.9	0.096	5.2	LOS A	0.5	2.8	0.30	0.52	0.30	32.4	
West: Wellington St (W)															
10	L2	52	2.0	52	2.0	0.143	3.9	LOS A	0.6	4.2	0.15	0.46	0.15	27.2	
11	T1	113	1.9	113	1.9	0.143	3.6	LOS A	0.6	4.2	0.15	0.46	0.15	43.5	
12	R2	21	0.0	21	0.0	0.143	6.8	LOS A	0.6	4.2	0.15	0.46	0.15	44.7	
Approach		185	1.7	185	1.7	0.143	4.1	LOS A	0.6	4.2	0.15	0.46	0.15	42.4	
All Vehicles		527	1.4	527	1.4	0.152	4.6	LOS A	0.8	5.4	0.24	0.48	0.24	40.6	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 Site: TCS137 [5. PM Existing Botany Road / Wellington Street / Buckland Street]

 Network: N101 [PM Existing]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.469	12.6	LOS A	16.8	120.1	0.53	0.48	0.53	34.3
2	T1	753	2.8	753	2.8	0.469	11.6	LOS A	16.8	120.1	0.55	0.51	0.55	37.7
3	R2	73	0.0	73	0.0	0.469	19.6	LOS B	7.8	55.6	0.61	0.60	0.61	34.6
Approach		827	2.5	827	2.5	0.469	12.3	LOS A	16.8	120.1	0.55	0.52	0.55	37.4
East: Wellington St (E)														
4	L2	142	3.0	142	3.0	0.477	47.6	LOS D	7.1	51.2	0.90	0.78	0.90	23.1
5	T1	57	0.0	57	0.0	0.235	41.7	LOS C	5.4	26.2	0.87	0.73	0.87	18.6
6	R2	56	0.0	56	0.0	0.235	46.0	LOS D	5.4	26.2	0.87	0.73	0.87	5.3
Approach		255	1.7	255	1.7	0.477	46.0	LOS D	7.1	51.2	0.88	0.76	0.88	19.5
North: Botany Rd (N)														
7	L2	20	0.0	20	0.0	0.481	10.3	LOS A	9.4	67.1	0.29	0.28	0.29	36.6
8	T1	1191	3.2	1191	3.2	0.481	6.6	LOS A	11.3	80.9	0.32	0.30	0.32	44.2
9	R2	1	0.0	1	0.0	0.481	9.3	LOS A	11.3	80.9	0.35	0.32	0.35	31.9
Approach		1212	3.1	1212	3.1	0.481	6.7	LOS A	11.3	80.9	0.32	0.30	0.32	44.1
West: Buckland St (W)														
10	L2	12	0.0	12	0.0	0.193	43.3	LOS D	4.6	29.4	0.84	0.67	0.84	23.4
11	T1	88	2.4	88	2.4	0.193	38.8	LOS C	4.6	29.4	0.84	0.67	0.84	23.4
12	R2	32	0.0	32	0.0	0.123	49.3	LOS D	1.6	11.0	0.87	0.72	0.87	29.6
Approach		132	1.6	132	1.6	0.193	41.7	LOS C	4.6	29.4	0.84	0.69	0.84	25.4
All Vehicles		2425	2.7	2425	2.7	0.481	14.6	LOS B	16.8	120.1	0.49	0.44	0.49	37.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	Distance m		
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 **Site: TCS055 [1. AM Base Henderson Road / Wyndham Street]**

 **Network: N101 [AM Base (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	13	8.3	13	8.3	1.013	115.2	LOS F	21.9	158.9	1.00	1.36	1.79	19.4
2	T1	487	7.6	487	7.6	1.013	110.8	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
3	R2	3	33.3	3	33.3	1.013	114.7	LOS F	23.2	169.0	1.00	1.36	1.78	12.6
Approach		503	7.7	503	7.7	1.013	111.0	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
East: Henderson Rd (E)														
4	L2	197	3.2	197	3.2	0.337	9.7	LOS A	4.5	32.4	0.22	0.41	0.22	41.8
5	T1	634	4.8	634	4.8	0.337	3.3	LOS A	4.5	32.4	0.16	0.21	0.16	45.6
6	R2	927	5.1	927	5.1	0.882	36.9	LOS C	15.7	114.2	0.98	0.95	1.20	26.1
Approach		1758	4.8	1758	4.8	0.882	21.7	LOS B	15.7	114.2	0.60	0.62	0.72	32.5
West: Henderson Rd (W)														
10	L2	526	6.6	526	6.6	1.028	118.8	LOS F	23.4	172.7	1.00	1.20	1.76	18.8
11	T1	288	3.6	288	3.6	0.487	36.3	LOS C	13.7	98.4	0.87	0.74	0.87	25.2
Approach		815	5.6	815	5.6	1.028	89.6	LOS F	23.4	172.7	0.95	1.04	1.45	19.9
All Vehicles		3076	5.5	3076	5.5	1.028	54.3	LOS D	23.4	172.7	0.76	0.85	1.08	24.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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 (Akcelik 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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: TCS047 [2. AM Base Botany Road / Raglan Street]

 Network: N101 [AM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
Approach		892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
East: Raglan St (E)														
4	L2	4	0.0	4	0.0	0.825	65.2	LOS E	8.2	58.9	0.98	0.95	1.28	4.4
5	T1	267	3.9	267	3.9	0.825	60.6	LOS E	8.3	59.9	0.98	0.95	1.28	4.4
Approach		272	3.9	272	3.9	0.825	60.6	LOS E	8.3	59.9	0.98	0.95	1.28	4.4
North: Botany Rd (N)														
7	L2	61	8.6	61	8.6	0.496	11.7	LOS A	16.1	120.0	0.45	0.44	0.45	41.6
8	T1	1327	7.6	1327	7.6	0.496	6.1	LOS A	16.1	120.0	0.42	0.40	0.42	42.8
9	R2	609	5.0	609	5.0	0.656	47.7	LOS D	16.1	117.0	0.95	0.84	0.95	21.8
Approach		1998	6.8	1998	6.8	0.656	18.9	LOS B	16.1	120.0	0.58	0.54	0.58	33.2
West: Henderson Rd (W)														
11	T1	251	2.1	250	2.1	0.850	52.3	LOS D	9.6	67.8	0.96	0.82	1.03	5.3
12	R2	49	14.9	49	14.9	0.850	68.8	LOS E	7.8	57.7	1.00	0.89	1.18	4.4
Approach		300	4.2	300	4.2	0.850	55.1	LOS D	9.6	67.8	0.97	0.83	1.06	5.1
All Vehicles		3461	6.0	3461	6.0	1.000	45.3	LOS D	44.3	323.3	0.76	0.76	0.93	18.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: 101 [3. AM Base Cope Street / Raglan Street]

 Network: N101 [AM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	32	0.0	32	0.0	0.135	5.6	LOS A	0.7	4.0	0.46	0.53	0.46	29.5	
2	T1	87	1.2	87	1.2	0.135	4.1	LOS A	0.7	4.0	0.46	0.53	0.46	37.9	
3	R2	12	0.0	12	0.0	0.135	8.4	LOS A	0.7	4.0	0.46	0.53	0.46	43.3	
Approach		131	0.8	131	0.8	0.135	4.8	LOS A	0.7	4.0	0.46	0.53	0.46	37.7	
East: Raglan St (E)															
4	L2	4	75.0	4	75.0	0.195	5.3	LOS A	1.2	8.2	0.29	0.46	0.29	42.6	
5	T1	205	5.6	205	5.6	0.195	4.2	LOS A	1.2	8.2	0.29	0.46	0.29	42.6	
6	R2	28	0.0	28	0.0	0.195	6.1	LOS A	1.2	8.2	0.29	0.46	0.29	42.4	
Approach		238	6.2	238	6.2	0.195	4.4	LOS A	1.2	8.2	0.29	0.46	0.29	42.6	
North: Cope St (N)															
7	L2	14	0.0	14	0.0	0.091	5.2	LOS A	0.6	3.8	0.44	0.56	0.44	43.0	
8	T1	31	0.0	31	0.0	0.091	4.7	LOS A	0.6	3.8	0.44	0.56	0.44	40.6	
9	R2	47	4.4	47	4.4	0.091	8.3	LOS A	0.6	3.8	0.44	0.56	0.44	40.6	
Approach		92	2.3	92	2.3	0.091	6.6	LOS A	0.6	3.8	0.44	0.56	0.44	41.2	
West: Raglan St (W)															
10	L2	54	3.9	54	3.9	0.247	4.2	LOS A	1.3	9.2	0.22	0.47	0.22	44.0	
11	T1	232	3.6	232	3.6	0.247	4.1	LOS A	1.3	9.2	0.22	0.47	0.22	44.9	
12	R2	21	5.0	21	5.0	0.247	7.3	LOS A	1.3	9.2	0.22	0.47	0.22	28.0	
Approach		306	3.8	306	3.8	0.247	4.3	LOS A	1.3	9.2	0.22	0.47	0.22	44.5	
All Vehicles		766	3.8	766	3.8	0.247	4.7	LOS A	1.3	9.2	0.31	0.49	0.31	42.2	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 Site: 102 [4. AM Base Cope Street / Wellington Street]

 Network: N101 [AM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	15	0.0	15	0.0	0.034	3.9	LOS A	0.2	0.9	0.23	0.45	0.23	40.7	
2	T1	20	0.0	20	0.0	0.034	3.5	LOS A	0.2	0.9	0.23	0.45	0.23	40.7	
3	R2	5	0.0	5	0.0	0.034	6.6	LOS A	0.2	0.9	0.23	0.45	0.23	43.3	
Approach		40	0.0	40	0.0	0.034	4.1	LOS A	0.2	0.9	0.23	0.45	0.23	41.3	
East: Wellington St (E)															
4	L2	12	0.0	12	0.0	0.066	4.3	LOS A	0.3	2.3	0.21	0.47	0.21	45.0	
5	T1	46	2.3	46	2.3	0.066	3.6	LOS A	0.3	2.3	0.21	0.47	0.21	42.0	
6	R2	22	0.0	22	0.0	0.066	7.1	LOS A	0.3	2.3	0.21	0.47	0.21	42.0	
Approach		80	1.3	80	1.3	0.066	4.7	LOS A	0.3	2.3	0.21	0.47	0.21	42.7	
North: Cope St (N)															
7	L2	13	0.0	13	0.0	0.050	4.8	LOS A	0.3	1.9	0.34	0.50	0.34	42.6	
8	T1	21	0.0	21	0.0	0.050	3.7	LOS A	0.3	1.9	0.34	0.50	0.34	38.9	
9	R2	21	15.0	21	15.0	0.050	7.6	LOS A	0.3	1.9	0.34	0.50	0.34	25.4	
Approach		55	5.8	55	5.8	0.050	5.4	LOS A	0.3	1.9	0.34	0.50	0.34	38.2	
West: Wellington St (W)															
10	L2	85	1.2	85	1.2	0.203	3.2	LOS A	1.0	5.7	0.13	0.44	0.13	27.0	
11	T1	158	3.3	158	3.3	0.203	3.5	LOS A	1.0	5.7	0.13	0.44	0.13	42.4	
12	R2	33	3.2	33	3.2	0.203	6.6	LOS A	1.0	5.7	0.13	0.44	0.13	43.0	
Approach		276	2.7	276	2.7	0.203	3.8	LOS A	1.0	5.7	0.13	0.44	0.13	41.1	
All Vehicles		451	2.6	451	2.6	0.203	4.2	LOS A	1.0	5.7	0.18	0.45	0.18	41.2	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: TCS137 [5. AM Base Botany Road / Wellington Street / Buckland Street]  Network: N101 [AM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.566	11.8	LOS A	21.5	157.0	0.55	0.50	0.55	34.6
2	T1	849	5.7	849	5.7	0.566	10.9	LOS A	21.5	157.0	0.56	0.53	0.56	38.3
3	R2	81	5.2	81	5.2	0.566	21.8	LOS B	7.2	53.0	0.67	0.66	0.67	33.0
Approach		933	5.6	933	5.6	0.566	11.8	LOS A	21.5	157.0	0.57	0.54	0.57	37.8
East: Wellington St (E)														
4	L2	52	6.1	52	6.1	0.156	49.0	LOS D	2.6	18.6	0.88	0.73	0.88	22.6
5	T1	22	0.0	22	0.0	0.127	46.8	LOS D	2.2	11.1	0.89	0.70	0.89	17.8
6	R2	22	4.8	22	4.8	0.127	51.1	LOS D	2.2	11.1	0.89	0.70	0.89	4.8
Approach		96	4.4	96	4.4	0.156	49.0	LOS D	2.6	18.6	0.89	0.72	0.89	18.6
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.536	10.9	LOS A	12.6	93.7	0.35	0.33	0.35	35.9
8	T1	1340	8.1	1340	8.1	0.536	7.0	LOS A	14.4	107.6	0.37	0.35	0.37	44.0
9	R2	2	0.0	2	0.0	0.536	9.6	LOS A	14.4	107.6	0.40	0.37	0.40	31.8
Approach		1363	8.0	1363	8.0	0.536	7.1	LOS A	14.4	107.6	0.37	0.35	0.37	43.9
West: Buckland St (W)														
10	L2	11	0.0	11	0.0	0.346	48.0	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
11	T1	178	1.2	178	1.2	0.346	43.5	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
12	R2	24	17.4	24	17.4	0.093	49.1	LOS D	1.2	9.6	0.86	0.71	0.86	29.6
Approach		213	3.0	213	3.0	0.346	44.4	LOS D	9.4	50.7	0.90	0.73	0.90	22.5
All Vehicles		2604	6.6	2604	6.6	0.566	13.4	LOS A	21.5	157.0	0.51	0.46	0.51	38.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		ped	Distance m			
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY

 Site: TCS055 [1. PM Base Henderson Road / Wyndham Street]

 Network: N101 [PM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	16	0.0	16	0.0	1.037	129.3	LOS F	23.5	164.6	1.00	1.41	1.90	18.3
2	T1	493	1.5	493	1.5	1.037	124.6	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
3	R2	2	0.0	2	0.0	1.037	128.9	LOS F	25.2	176.1	1.00	1.42	1.88	11.5
Approach		511	1.4	511	1.4	1.037	124.7	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
East: Henderson Rd (E)														
4	L2	165	1.3	161	1.3	0.399	15.7	LOS B	14.6	102.1	0.56	0.58	0.56	37.9
5	T1	915	0.9	891	0.9	0.399	8.8	LOS A	14.6	102.1	0.45	0.43	0.45	40.5
6	R2	851	3.5	828	3.4	0.738	22.2	LOS B	12.1	87.0	0.86	0.82	0.87	32.0
Approach		1931	2.1	1879 <sup>N1</sup>	2.1	0.738	15.3	LOS B	14.6	102.1	0.64	0.62	0.64	36.1
West: Henderson Rd (W)														
10	L2	525	1.6	525	1.6	1.021	114.1	LOS F	22.8	161.6	1.00	1.18	1.73	19.3
11	T1	311	0.0	311	0.0	0.522	37.5	LOS C	15.1	103.9	0.88	0.76	0.88	24.8
Approach		836	1.0	836	1.0	1.021	85.7	LOS F	22.8	161.6	0.96	1.02	1.41	20.4
All Vehicles		3277	1.7	3225 <sup>N1</sup>	1.7	1.037	50.9	LOS D	25.2	176.1	0.78	0.85	1.04	24.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: TCS047 [2. PM Base Botany Road / Raglan Street]

 Network: N101 [PM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	838	2.9	838	2.9	1.046	128.0	LOS F	42.7	306.2	1.00	1.24	1.75	5.8
Approach		838	2.9	838	2.9	1.046	128.0	LOS F	42.7	306.2	1.00	1.24	1.75	5.8
East: Raglan St (E)														
4	L2	9	0.0	9	0.0	1.016	125.1	LOS F	13.3	92.5	1.00	1.30	1.95	2.3
5	T1	315	1.3	315	1.3	1.016	118.4	LOS F	15.3	106.1	1.00	1.31	1.91	2.3
Approach		324	1.3	324	1.3	1.016	118.6	LOS F	15.3	106.1	1.00	1.31	1.91	2.3
North: Botany Rd (N)														
7	L2	87	8.4	87	8.4	0.498	15.6	LOS B	18.2	130.0	0.55	0.53	0.55	38.0
8	T1	1227	3.2	1227	3.2	0.498	9.2	LOS A	18.2	130.0	0.51	0.48	0.51	39.7
9	R2	757	1.5	757	1.5	0.789	46.0	LOS D	24.2	169.7	0.96	0.90	1.04	22.2
Approach		2072	2.8	2072	2.8	0.789	22.9	LOS B	24.2	169.7	0.68	0.64	0.70	30.8
West: Henderson Rd (W)														
11	T1	262	0.8	262	0.8	0.835	24.2	LOS B	8.6	60.0	0.66	0.56	0.69	10.2
12	R2	37	0.0	37	0.0	0.835	74.8	LOS F	3.8	26.2	1.00	0.85	1.28	4.1
Approach		299	0.7	299	0.7	0.835	30.4	LOS C	8.6	60.0	0.71	0.59	0.76	8.5
All Vehicles		3533	2.5	3533	2.5	1.046	57.3	LOS E	42.7	306.2	0.78	0.84	1.07	15.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 Site: 101 [3. PM Base Cope Street / Raglan Street]

 Network: N101 [PM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				
South: Cope St (S)														
1	L2	55	0.0	55	0.0	0.175	5.6	LOS A	0.6	3.9	0.46	0.57	0.46	30.5
2	T1	54	0.0	54	0.0	0.175	4.7	LOS A	0.6	3.9	0.46	0.57	0.46	41.1
3	R2	5	20.0	5	20.0	0.175	8.9	LOS A	0.6	3.9	0.46	0.57	0.46	43.3
Approach		114	0.9	114	0.9	0.175	5.3	LOS A	0.6	3.9	0.46	0.57	0.46	39.0
East: Raglan St (E)														
4	L2	1	100.0	1	100.0	0.355	6.0	LOS A	1.1	7.5	0.37	0.50	0.37	43.3
5	T1	197	2.1	197	2.1	0.355	4.5	LOS A	1.1	7.5	0.37	0.50	0.37	43.3
6	R2	9	0.0	9	0.0	0.355	7.4	LOS A	1.1	7.5	0.37	0.50	0.37	45.5
Approach		207	2.5	207	2.5	0.355	4.6	LOS A	1.1	7.5	0.37	0.50	0.37	43.4
North: Cope St (N)														
7	L2	24	0.0	24	0.0	0.287	4.9	LOS A	1.2	6.7	0.48	0.58	0.48	39.2
8	T1	79	1.3	79	1.3	0.287	3.8	LOS A	1.2	6.7	0.48	0.58	0.48	37.0
9	R2	94	0.0	94	0.0	0.287	8.1	LOS A	1.2	6.7	0.48	0.58	0.48	37.0
Approach		197	0.5	197	0.5	0.287	6.0	LOS A	1.2	6.7	0.48	0.58	0.48	37.4
West: Raglan St (W)														
10	L2	83	1.3	83	1.3	0.259	3.9	LOS A	1.4	9.9	0.19	0.44	0.19	43.7
11	T1	256	3.3	256	3.3	0.259	3.9	LOS A	1.4	9.9	0.19	0.44	0.19	45.0
12	R2	11	0.0	11	0.0	0.259	6.6	LOS A	1.4	9.9	0.19	0.44	0.19	28.4
Approach		349	2.7	349	2.7	0.259	4.0	LOS A	1.4	9.9	0.19	0.44	0.19	44.6
All Vehicles		867	1.9	867	1.9	0.355	4.8	LOS A	1.4	9.9	0.33	0.50	0.33	41.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSWMIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 Site: 102 [4. PM Base Cope Street / Wellington Street]

 Network: N101 [PM Base (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				
South: Cope St (S)														
1	L2	29	0.0	29	0.0	0.045	4.9	LOS A	0.2	1.4	0.39	0.52	0.39	41.6
2	T1	14	0.0	14	0.0	0.045	4.3	LOS A	0.2	1.4	0.39	0.52	0.39	41.6
3	R2	4	0.0	4	0.0	0.045	7.9	LOS A	0.2	1.4	0.39	0.52	0.39	45.2
Approach		47	0.0	47	0.0	0.045	5.0	LOS A	0.2	1.4	0.39	0.52	0.39	42.1
East: Wellington St (E)														
4	L2	8	0.0	8	0.0	0.158	4.2	LOS A	0.9	5.7	0.27	0.47	0.27	43.8
5	T1	141	1.5	141	1.5	0.158	3.8	LOS A	0.9	5.7	0.27	0.47	0.27	41.6
6	R2	43	0.0	43	0.0	0.158	7.2	LOS A	0.9	5.7	0.27	0.47	0.27	41.6
Approach		193	1.1	193	1.1	0.158	4.6	LOS A	0.9	5.7	0.27	0.47	0.27	41.7
North: Cope St (N)														
7	L2	15	0.0	15	0.0	0.099	4.1	LOS A	0.6	2.9	0.31	0.52	0.31	38.7
8	T1	24	0.0	24	0.0	0.099	2.6	LOS A	0.6	2.9	0.31	0.52	0.31	34.3
9	R2	75	2.8	75	2.8	0.099	6.3	LOS A	0.6	2.9	0.31	0.52	0.31	24.1
Approach		114	1.9	114	1.9	0.099	5.2	LOS A	0.6	2.9	0.31	0.52	0.31	32.2
West: Wellington St (W)														
10	L2	54	2.0	54	2.0	0.150	3.9	LOS A	0.7	4.5	0.15	0.46	0.15	27.2
11	T1	118	1.8	118	1.8	0.150	3.6	LOS A	0.7	4.5	0.15	0.46	0.15	43.5
12	R2	22	0.0	22	0.0	0.150	6.8	LOS A	0.7	4.5	0.15	0.46	0.15	44.7
Approach		194	1.6	194	1.6	0.150	4.1	LOS A	0.7	4.5	0.15	0.46	0.15	42.4
All Vehicles		547	1.3	547	1.3	0.158	4.6	LOS A	0.9	5.7	0.25	0.48	0.25	40.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: TCS137 [5. PM Base Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [PM Base (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.674	15.4	LOS B	22.1	157.9	0.67	0.61	0.67	33.5
2	T1	783	2.8	783	2.8	0.674	14.5	LOS B	22.1	157.9	0.68	0.63	0.68	35.6
3	R2	76	0.0	76	0.0	0.674	23.2	LOS B	9.9	70.4	0.72	0.70	0.74	32.4
Approach		861	2.6	861	2.6	0.674	15.3	LOS B	22.1	157.9	0.68	0.64	0.69	35.3
East: Wellington St (E)														
4	L2	147	2.9	147	2.9	0.534	47.8	LOS D	7.4	53.2	0.90	0.78	0.90	23.0
5	T1	59	0.0	59	0.0	0.330	42.9	LOS D	5.8	28.0	0.88	0.74	0.88	18.4
6	R2	58	0.0	58	0.0	0.330	47.2	LOS D	5.8	28.0	0.88	0.74	0.88	5.2
Approach		264	1.6	264	1.6	0.534	46.6	LOS D	7.4	53.2	0.89	0.76	0.89	19.3
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.501	10.4	LOS A	10.1	71.7	0.30	0.29	0.30	36.5
8	T1	1239	3.1	1239	3.1	0.501	6.3	LOS A	10.8	77.2	0.31	0.29	0.31	44.4
9	R2	1	0.0	1	0.0	0.501	8.5	LOS A	10.8	77.2	0.32	0.29	0.32	32.2
Approach		1261	3.1	1261	3.1	0.501	6.3	LOS A	10.8	77.2	0.31	0.29	0.31	44.4
West: Buckland St (W)														
10	L2	12	0.0	12	0.0	0.208	43.5	LOS D	4.9	30.8	0.84	0.68	0.84	23.3
11	T1	93	2.3	93	2.3	0.208	39.0	LOS C	4.9	30.8	0.84	0.68	0.84	23.3
12	R2	33	0.0	33	0.0	0.129	50.3	LOS D	1.6	11.5	0.88	0.72	0.88	29.3
Approach		137	1.5	137	1.5	0.208	42.1	LOS C	4.9	30.8	0.85	0.69	0.85	25.3
All Vehicles		2523	2.7	2523	2.7	0.674	15.5	LOS B	22.1	157.9	0.53	0.48	0.53	36.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian ped	Distance m			
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.



# MOVEMENT SUMMARY

 **Site: TCS055 [1. AM Base + Dev 1 Henderson Road / Wyndham Street]**

 **Network: N101 [AM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	13	8.3	13	8.3	1.013	115.2	LOS F	21.9	158.9	1.00	1.36	1.79	19.4
2	T1	487	7.6	487	7.6	1.013	110.8	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
3	R2	3	33.3	3	33.3	1.013	114.7	LOS F	23.2	169.0	1.00	1.36	1.78	12.6
Approach		503	7.7	503	7.7	1.013	111.0	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
East: Henderson Rd (E)														
4	L2	197	3.2	197	3.2	0.341	9.5	LOS A	4.4	32.2	0.21	0.40	0.21	41.9
5	T1	645	4.7	645	4.7	0.341	3.3	LOS A	4.4	32.2	0.16	0.21	0.16	45.6
6	R2	945	5.0	945	5.0	0.898	39.6	LOS C	15.7	114.2	0.99	0.97	1.24	25.2
Approach		1787	4.7	1787	4.7	0.898	23.2	LOS B	15.7	114.2	0.60	0.63	0.74	31.8
West: Henderson Rd (W)														
10	L2	526	6.6	526	6.6	1.028	118.8	LOS F	23.4	172.7	1.00	1.20	1.76	18.8
11	T1	292	3.6	292	3.6	0.493	36.4	LOS C	13.9	99.7	0.87	0.74	0.87	25.2
Approach		818	5.5	818	5.5	1.028	89.4	LOS F	23.4	172.7	0.95	1.04	1.44	19.9
All Vehicles		3108	5.4	3108	5.4	1.028	54.8	LOS D	23.4	172.7	0.76	0.86	1.09	24.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

## MOVEMENT SUMMARY

 **Site: TCS047 [2. AM Base + Dev 1 Botany Road / Raglan Street]**

 **Network: N101 [AM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
Approach		892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
East: Raglan St (E)														
4	L2	4	0.0	4	0.0	0.943	83.8	LOS F	10.6	75.9	0.99	1.13	1.61	3.4
5	T1	297	3.5	297	3.5	0.943	79.1	LOS F	10.8	77.1	0.99	1.13	1.61	3.4
Approach		301	3.5	301	3.5	0.943	79.1	LOS F	10.8	77.1	0.99	1.13	1.61	3.4
North: Botany Rd (N)														
7	L2	65	8.1	65	8.1	0.498	11.7	LOS A	16.2	120.4	0.46	0.44	0.46	41.6
8	T1	1327	7.6	1327	7.6	0.498	6.1	LOS A	16.2	120.4	0.42	0.40	0.42	42.8
9	R2	609	5.0	609	5.0	0.656	47.7	LOS D	16.1	117.0	0.95	0.84	0.95	21.8
Approach		2002	6.8	2002	6.8	0.656	18.9	LOS B	16.2	120.4	0.59	0.54	0.59	33.2
West: Henderson Rd (W)														
11	T1	254	2.1	254	2.1	0.894	53.1	LOS D	10.3	72.5	0.97	0.84	1.07	5.2
12	R2	49	14.9	49	14.9	0.894	72.1	LOS F	7.6	56.5	1.00	0.93	1.26	4.2
Approach		303	4.2	303	4.2	0.894	56.2	LOS D	10.3	72.5	0.98	0.85	1.10	5.0
All Vehicles		3498	5.9	3498	5.9	1.000	47.1	LOS D	44.3	323.3	0.76	0.78	0.96	18.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY



Site: 101 [3. AM Base + Dev 1 Cope Street / Raglan Street]



Network: N101 [AM Base + Existing PP (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	60	0.0	60	0.0	0.214	5.7	LOS A	1.1	6.5	0.48	0.59	0.48	29.3
2	T1	87	1.2	87	1.2	0.214	4.2	LOS A	1.1	6.5	0.48	0.59	0.48	37.8
3	R2	43	0.0	43	0.0	0.214	8.5	LOS A	1.1	6.5	0.48	0.59	0.48	43.1
Approach		191	0.6	191	0.6	0.214	5.6	LOS A	1.1	6.5	0.48	0.59	0.48	38.2
East: Raglan St (E)														
4	L2	11	30.0	11	30.0	0.250	4.7	LOS A	1.2	8.6	0.30	0.47	0.30	42.6
5	T1	205	5.6	205	5.6	0.250	4.2	LOS A	1.2	8.6	0.30	0.47	0.30	42.6
6	R2	28	0.0	28	0.0	0.250	6.1	LOS A	1.2	8.6	0.30	0.47	0.30	42.4
Approach		244	6.0	244	6.0	0.250	4.5	LOS A	1.2	8.6	0.30	0.47	0.30	42.5
North: Cope St (N)														
7	L2	14	0.0	14	0.0	0.108	5.5	LOS A	0.6	3.8	0.48	0.58	0.48	42.9
8	T1	31	0.0	31	0.0	0.108	4.9	LOS A	0.6	3.8	0.48	0.58	0.48	40.4
9	R2	47	4.4	47	4.4	0.108	8.6	LOS A	0.6	3.8	0.48	0.58	0.48	40.4
Approach		92	2.3	92	2.3	0.108	6.9	LOS A	0.6	3.8	0.48	0.58	0.48	41.0
West: Raglan St (W)														
10	L2	54	3.9	54	3.9	0.263	4.4	LOS A	1.4	10.0	0.25	0.49	0.25	43.7
11	T1	232	3.6	232	3.6	0.263	4.3	LOS A	1.4	10.0	0.25	0.49	0.25	44.7
12	R2	27	3.8	27	3.8	0.263	7.5	LOS A	1.4	10.0	0.25	0.49	0.25	27.4
Approach		313	3.7	313	3.7	0.263	4.6	LOS A	1.4	10.0	0.25	0.49	0.25	44.1
All Vehicles		839	3.5	839	3.5	0.263	5.1	LOS A	1.4	10.0	0.34	0.52	0.34	42.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: 102 [4. AM Base + Dev 1 Cope Street / Wellington Street]**

 **Network: N101 [AM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	15	0.0	15	0.0	0.034	4.0	LOS A	0.2	1.0	0.25	0.45	0.25	40.6
2	T1	20	0.0	20	0.0	0.034	3.6	LOS A	0.2	1.0	0.25	0.45	0.25	40.6
3	R2	5	0.0	5	0.0	0.034	6.7	LOS A	0.2	1.0	0.25	0.45	0.25	43.2
Approach		40	0.0	40	0.0	0.034	4.1	LOS A	0.2	1.0	0.25	0.45	0.25	41.2
East: Wellington St (E)														
4	L2	12	0.0	12	0.0	0.069	4.3	LOS A	0.4	2.4	0.23	0.48	0.23	44.9
5	T1	46	2.3	46	2.3	0.069	3.7	LOS A	0.4	2.4	0.23	0.48	0.23	41.9
6	R2	24	0.0	24	0.0	0.069	7.1	LOS A	0.4	2.4	0.23	0.48	0.23	41.9
Approach		82	1.3	82	1.3	0.069	4.8	LOS A	0.4	2.4	0.23	0.48	0.23	42.6
North: Cope St (N)														
7	L2	22	0.0	22	0.0	0.071	4.9	LOS A	0.4	2.8	0.35	0.53	0.35	42.5
8	T1	21	0.0	21	0.0	0.071	3.7	LOS A	0.4	2.8	0.35	0.53	0.35	38.7
9	R2	35	9.1	35	9.1	0.071	7.6	LOS A	0.4	2.8	0.35	0.53	0.35	25.0
Approach		78	4.1	78	4.1	0.071	5.8	LOS A	0.4	2.8	0.35	0.53	0.35	38.0
West: Wellington St (W)														
10	L2	88	1.2	88	1.2	0.206	3.3	LOS A	1.0	5.9	0.13	0.44	0.13	27.0
11	T1	158	3.3	158	3.3	0.206	3.5	LOS A	1.0	5.9	0.13	0.44	0.13	42.4
12	R2	33	3.2	33	3.2	0.206	6.7	LOS A	1.0	5.9	0.13	0.44	0.13	43.0
Approach		279	2.6	279	2.6	0.206	3.8	LOS A	1.0	5.9	0.13	0.44	0.13	41.1
All Vehicles		479	2.4	479	2.4	0.206	4.3	LOS A	1.0	5.9	0.19	0.46	0.19	41.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: TCS137 [5. AM Base + Dev 1 Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [AM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Queue	Back of Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.576	12.0	LOS A	22.2	161.9	0.56	0.51	0.56	34.5
2	T1	849	5.7	849	5.7	0.576	10.9	LOS A	22.2	161.9	0.57	0.53	0.57	38.3
3	R2	84	5.0	84	5.0	0.576	22.0	LOS B	6.9	50.7	0.67	0.68	0.67	32.7
Approach		936	5.6	936	5.6	0.576	11.9	LOS A	22.2	161.9	0.58	0.54	0.58	37.7
East: Wellington St (E)														
4	L2	65	4.8	65	4.8	0.196	49.4	LOS D	3.3	23.6	0.89	0.74	0.89	22.6
5	T1	22	0.0	22	0.0	0.127	46.8	LOS D	2.2	11.1	0.89	0.70	0.89	17.8
6	R2	22	4.8	22	4.8	0.127	51.1	LOS D	2.2	11.1	0.89	0.70	0.89	4.8
Approach		109	3.8	109	3.8	0.196	49.2	LOS D	3.3	23.6	0.89	0.73	0.89	19.1
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.536	10.8	LOS A	12.5	93.3	0.35	0.33	0.35	36.0
8	T1	1340	8.1	1340	8.1	0.536	7.0	LOS A	14.3	106.8	0.37	0.35	0.37	44.0
9	R2	2	0.0	2	0.0	0.536	9.5	LOS A	14.3	106.8	0.40	0.36	0.40	31.8
Approach		1363	8.0	1363	8.0	0.536	7.0	LOS A	14.3	106.8	0.37	0.35	0.37	44.0
West: Buckland St (W)														
10	L2	11	0.0	11	0.0	0.346	48.0	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
11	T1	178	1.2	178	1.2	0.346	43.5	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
12	R2	24	17.4	24	17.4	0.095	49.2	LOS D	1.2	9.6	0.86	0.71	0.86	29.5
Approach		213	3.0	213	3.0	0.346	44.4	LOS D	9.4	50.7	0.90	0.73	0.90	22.5
All Vehicles		2621	6.5	2621	6.5	0.576	13.6	LOS A	22.2	161.9	0.51	0.46	0.51	37.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	Distance m		
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

Site: 101 [6. AM Base + Dev 1 Cope Street / Shared Zone]

Network: N101 [AM Base + Existing PP (2036)]

New Site  
Site Category: (None)  
Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	6	0.0	6	0.0	0.054	3.8	LOS A	0.0	0.0	0.00	0.03	0.00	43.3
2	T1	127	0.8	127	0.8	0.054	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	42.1
Approach		134	0.8	134	0.8	0.054	0.2	NA	0.0	0.0	0.00	0.03	0.00	42.4
North: Cope St (N)														
8	T1	55	7.7	55	7.7	0.036	0.2	LOS A	0.1	0.6	0.10	0.14	0.10	41.5
9	R2	15	0.0	15	0.0	0.036	4.9	LOS A	0.1	0.6	0.10	0.14	0.10	46.5
Approach		69	6.1	69	6.1	0.036	1.2	NA	0.1	0.6	0.10	0.14	0.10	44.2
West: Shared Zone (W)														
10	L2	59	0.0	59	0.0	0.060	4.9	LOS A	0.2	1.6	0.20	0.52	0.20	43.7
12	R2	23	0.0	23	0.0	0.060	5.2	LOS A	0.2	1.6	0.20	0.52	0.20	43.7
Approach		82	0.0	82	0.0	0.060	5.0	LOS A	0.2	1.6	0.20	0.52	0.20	43.7
All Vehicles		285	1.8	285	1.8	0.060	1.8	NA	0.2	1.6	0.08	0.20	0.08	43.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).  
Vehicle movement LOS values are based on average delay per movement.  
Minor Road Approach LOS values are based on average delay for all vehicle movements.  
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

 Site: TCS055 [1. PM Base + Dev 1 Henderson Road / Wyndham Street]

 Network: N101 [PM Base + Existing PP (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	16	0.0	16	0.0	1.037	129.3	LOS F	23.5	164.6	1.00	1.41	1.90	18.3
2	T1	493	1.5	493	1.5	1.037	124.6	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
3	R2	2	0.0	2	0.0	1.037	128.9	LOS F	25.2	176.1	1.00	1.42	1.88	11.5
Approach		511	1.4	511	1.4	1.037	124.7	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
East: Henderson Rd (E)														
4	L2	165	1.3	160	1.3	0.399	15.7	LOS B	14.6	101.8	0.56	0.58	0.56	38.0
5	T1	918	0.9	889	0.9	0.399	8.8	LOS A	14.6	101.8	0.45	0.43	0.45	40.6
6	R2	855	3.4	828	3.4	0.739	22.3	LOS B	12.1	87.1	0.86	0.82	0.87	31.9
Approach		1938	2.1	1877 <sup>N1</sup>	2.1	0.739	15.3	LOS B	14.6	101.8	0.64	0.62	0.64	36.1
West: Henderson Rd (W)														
10	L2	525	1.6	525	1.6	1.021	114.1	LOS F	22.8	161.6	1.00	1.18	1.73	19.3
11	T1	322	0.0	322	0.0	0.542	37.7	LOS C	15.7	108.7	0.89	0.76	0.89	24.7
Approach		847	1.0	847	1.0	1.021	85.1	LOS F	22.8	161.6	0.96	1.02	1.41	20.4
All Vehicles		3296	1.7	3235 <sup>N1</sup>	1.7	1.037	50.9	LOS D	25.2	176.1	0.78	0.85	1.04	24.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 **Site: TCS047 [2. PM Base + Dev 1 Botany Road / Raglan Street]**

 **Network: N101 [PM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	838	2.9	838	2.9	1.046	128.4	LOS F	42.7	306.0	1.00	1.24	1.75	5.7
Approach		838	2.9	838	2.9	1.046	128.4	LOS F	42.7	306.0	1.00	1.24	1.75	5.7
East: Raglan St (E)														
4	L2	9	0.0	9	0.0	1.036	136.3	LOS F	14.3	99.4	1.00	1.35	2.03	2.1
5	T1	322	1.3	322	1.3	1.036	129.7	LOS F	15.3	106.1	1.00	1.36	1.99	2.1
Approach		332	1.3	332	1.3	1.036	129.9	LOS F	15.3	106.1	1.00	1.36	1.99	2.1
North: Botany Rd (N)														
7	L2	104	7.1	104	7.1	0.508	16.2	LOS B	18.8	134.3	0.56	0.55	0.56	37.4
8	T1	1227	3.2	1227	3.2	0.508	9.5	LOS A	18.8	134.3	0.52	0.49	0.52	39.4
9	R2	757	1.5	757	1.5	0.786	45.7	LOS D	24.1	168.8	0.96	0.90	1.03	22.2
Approach		2088	2.8	2088	2.8	0.786	23.0	LOS B	24.1	168.8	0.68	0.64	0.71	30.8
West: Henderson Rd (W)														
11	T1	275	0.8	275	0.8	0.866	24.4	LOS B	9.1	63.0	0.67	0.57	0.71	10.1
12	R2	37	0.0	37	0.0	0.866	75.4	LOS F	4.0	28.2	1.00	0.87	1.32	4.0
Approach		312	0.7	312	0.7	0.866	30.4	LOS C	9.1	63.0	0.71	0.61	0.78	8.5
All Vehicles		3569	2.5	3569	2.5	1.046	58.3	LOS E	42.7	306.0	0.79	0.84	1.08	15.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY

 Site: 101 [3. PM Base + Dev 1 Cope Street / Raglan Street]

 Network: N101 [PM Base + Existing PP (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	62	0.0	62	0.0	0.199	5.6	LOS A	0.7	4.6	0.47	0.59	0.47	30.2	
2	T1	54	0.0	54	0.0	0.199	4.7	LOS A	0.7	4.6	0.47	0.59	0.47	41.0	
3	R2	13	8.3	13	8.3	0.199	8.7	LOS A	0.7	4.6	0.47	0.59	0.47	43.5	
Approach		128	0.8	128	0.8	0.199	5.5	LOS A	0.7	4.6	0.47	0.59	0.47	39.0	
East: Raglan St (E)															
4	L2	32	3.3	32	3.3	0.392	4.8	LOS A	1.3	9.1	0.41	0.53	0.41	43.2	
5	T1	197	2.1	197	2.1	0.392	4.7	LOS A	1.3	9.1	0.41	0.53	0.41	43.2	
6	R2	9	0.0	9	0.0	0.392	7.6	LOS A	1.3	9.1	0.41	0.53	0.41	45.4	
Approach		238	2.2	238	2.2	0.392	4.8	LOS A	1.3	9.1	0.41	0.53	0.41	43.3	
North: Cope St (N)															
7	L2	24	0.0	24	0.0	0.296	5.2	LOS A	1.3	7.0	0.51	0.60	0.51	39.1	
8	T1	79	1.3	79	1.3	0.296	4.1	LOS A	1.3	7.0	0.51	0.60	0.51	36.8	
9	R2	94	0.0	94	0.0	0.296	8.4	LOS A	1.3	7.0	0.51	0.60	0.51	36.8	
Approach		197	0.5	197	0.5	0.296	6.3	LOS A	1.3	7.0	0.51	0.60	0.51	37.3	
West: Raglan St (W)															
10	L2	83	1.3	83	1.3	0.284	4.0	LOS A	1.6	11.2	0.20	0.46	0.20	43.5	
11	T1	256	3.3	256	3.3	0.284	3.9	LOS A	1.6	11.2	0.20	0.46	0.20	44.7	
12	R2	40	0.0	40	0.0	0.284	7.0	LOS A	1.6	11.2	0.20	0.46	0.20	27.7	
Approach		379	2.5	379	2.5	0.284	4.3	LOS A	1.6	11.2	0.20	0.46	0.20	44.0	
All Vehicles		942	1.8	942	1.8	0.392	5.0	LOS A	1.6	11.2	0.36	0.52	0.36	41.5	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: 102 [4. PM Base + Dev 1 Cope Street / Wellington Street]**

 **Network: N101 [PM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	29	0.0	29	0.0	0.046	4.9	LOS A	0.2	1.4	0.40	0.52	0.40	41.6
2	T1	14	0.0	14	0.0	0.046	4.4	LOS A	0.2	1.4	0.40	0.52	0.40	41.6
3	R2	4	0.0	4	0.0	0.046	8.0	LOS A	0.2	1.4	0.40	0.52	0.40	45.2
Approach		47	0.0	47	0.0	0.046	5.0	LOS A	0.2	1.4	0.40	0.52	0.40	42.1
East: Wellington St (E)														
4	L2	8	0.0	8	0.0	0.166	4.2	LOS A	0.9	6.0	0.28	0.48	0.28	43.8
5	T1	141	1.5	141	1.5	0.166	3.9	LOS A	0.9	6.0	0.28	0.48	0.28	41.5
6	R2	52	0.0	52	0.0	0.166	7.2	LOS A	0.9	6.0	0.28	0.48	0.28	41.5
Approach		201	1.0	201	1.0	0.166	4.7	LOS A	0.9	6.0	0.28	0.48	0.28	41.7
North: Cope St (N)														
7	L2	18	0.0	18	0.0	0.106	4.2	LOS A	0.6	3.2	0.31	0.52	0.31	39.3
8	T1	24	0.0	24	0.0	0.106	2.6	LOS A	0.6	3.2	0.31	0.52	0.31	34.3
9	R2	79	2.7	79	2.7	0.106	6.4	LOS A	0.6	3.2	0.31	0.52	0.31	24.1
Approach		121	1.7	121	1.7	0.106	5.3	LOS A	0.6	3.2	0.31	0.52	0.31	32.6
West: Wellington St (W)														
10	L2	67	1.6	67	1.6	0.162	4.0	LOS A	0.7	4.9	0.17	0.46	0.17	27.0
11	T1	118	1.8	118	1.8	0.162	3.7	LOS A	0.7	4.9	0.17	0.46	0.17	43.5
12	R2	22	0.0	22	0.0	0.162	6.8	LOS A	0.7	4.9	0.17	0.46	0.17	44.7
Approach		207	1.5	207	1.5	0.162	4.1	LOS A	0.7	4.9	0.17	0.46	0.17	42.1
All Vehicles		577	1.3	577	1.3	0.166	4.7	LOS A	0.9	6.0	0.26	0.49	0.26	40.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: TCS137 [5. PM Base + Dev 1 Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [PM Base + Existing PP (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.714	16.1	LOS B	24.3	173.7	0.70	0.64	0.70	33.3
2	T1	783	2.8	783	2.8	0.714	15.7	LOS B	24.3	173.7	0.71	0.67	0.72	34.8
3	R2	89	0.0	89	0.0	0.714	27.8	LOS B	10.4	73.9	0.76	0.78	0.83	29.8
Approach		875	2.5	875	2.5	0.714	16.9	LOS B	24.3	173.7	0.71	0.68	0.73	34.2
East: Wellington St (E)														
4	L2	152	2.8	152	2.8	0.551	47.9	LOS D	7.7	54.8	0.90	0.78	0.90	23.0
5	T1	59	0.0	59	0.0	0.333	42.9	LOS D	5.8	28.0	0.88	0.74	0.88	18.4
6	R2	58	0.0	58	0.0	0.333	47.2	LOS D	5.8	28.0	0.88	0.74	0.88	5.2
Approach		268	1.6	268	1.6	0.551	46.7	LOS D	7.7	54.8	0.89	0.76	0.89	19.4
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.502	10.4	LOS A	10.1	71.8	0.30	0.29	0.30	36.5
8	T1	1239	3.1	1238	3.1	0.502	6.2	LOS A	10.8	77.0	0.31	0.29	0.31	44.4
9	R2	1	0.0	1	0.0	0.502	8.5	LOS A	10.8	77.0	0.32	0.29	0.32	32.2
Approach		1261	3.1	1261	3.1	0.502	6.3	LOS A	10.8	77.0	0.31	0.29	0.31	44.4
West: Buckland St (W)														
10	L2	12	0.0	12	0.0	0.209	43.5	LOS D	4.9	30.8	0.84	0.68	0.84	23.3
11	T1	93	2.3	93	2.3	0.209	39.0	LOS C	4.9	30.8	0.84	0.68	0.84	23.3
12	R2	33	0.0	33	0.0	0.130	50.3	LOS D	1.6	11.5	0.88	0.72	0.88	29.3
Approach		137	1.5	137	1.5	0.209	42.1	LOS C	4.9	30.8	0.85	0.69	0.85	25.3
All Vehicles		2541	2.7	2541	2.7	0.714	16.2	LOS B	24.3	173.7	0.54	0.50	0.55	36.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	Distance m		
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

Site: 101 [6. PM Base + Dev 1 Cope Street / Shared Zone]

Network: N101 [PM Base + Existing PP (2036)]

New Site  
Site Category: (None)  
Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	23	0.0	23	0.0	0.065	4.4	LOS A	0.0	0.0	0.00	0.10	0.00	46.8
2	T1	111	1.0	111	1.0	0.065	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	42.6
Approach		134	0.8	134	0.8	0.065	0.8	NA	0.0	0.0	0.00	0.10	0.00	45.1
North: Cope St (N)														
8	T1	91	2.3	91	2.3	0.073	0.4	LOS A	0.4	2.0	0.20	0.23	0.20	34.4
9	R2	59	0.0	59	0.0	0.073	5.0	LOS A	0.4	2.0	0.20	0.23	0.20	44.4
Approach		149	1.4	149	1.4	0.073	2.2	NA	0.4	2.0	0.20	0.23	0.20	41.5
West: Shared Zone (W)														
10	L2	15	0.0	15	0.0	0.016	4.8	LOS A	0.1	0.4	0.20	0.51	0.20	43.7
12	R2	6	0.0	6	0.0	0.016	5.4	LOS A	0.1	0.4	0.20	0.51	0.20	43.7
Approach		21	0.0	21	0.0	0.016	5.0	LOS A	0.1	0.4	0.20	0.51	0.20	43.7
All Vehicles		304	1.0	304	1.0	0.073	1.8	NA	0.4	2.0	0.11	0.19	0.11	42.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).  
Vehicle movement LOS values are based on average delay per movement.  
Minor Road Approach LOS values are based on average delay for all vehicle movements.  
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

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# MOVEMENT SUMMARY

 **Site: TCS055 [1. AM Base + Dev 2 Henderson Road / Wyndham Street]**

 **Network: N101 [AM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	13	8.3	13	8.3	1.013	115.2	LOS F	21.9	158.9	1.00	1.36	1.79	19.4
2	T1	487	7.6	487	7.6	1.013	110.8	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
3	R2	3	33.3	3	33.3	1.013	114.7	LOS F	23.2	169.0	1.00	1.36	1.78	12.6
Approach		503	7.7	503	7.7	1.013	111.0	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
East: Henderson Rd (E)														
4	L2	197	3.2	193	3.2	0.342	9.4	LOS A	4.3	31.3	0.21	0.39	0.21	42.1
5	T1	665	4.6	652	4.6	0.342	3.2	LOS A	4.3	31.3	0.16	0.20	0.16	45.8
6	R2	974	4.9	955	4.9	0.907	41.1	LOS C	15.7	114.2	0.99	0.98	1.26	24.8
Approach		1836	4.6	1800 <sup>N1</sup>	4.6	0.907	23.9	LOS B	15.7	114.2	0.60	0.64	0.75	31.4
West: Henderson Rd (W)														
10	L2	526	6.6	526	6.6	1.028	118.8	LOS F	23.4	172.7	1.00	1.20	1.76	18.8
11	T1	297	3.5	297	3.5	0.501	36.5	LOS C	14.2	101.8	0.87	0.74	0.87	25.2
Approach		823	5.5	823	5.5	1.028	89.1	LOS F	23.4	172.7	0.95	1.03	1.44	19.9
All Vehicles		3162	5.3	3126 <sup>N1</sup>	5.4	1.028	55.1	LOS D	23.4	172.7	0.76	0.86	1.10	24.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.



# MOVEMENT SUMMARY

 **Site: TCS047 [2. AM Base + Dev 2 Botany Road / Raglan Street]**

 **Network: N101 [AM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	892	5.3	892	5.3	1.000	105.6	LOS F	46.6	340.2	1.00	1.20	1.63	6.9
Approach		892	5.3	892	5.3	1.000	105.6	LOS F	46.6	340.2	1.00	1.20	1.63	6.9
East: Raglan St (E)														
4	L2	4	0.0	4	0.0	1.106	177.8	LOS F	14.9	106.1	1.00	1.50	2.27	1.6
5	T1	345	3.0	345	3.0	1.106	173.2	LOS F	14.9	106.1	1.00	1.50	2.27	1.6
Approach		349	3.0	349	3.0	1.106	173.2	LOS F	14.9	106.1	1.00	1.50	2.27	1.6
North: Botany Rd (N)														
7	L2	73	7.2	73	7.2	0.502	12.1	LOS A	16.7	124.1	0.47	0.46	0.47	41.1
8	T1	1327	7.6	1327	7.6	0.502	6.3	LOS A	16.7	124.1	0.43	0.41	0.43	42.6
9	R2	609	5.0	609	5.0	0.656	47.7	LOS D	16.1	117.0	0.95	0.84	0.95	21.8
Approach		2009	6.8	2009	6.8	0.656	19.1	LOS B	16.7	124.1	0.59	0.54	0.59	33.1
West: Henderson Rd (W)														
11	T1	258	2.0	258	2.0	1.125	61.8	LOS E	14.1	99.1	1.00	0.93	1.21	4.5
12	R2	49	14.9	49	14.9	1.125	182.5	LOS F	8.3	63.0	1.00	1.19	2.15	1.7
Approach		307	4.1	307	4.1	1.125	81.3	LOS F	14.1	99.1	1.00	0.97	1.36	3.5
All Vehicles		3558	5.8	3558	5.8	1.125	61.3	LOS E	46.6	340.2	0.77	0.84	1.08	15.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY



Site: 101 [3. AM Base + Dev 2 Cope Street / Raglan Street]



Network: N101 [AM Base + Max Permissible (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h	
South: Cope St (S)														
1	L2	109	0.0	109	0.0	0.413	5.9	LOS A	1.8	11.5	0.52	0.65	0.52	28.9
2	T1	87	1.2	87	1.2	0.413	4.4	LOS A	1.8	11.5	0.52	0.65	0.52	37.7
3	R2	95	0.0	95	0.0	0.413	8.7	LOS A	1.8	11.5	0.52	0.65	0.52	42.9
Approach		292	0.4	292	0.4	0.413	6.4	LOS A	1.8	11.5	0.52	0.65	0.52	38.5
East: Raglan St (E)														
4	L2	24	13.0	24	13.0	0.387	4.5	LOS A	1.3	9.3	0.32	0.48	0.32	42.6
5	T1	205	5.6	205	5.6	0.387	4.3	LOS A	1.3	9.3	0.32	0.48	0.32	42.6
6	R2	28	0.0	28	0.0	0.387	6.2	LOS A	1.3	9.3	0.32	0.48	0.32	42.4
Approach		258	5.7	258	5.7	0.387	4.6	LOS A	1.3	9.3	0.32	0.48	0.32	42.5
North: Cope St (N)														
7	L2	14	0.0	14	0.0	0.150	5.9	LOS A	0.6	4.0	0.52	0.62	0.52	42.8
8	T1	31	0.0	31	0.0	0.150	5.3	LOS A	0.6	4.0	0.52	0.62	0.52	40.1
9	R2	47	4.4	47	4.4	0.150	9.0	LOS A	0.6	4.0	0.52	0.62	0.52	40.1
Approach		92	2.3	92	2.3	0.150	7.3	LOS A	0.6	4.0	0.52	0.62	0.52	40.8
West: Raglan St (W)														
10	L2	54	3.9	53	3.9	0.291	4.8	LOS A	1.6	11.3	0.31	0.52	0.31	43.4
11	T1	232	3.6	230	3.6	0.291	4.7	LOS A	1.6	11.3	0.31	0.52	0.31	44.3
12	R2	40	2.6	40	2.6	0.291	7.9	LOS A	1.6	11.3	0.31	0.52	0.31	26.5
Approach		325	3.6	323 <sup>N1</sup>	3.6	0.291	5.1	LOS A	1.6	11.3	0.31	0.52	0.31	43.6
All Vehicles		966	3.1	964 <sup>N1</sup>	3.1	0.413	5.6	LOS A	1.8	11.5	0.40	0.56	0.40	41.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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# MOVEMENT SUMMARY

 **Site: 102 [4. AM Base + Dev 2 Cope Street / Wellington Street]**

 **Network: N101 [AM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	15	0.0	15	0.0	0.035	4.1	LOS A	0.2	1.0	0.28	0.46	0.28	40.5
2	T1	20	0.0	20	0.0	0.035	3.7	LOS A	0.2	1.0	0.28	0.46	0.28	40.5
3	R2	5	0.0	5	0.0	0.035	6.9	LOS A	0.2	1.0	0.28	0.46	0.28	43.2
Approach		40	0.0	40	0.0	0.035	4.3	LOS A	0.2	1.0	0.28	0.46	0.28	41.1
East: Wellington St (E)														
4	L2	12	0.0	12	0.0	0.074	4.4	LOS A	0.4	2.6	0.27	0.50	0.27	44.8
5	T1	46	2.3	46	2.3	0.074	3.8	LOS A	0.4	2.6	0.27	0.50	0.27	41.8
6	R2	28	0.0	28	0.0	0.074	7.3	LOS A	0.4	2.6	0.27	0.50	0.27	41.8
Approach		86	1.2	86	1.2	0.074	5.0	LOS A	0.4	2.6	0.27	0.50	0.27	42.5
North: Cope St (N)														
7	L2	38	0.0	38	0.0	0.105	4.9	LOS A	0.6	4.3	0.36	0.55	0.36	42.3
8	T1	21	0.0	21	0.0	0.105	3.7	LOS A	0.6	4.3	0.36	0.55	0.36	38.6
9	R2	58	5.5	58	5.5	0.105	7.7	LOS A	0.6	4.3	0.36	0.55	0.36	24.8
Approach		117	2.7	117	2.7	0.105	6.1	LOS A	0.6	4.3	0.36	0.55	0.36	37.7
West: Wellington St (W)														
10	L2	95	1.1	95	1.1	0.212	3.4	LOS A	1.0	6.1	0.14	0.44	0.14	26.9
11	T1	158	3.3	158	3.3	0.212	3.5	LOS A	1.0	6.1	0.14	0.44	0.14	42.3
12	R2	33	3.2	33	3.2	0.212	6.7	LOS A	1.0	6.1	0.14	0.44	0.14	43.0
Approach		285	2.6	285	2.6	0.212	3.8	LOS A	1.0	6.1	0.14	0.44	0.14	41.0
All Vehicles		528	2.2	528	2.2	0.212	4.6	LOS A	1.0	6.1	0.22	0.47	0.22	40.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: TCS137 [5. AM Base + Dev 2 Botany Road / Wellington Street / Buckland Street]  Network: N101 [AM Base + Max Permissible (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h	
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.585	12.1	LOS A	22.7	165.8	0.56	0.52	0.56	34.5
2	T1	849	5.7	849	5.7	0.585	10.8	LOS A	22.7	165.8	0.57	0.53	0.57	38.4
3	R2	91	4.7	91	4.7	0.585	21.6	LOS B	6.7	49.2	0.67	0.68	0.67	32.8
Approach		942	5.6	942	5.6	0.585	11.9	LOS A	22.7	165.8	0.58	0.55	0.58	37.7
East: Wellington St (E)														
4	L2	89	3.5	89	3.5	0.288	50.1	LOS D	4.5	32.6	0.90	0.76	0.90	22.4
5	T1	22	0.0	22	0.0	0.127	46.8	LOS D	2.2	11.1	0.89	0.70	0.89	17.8
6	R2	22	4.8	22	4.8	0.127	51.1	LOS D	2.2	11.1	0.89	0.70	0.89	4.8
Approach		134	3.1	134	3.1	0.288	49.7	LOS D	4.5	32.6	0.90	0.74	0.90	19.6
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.533	10.8	LOS A	12.4	92.5	0.34	0.33	0.34	36.0
8	T1	1340	8.1	1334	8.1	0.533	6.4	LOS A	12.6	93.9	0.35	0.32	0.35	44.4
9	R2	2	0.0	2	0.0	0.533	8.5	LOS A	12.6	93.9	0.35	0.32	0.35	32.2
Approach		1363	8.0	1357 <sup>N1</sup>	7.9	0.533	6.5	LOS A	12.6	93.9	0.35	0.32	0.35	44.4
West: Buckland St (W)														
10	L2	11	0.0	11	0.0	0.346	48.0	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
11	T1	178	1.2	178	1.2	0.346	43.5	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
12	R2	24	17.4	24	17.4	0.102	51.1	LOS D	1.2	9.8	0.88	0.71	0.88	29.1
Approach		213	3.0	213	3.0	0.346	44.6	LOS D	9.4	50.7	0.90	0.73	0.90	22.4
All Vehicles		2652	6.5	2646 <sup>N1</sup>	6.5	0.585	13.7	LOS A	22.7	165.8	0.50	0.46	0.50	37.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue pedestrian	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

# MOVEMENT SUMMARY

Site: 101 [6. AM Base + Dev 2 Cope Street / Shared Zone]

Network: N101 [AM Base + Max Permissible (2036)]

New Site  
Site Category: (None)  
Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	16	0.0	16	0.0	0.059	3.9	LOS A	0.0	0.0	0.00	0.07	0.00	43.4
2	T1	127	0.8	127	0.8	0.059	0.1	LOS A	0.0	0.0	0.00	0.07	0.00	40.8
Approach		143	0.7	143	0.7	0.059	0.5	NA	0.0	0.0	0.00	0.07	0.00	42.0
North: Cope St (N)														
8	T1	55	7.7	55	7.7	0.052	0.4	LOS A	0.2	1.5	0.18	0.24	0.18	37.6
9	R2	40	0.0	40	0.0	0.052	4.9	LOS A	0.2	1.5	0.18	0.24	0.18	45.5
Approach		95	4.4	94 <sup>N1</sup>	4.5	0.052	2.3	NA	0.2	1.5	0.18	0.24	0.18	43.5
West: Shared Zone (W)														
10	L2	160	0.0	160	0.0	0.165	4.9	LOS A	0.7	4.8	0.22	0.53	0.22	43.6
12	R2	63	0.0	63	0.0	0.165	5.4	LOS A	0.7	4.8	0.22	0.53	0.22	43.6
Approach		223	0.0	223	0.0	0.165	5.1	LOS A	0.7	4.8	0.22	0.53	0.22	43.6
All Vehicles		461	1.1	461	1.1	0.165	3.1	NA	0.7	4.8	0.15	0.33	0.15	43.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).  
 Vehicle movement LOS values are based on average delay per movement.  
 Minor Road Approach LOS values are based on average delay for all vehicle movements.  
 NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

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# MOVEMENT SUMMARY

 **Site: TCS055 [1. PM Base + Dev 2 Henderson Road / Wyndham Street]**

 **Network: N101 [PM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Wyndham St (S)														
1	L2	16	0.0	16	0.0	1.037	129.3	LOS F	23.5	164.6	1.00	1.41	1.90	18.3
2	T1	493	1.5	493	1.5	1.037	124.6	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
3	R2	2	0.0	2	0.0	1.037	128.9	LOS F	25.2	176.1	1.00	1.42	1.88	11.5
Approach		511	1.4	511	1.4	1.037	124.7	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
East: Henderson Rd (E)														
4	L2	165	1.3	159	1.3	0.397	15.8	LOS B	14.7	102.6	0.56	0.58	0.56	37.9
5	T1	922	0.9	887	0.9	0.397	8.9	LOS A	14.7	102.6	0.46	0.44	0.46	40.5
6	R2	862	3.4	829	3.4	0.740	22.3	LOS B	12.2	87.4	0.86	0.82	0.87	31.9
Approach		1949	2.1	1875 <sup>N1</sup>	2.0	0.740	15.4	LOS B	14.7	102.6	0.64	0.62	0.65	36.0
West: Henderson Rd (W)														
10	L2	525	1.6	525	1.6	1.021	114.1	LOS F	22.8	161.6	1.00	1.18	1.73	19.3
11	T1	342	0.0	342	0.0	0.576	38.2	LOS C	16.9	117.0	0.90	0.78	0.90	24.6
Approach		867	1.0	867	1.0	1.021	84.2	LOS F	22.8	161.6	0.96	1.02	1.40	20.4
All Vehicles		3327	1.7	3253 <sup>N1</sup>	1.7	1.037	50.9	LOS D	25.2	176.1	0.78	0.85	1.04	24.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 **Site: TCS047 [2. PM Base + Dev 2 Botany Road / Raglan Street]**

 **Network: N101 [PM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	838	2.9	838	2.9	1.051	132.2	LOS F	43.4	310.9	1.00	1.25	1.78	5.6
Approach		838	2.9	838	2.9	1.051	132.2	LOS F	43.4	310.9	1.00	1.25	1.78	5.6
East: Raglan St (E)														
4	L2	9	0.0	9	0.0	1.084	168.4	LOS F	15.2	106.1	1.00	1.45	2.23	1.7
5	T1	335	1.3	335	1.3	1.084	162.0	LOS F	15.3	106.1	1.00	1.47	2.20	1.7
Approach		344	1.2	344	1.2	1.084	162.2	LOS F	15.3	106.1	1.00	1.47	2.20	1.7
North: Botany Rd (N)														
7	L2	133	5.6	133	5.6	0.523	16.8	LOS B	19.6	140.3	0.58	0.58	0.58	36.8
8	T1	1227	3.2	1227	3.2	0.523	9.8	LOS A	19.6	140.3	0.53	0.50	0.53	39.1
9	R2	757	1.5	757	1.5	0.794	46.5	LOS D	24.4	171.2	0.96	0.91	1.05	22.0
Approach		2117	2.7	2117	2.7	0.794	23.4	LOS B	24.4	171.2	0.69	0.65	0.72	30.6
West: Henderson Rd (W)														
11	T1	294	0.7	294	0.7	0.907	25.2	LOS B	9.8	68.1	0.70	0.60	0.75	9.8
12	R2	37	0.0	37	0.0	0.907	76.7	LOS F	4.5	31.7	1.00	0.90	1.38	4.0
Approach		331	0.6	330	0.6	0.907	30.9	LOS C	9.8	68.1	0.73	0.63	0.82	8.4
All Vehicles		3629	2.4	3629	2.4	1.084	62.3	LOS E	43.4	310.9	0.79	0.87	1.11	14.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.



# MOVEMENT SUMMARY



Site: 101 [3. PM Base + Dev 2 Cope Street / Raglan Street]

Network: N101 [PM Base + Max Permissible (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	m				km/h
South: Cope St (S)														
1	L2	74	0.0	74	0.0	0.238	5.7	LOS A	0.9	5.7	0.49	0.61	0.49	29.9
2	T1	54	0.0	54	0.0	0.238	4.8	LOS A	0.9	5.7	0.49	0.61	0.49	40.8
3	R2	26	4.0	26	4.0	0.238	8.6	LOS A	0.9	5.7	0.49	0.61	0.49	43.4
Approach		154	0.7	154	0.7	0.238	5.9	LOS A	0.9	5.7	0.49	0.61	0.49	39.1
East: Raglan St (E)														
4	L2	83	1.3	83	1.3	0.455	5.1	LOS A	1.7	12.1	0.47	0.57	0.47	43.0
5	T1	197	2.1	197	2.1	0.455	5.1	LOS A	1.7	12.1	0.47	0.57	0.47	43.0
6	R2	9	0.0	9	0.0	0.455	7.9	LOS A	1.7	12.1	0.47	0.57	0.47	45.3
Approach		289	1.8	289	1.8	0.455	5.2	LOS A	1.7	12.1	0.47	0.57	0.47	43.1
North: Cope St (N)														
7	L2	24	0.0	24	0.0	0.310	5.7	LOS A	1.4	7.6	0.56	0.63	0.56	38.9
8	T1	79	1.3	79	1.3	0.310	4.6	LOS A	1.4	7.6	0.56	0.63	0.56	36.5
9	R2	94	0.0	94	0.0	0.310	8.9	LOS A	1.4	7.6	0.56	0.63	0.56	36.5
Approach		197	0.5	197	0.5	0.310	6.8	LOS A	1.4	7.6	0.56	0.63	0.56	37.0
West: Raglan St (W)														
10	L2	83	1.3	83	1.3	0.325	4.1	LOS A	1.9	13.6	0.23	0.49	0.23	43.1
11	T1	256	3.3	256	3.3	0.325	4.0	LOS A	1.9	13.6	0.23	0.49	0.23	44.3
12	R2	88	0.0	88	0.0	0.325	7.2	LOS A	1.9	13.6	0.23	0.49	0.23	26.9
Approach		427	2.2	427	2.2	0.325	4.7	LOS A	1.9	13.6	0.23	0.49	0.23	43.0
All Vehicles		1067	1.6	1067	1.6	0.455	5.4	LOS A	1.9	13.6	0.40	0.55	0.40	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: 102 [4. PM Base + Dev 2 Cope Street / Wellington Street]**

 **Network: N101 [PM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	29	0.0	29	0.0	0.046	5.0	LOS A	0.2	1.5	0.41	0.53	0.41	41.5
2	T1	14	0.0	14	0.0	0.046	4.5	LOS A	0.2	1.5	0.41	0.53	0.41	41.5
3	R2	4	0.0	4	0.0	0.046	8.1	LOS A	0.2	1.5	0.41	0.53	0.41	45.2
Approach		47	0.0	47	0.0	0.046	5.2	LOS A	0.2	1.5	0.41	0.53	0.41	42.0
East: Wellington St (E)														
4	L2	8	0.0	8	0.0	0.180	4.2	LOS A	1.0	6.6	0.29	0.50	0.29	43.8
5	T1	141	1.5	141	1.5	0.180	3.9	LOS A	1.0	6.6	0.29	0.50	0.29	41.5
6	R2	67	0.0	67	0.0	0.180	7.3	LOS A	1.0	6.6	0.29	0.50	0.29	41.5
Approach		217	1.0	217	1.0	0.180	5.0	LOS A	1.0	6.6	0.29	0.50	0.29	41.7
North: Cope St (N)														
7	L2	21	0.0	21	0.0	0.113	4.3	LOS A	0.7	3.5	0.32	0.52	0.32	39.7
8	T1	24	0.0	24	0.0	0.113	2.6	LOS A	0.7	3.5	0.32	0.52	0.32	34.3
9	R2	84	2.5	84	2.5	0.113	6.5	LOS A	0.7	3.5	0.32	0.52	0.32	24.1
Approach		129	1.6	129	1.6	0.113	5.4	LOS A	0.7	3.5	0.32	0.52	0.32	32.8
West: Wellington St (W)														
10	L2	91	1.2	91	1.2	0.184	4.1	LOS A	0.9	5.8	0.19	0.47	0.19	26.8
11	T1	118	1.8	118	1.8	0.184	3.8	LOS A	0.9	5.8	0.19	0.47	0.19	43.4
12	R2	22	0.0	22	0.0	0.184	6.9	LOS A	0.9	5.8	0.19	0.47	0.19	44.6
Approach		231	1.4	231	1.4	0.184	4.2	LOS A	0.9	5.8	0.19	0.47	0.19	41.5
All Vehicles		624	1.2	624	1.2	0.184	4.8	LOS A	1.0	6.6	0.27	0.50	0.27	40.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSWMIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: TCS137 [5. PM Base + Dev 2 Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [PM Base + Max Permissible (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.771	17.2	LOS B	28.0	199.9	0.75	0.70	0.75	32.9
2	T1	783	2.8	783	2.8	0.771	17.2	LOS B	28.0	199.9	0.76	0.72	0.78	33.9
3	R2	114	0.0	114	0.0	0.771	36.7	LOS C	11.3	79.9	0.81	0.89	0.99	25.8
Approach		899	2.5	899	2.5	0.771	19.7	LOS B	28.0	199.9	0.77	0.74	0.81	32.6
East: Wellington St (E)														
4	L2	157	2.7	157	2.7	0.570	48.1	LOS D	7.9	56.9	0.90	0.78	0.90	23.0
5	T1	59	0.0	59	0.0	0.336	42.9	LOS D	5.8	28.0	0.88	0.74	0.88	18.4
6	R2	58	0.0	58	0.0	0.336	47.2	LOS D	5.8	28.0	0.88	0.74	0.88	5.2
Approach		274	1.5	274	1.5	0.570	46.8	LOS D	7.9	56.9	0.90	0.77	0.90	19.4
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.502	10.4	LOS A	10.1	71.9	0.30	0.29	0.30	36.5
8	T1	1239	3.1	1238	3.1	0.502	6.2	LOS A	10.8	76.7	0.31	0.29	0.31	44.5
9	R2	1	0.0	1	0.0	0.502	8.4	LOS A	10.8	76.7	0.32	0.29	0.32	32.2
Approach		1261	3.1	1260 <sup>N1</sup>	3.1	0.502	6.3	LOS A	10.8	76.7	0.31	0.29	0.31	44.4
West: Buckland St (W)														
10	L2	12	0.0	12	0.0	0.209	43.5	LOS D	4.9	30.8	0.84	0.68	0.84	23.3
11	T1	93	2.3	93	2.3	0.209	39.0	LOS C	4.9	30.8	0.84	0.68	0.84	23.3
12	R2	33	0.0	33	0.0	0.132	50.4	LOS D	1.6	11.5	0.88	0.72	0.88	29.3
Approach		137	1.5	137	1.5	0.209	42.1	LOS C	4.9	30.8	0.85	0.69	0.85	25.3
All Vehicles		2571	2.6	2570 <sup>N1</sup>	2.6	0.771	17.2	LOS B	28.0	199.9	0.56	0.52	0.58	35.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue pedestrian	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

# MOVEMENT SUMMARY

Site: 101 [6. PM Base + Dev 2 Cope Street / Shared Zone]

Network: N101 [PM Base + Max Permissible (2036)]

New Site  
Site Category: (None)  
Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	48	0.0	48	0.0	0.079	4.4	LOS A	0.0	0.0	0.00	0.17	0.00	46.4
2	T1	111	1.0	111	1.0	0.079	0.1	LOS A	0.0	0.0	0.00	0.17	0.00	39.4
Approach		159	0.7	159	0.7	0.079	1.4	NA	0.0	0.0	0.00	0.17	0.00	44.5
North: Cope St (N)														
8	T1	91	2.3	91	2.3	0.119	0.6	LOS A	0.6	3.7	0.26	0.33	0.26	33.1
9	R2	123	0.0	123	0.0	0.119	5.1	LOS A	0.6	3.7	0.26	0.33	0.26	44.0
Approach		214	1.0	214	1.0	0.119	3.2	NA	0.6	3.7	0.26	0.33	0.26	42.1
West: Shared Zone (W)														
10	L2	31	0.0	31	0.0	0.032	4.9	LOS A	0.1	0.8	0.20	0.52	0.20	43.7
12	R2	12	0.0	12	0.0	0.032	5.7	LOS A	0.1	0.8	0.20	0.52	0.20	43.7
Approach		42	0.0	42	0.0	0.032	5.1	LOS A	0.1	0.8	0.20	0.52	0.20	43.7
All Vehicles		415	0.8	415	0.8	0.119	2.7	NA	0.6	3.7	0.16	0.29	0.16	42.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).  
Vehicle movement LOS values are based on average delay per movement.  
Minor Road Approach LOS values are based on average delay for all vehicle movements.  
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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 SUMMARY

 **Site: TCS055 [1. AM Base + Dev 3 Henderson Road / Wyndham Street]**

 **Network: N101 [AM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	13	8.3	13	8.3	1.013	115.2	LOS F	21.9	158.9	1.00	1.36	1.79	19.4
2	T1	487	7.6	487	7.6	1.013	110.8	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
3	R2	3	33.3	3	33.3	1.013	114.7	LOS F	23.2	169.0	1.00	1.36	1.78	12.6
Approach		503	7.7	503	7.7	1.013	111.0	LOS F	23.2	169.0	1.00	1.36	1.79	19.7
East: Henderson Rd (E)														
4	L2	197	3.2	197	3.2	0.339	9.6	LOS A	4.5	32.3	0.22	0.40	0.22	41.9
5	T1	640	4.8	640	4.8	0.339	3.3	LOS A	4.5	32.3	0.16	0.21	0.16	45.6
6	R2	937	5.1	937	5.1	0.891	38.2	LOS C	15.7	114.2	0.98	0.96	1.22	25.7
Approach		1774	4.7	1774	4.7	0.891	22.4	LOS B	15.7	114.2	0.60	0.63	0.73	32.1
West: Henderson Rd (W)														
10	L2	526	6.6	526	6.6	1.028	118.8	LOS F	23.4	172.7	1.00	1.20	1.76	18.8
11	T1	291	3.6	291	3.6	0.491	36.3	LOS C	13.8	99.3	0.87	0.74	0.87	25.2
Approach		817	5.5	817	5.5	1.028	89.5	LOS F	23.4	172.7	0.95	1.04	1.44	19.9
All Vehicles		3094	5.4	3094	5.4	1.028	54.6	LOS D	23.4	172.7	0.76	0.86	1.09	24.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 **Site: TCS047 [2. AM Base + Dev 3 Botany Road / Raglan Street]**

 **Network: N101 [AM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
Approach		892	5.3	892	5.3	1.000	96.4	LOS F	44.3	323.3	1.00	1.16	1.55	7.5
East: Raglan St (E)														
4	L2	4	0.0	4	0.0	0.888	72.0	LOS F	9.3	66.3	0.99	1.03	1.44	4.0
5	T1	283	3.7	283	3.7	0.888	67.3	LOS E	9.4	67.3	0.99	1.03	1.43	4.0
Approach		287	3.7	287	3.7	0.888	67.4	LOS E	9.4	67.3	0.99	1.03	1.43	4.0
North: Botany Rd (N)														
7	L2	63	8.3	63	8.3	0.497	11.7	LOS A	16.2	120.2	0.45	0.44	0.45	41.6
8	T1	1327	7.6	1327	7.6	0.497	6.1	LOS A	16.2	120.2	0.42	0.40	0.42	42.8
9	R2	609	5.0	609	5.0	0.656	47.7	LOS D	16.1	117.0	0.95	0.84	0.95	21.8
Approach		2000	6.8	2000	6.8	0.656	18.9	LOS B	16.2	120.2	0.59	0.54	0.59	33.2
West: Henderson Rd (W)														
11	T1	252	2.1	252	2.1	0.862	52.5	LOS D	9.8	69.1	0.97	0.82	1.04	5.3
12	R2	49	14.9	49	14.9	0.862	69.6	LOS E	7.8	57.4	1.00	0.90	1.20	4.4
Approach		301	4.2	301	4.2	0.862	55.3	LOS D	9.8	69.1	0.97	0.84	1.07	5.1
All Vehicles		3480	6.0	3480	6.0	1.000	45.9	LOS D	44.3	323.3	0.76	0.76	0.94	18.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian ped	Distance m			
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY



Site: 101 [3. AM Base + Dev 3 Cope Street / Raglan Street]



Network: N101 [AM Base + Prop Dev (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles															
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed		
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m			km/h		
South: Cope St (S)															
1	L2	47	0.0	47	0.0	0.173	5.7	LOS A	0.9	5.3	0.47	0.57	0.47	29.4	
2	T1	87	1.2	87	1.2	0.173	4.1	LOS A	0.9	5.3	0.47	0.57	0.47	37.9	
3	R2	28	0.0	28	0.0	0.173	8.4	LOS A	0.9	5.3	0.47	0.57	0.47	43.2	
Approach		163	0.6	163	0.6	0.173	5.3	LOS A	0.9	5.3	0.47	0.57	0.47	38.0	
East: Raglan St (E)															
4	L2	7	42.9	7	42.9	0.215	4.8	LOS A	1.2	8.4	0.29	0.47	0.29	42.6	
5	T1	205	5.6	205	5.6	0.215	4.2	LOS A	1.2	8.4	0.29	0.47	0.29	42.6	
6	R2	28	0.0	28	0.0	0.215	6.1	LOS A	1.2	8.4	0.29	0.47	0.29	42.4	
Approach		241	6.1	241	6.1	0.215	4.5	LOS A	1.2	8.4	0.29	0.47	0.29	42.5	
North: Cope St (N)															
7	L2	14	0.0	14	0.0	0.097	5.4	LOS A	0.6	3.8	0.46	0.57	0.46	43.0	
8	T1	31	0.0	31	0.0	0.097	4.8	LOS A	0.6	3.8	0.46	0.57	0.46	40.5	
9	R2	47	4.4	47	4.4	0.097	8.5	LOS A	0.6	3.8	0.46	0.57	0.46	40.5	
Approach		92	2.3	92	2.3	0.097	6.8	LOS A	0.6	3.8	0.46	0.57	0.46	41.1	
West: Raglan St (W)															
10	L2	54	3.9	54	3.9	0.255	4.3	LOS A	1.3	9.6	0.24	0.48	0.24	43.8	
11	T1	232	3.6	232	3.6	0.255	4.2	LOS A	1.3	9.6	0.24	0.48	0.24	44.8	
12	R2	24	4.3	24	4.3	0.255	7.4	LOS A	1.3	9.6	0.24	0.48	0.24	27.6	
Approach		309	3.7	309	3.7	0.255	4.5	LOS A	1.3	9.6	0.24	0.48	0.24	44.3	
All Vehicles		805	3.7	805	3.7	0.255	4.9	LOS A	1.3	9.6	0.33	0.50	0.33	42.1	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: 102 [4. AM Base + Dev 3 Cope Street / Wellington Street]**

 **Network: N101 [AM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	15	0.0	15	0.0	0.034	3.9	LOS A	0.2	1.0	0.24	0.45	0.24	40.7
2	T1	20	0.0	20	0.0	0.034	3.6	LOS A	0.2	1.0	0.24	0.45	0.24	40.7
3	R2	5	0.0	5	0.0	0.034	6.7	LOS A	0.2	1.0	0.24	0.45	0.24	43.2
Approach		40	0.0	40	0.0	0.034	4.1	LOS A	0.2	1.0	0.24	0.45	0.24	41.2
East: Wellington St (E)														
4	L2	12	0.0	12	0.0	0.068	4.3	LOS A	0.4	2.3	0.22	0.48	0.22	45.0
5	T1	46	2.3	46	2.3	0.068	3.7	LOS A	0.4	2.3	0.22	0.48	0.22	42.0
6	R2	23	0.0	23	0.0	0.068	7.1	LOS A	0.4	2.3	0.22	0.48	0.22	42.0
Approach		81	1.3	81	1.3	0.068	4.7	LOS A	0.4	2.3	0.22	0.48	0.22	42.7
North: Cope St (N)														
7	L2	18	0.0	18	0.0	0.061	4.9	LOS A	0.4	2.4	0.35	0.52	0.35	42.5
8	T1	21	0.0	21	0.0	0.061	3.7	LOS A	0.4	2.4	0.35	0.52	0.35	38.8
9	R2	28	11.1	28	11.1	0.061	7.6	LOS A	0.4	2.4	0.35	0.52	0.35	25.2
Approach		67	4.7	67	4.7	0.061	5.7	LOS A	0.4	2.4	0.35	0.52	0.35	38.1
West: Wellington St (W)														
10	L2	87	1.2	87	1.2	0.205	3.3	LOS A	1.0	5.8	0.13	0.44	0.13	27.0
11	T1	158	3.3	158	3.3	0.205	3.5	LOS A	1.0	5.8	0.13	0.44	0.13	42.4
12	R2	33	3.2	33	3.2	0.205	6.6	LOS A	1.0	5.8	0.13	0.44	0.13	43.0
Approach		278	2.7	278	2.7	0.205	3.8	LOS A	1.0	5.8	0.13	0.44	0.13	41.1
All Vehicles		466	2.5	466	2.5	0.205	4.2	LOS A	1.0	5.8	0.19	0.46	0.19	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: TCS137 [5. AM Base + Dev 3 Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [AM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand	Flows	Arrival	Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.574	11.9	LOS A	22.0	160.6	0.55	0.51	0.55	34.5
2	T1	849	5.7	849	5.7	0.574	10.9	LOS A	22.0	160.6	0.57	0.53	0.57	38.3
3	R2	83	5.1	83	5.1	0.574	22.0	LOS B	7.0	51.3	0.67	0.67	0.67	32.8
Approach		935	5.6	935	5.6	0.574	11.9	LOS A	22.0	160.6	0.58	0.54	0.58	37.7
East: Wellington St (E)														
4	L2	59	5.4	59	5.4	0.178	49.2	LOS D	2.9	21.3	0.88	0.74	0.88	22.6
5	T1	22	0.0	22	0.0	0.127	46.8	LOS D	2.2	11.1	0.89	0.70	0.89	17.8
6	R2	22	4.8	22	4.8	0.127	51.1	LOS D	2.2	11.1	0.89	0.70	0.89	4.8
Approach		103	4.1	103	4.1	0.178	49.1	LOS D	2.9	21.3	0.89	0.72	0.89	18.9
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.536	10.9	LOS A	12.6	93.5	0.35	0.33	0.35	35.9
8	T1	1340	8.1	1340	8.1	0.536	7.0	LOS A	14.4	107.6	0.37	0.35	0.37	44.0
9	R2	2	0.0	2	0.0	0.536	9.6	LOS A	14.4	107.6	0.40	0.37	0.40	31.8
Approach		1363	8.0	1363	8.0	0.536	7.1	LOS A	14.4	107.6	0.37	0.35	0.37	43.9
West: Buckland St (W)														
10	L2	11	0.0	11	0.0	0.346	48.0	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
11	T1	178	1.2	178	1.2	0.346	43.5	LOS D	9.4	50.7	0.90	0.74	0.90	21.2
12	R2	24	17.4	24	17.4	0.094	49.1	LOS D	1.2	9.6	0.86	0.71	0.86	29.6
Approach		213	3.0	213	3.0	0.346	44.4	LOS D	9.4	50.7	0.90	0.73	0.90	22.5
All Vehicles		2614	6.6	2614	6.6	0.574	13.5	LOS A	22.0	160.6	0.51	0.46	0.51	37.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate	
		ped/h	sec		ped	Distance m		
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

## MOVEMENT SUMMARY

Site: 101 [6. AM Base + Dev 3 Cope Street / Shared Zone]

Network: N101 [AM Base + Prop Dev (2036)]

New Site

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: Cope St (S)														
1	L2	3	0.0	3	0.0	0.052	3.8	LOS A	0.0	0.0	0.00	0.02	0.00	43.3
2	T1	127	0.8	127	0.8	0.052	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	42.6
Approach		131	0.8	131	0.8	0.052	0.1	NA	0.0	0.0	0.00	0.02	0.00	42.7
North: Cope St (N)														
8	T1	55	7.7	55	7.7	0.032	0.2	LOS A	0.1	0.4	0.06	0.10	0.06	43.2
9	R2	8	0.0	8	0.0	0.032	4.9	LOS A	0.1	0.4	0.06	0.10	0.06	47.0
Approach		63	6.7	63	6.7	0.032	0.8	NA	0.1	0.4	0.06	0.10	0.06	44.8
West: Shared Zone (W)														
10	L2	32	0.0	32	0.0	0.032	4.9	LOS A	0.1	0.8	0.20	0.51	0.20	43.7
12	R2	13	0.0	13	0.0	0.032	5.1	LOS A	0.1	0.8	0.20	0.51	0.20	43.7
Approach		44	0.0	44	0.0	0.032	4.9	LOS A	0.1	0.8	0.20	0.51	0.20	43.7
All Vehicles		238	2.2	238	2.2	0.052	1.2	NA	0.1	0.8	0.05	0.13	0.05	43.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

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# MOVEMENT SUMMARY

 **Site: TCS055 [1. PM Base + Dev 3 Henderson Road / Wyndham Street]**

 **Network: N101 [PM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Wyndham St (S)														
1	L2	16	0.0	16	0.0	1.037	129.3	LOS F	23.5	164.6	1.00	1.41	1.90	18.3
2	T1	493	1.5	493	1.5	1.037	124.6	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
3	R2	2	0.0	2	0.0	1.037	128.9	LOS F	25.2	176.1	1.00	1.42	1.88	11.5
Approach		511	1.4	511	1.4	1.037	124.7	LOS F	25.2	176.1	1.00	1.41	1.89	18.3
East: Henderson Rd (E)														
4	L2	165	1.3	160	1.3	0.399	15.7	LOS B	14.6	101.8	0.56	0.58	0.56	38.0
5	T1	916	0.9	889	0.9	0.399	8.8	LOS A	14.6	101.8	0.45	0.43	0.45	40.6
6	R2	854	3.5	828	3.4	0.739	22.3	LOS B	12.1	87.2	0.86	0.82	0.87	31.9
Approach		1935	2.1	1877 <sup>N1</sup>	2.1	0.739	15.3	LOS B	14.6	101.8	0.64	0.62	0.64	36.1
West: Henderson Rd (W)														
10	L2	525	1.6	525	1.6	1.021	114.1	LOS F	22.8	161.6	1.00	1.18	1.73	19.3
11	T1	317	0.0	317	0.0	0.533	37.6	LOS C	15.4	106.5	0.89	0.76	0.89	24.7
Approach		842	1.0	842	1.0	1.021	85.3	LOS F	22.8	161.6	0.96	1.02	1.41	20.4
All Vehicles		3287	1.7	3230 <sup>N1</sup>	1.7	1.037	50.9	LOS D	25.2	176.1	0.78	0.85	1.04	24.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

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.

# MOVEMENT SUMMARY

 **Site: TCS047 [2. PM Base + Dev 3 Botany Road / Raglan Street]**

 **Network: N101 [PM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	838	2.9	838	2.9	1.046	128.8	LOS F	42.8	306.6	1.00	1.24	1.76	5.7
Approach		838	2.9	838	2.9	1.046	128.8	LOS F	42.8	306.6	1.00	1.24	1.76	5.7
East: Raglan St (E)														
4	L2	9	0.0	9	0.0	1.026	130.4	LOS F	13.8	96.0	1.00	1.32	1.99	2.2
5	T1	319	1.3	319	1.3	1.026	123.8	LOS F	15.3	106.1	1.00	1.34	1.95	2.2
Approach		328	1.3	328	1.3	1.026	124.0	LOS F	15.3	106.1	1.00	1.34	1.95	2.2
North: Botany Rd (N)														
7	L2	97	7.6	97	7.6	0.504	16.1	LOS B	18.7	133.5	0.56	0.55	0.56	37.5
8	T1	1227	3.2	1227	3.2	0.504	9.5	LOS A	18.7	133.5	0.52	0.49	0.52	39.4
9	R2	757	1.5	757	1.5	0.786	45.7	LOS D	24.1	168.8	0.96	0.90	1.03	22.2
Approach		2081	2.8	2081	2.8	0.786	23.0	LOS B	24.1	168.8	0.68	0.64	0.71	30.8
West: Henderson Rd (W)														
11	T1	268	0.8	268	0.8	0.851	24.6	LOS B	8.9	62.1	0.67	0.57	0.70	10.0
12	R2	37	0.0	37	0.0	0.851	75.0	LOS F	3.9	27.1	1.00	0.86	1.30	4.0
Approach		305	0.7	305	0.7	0.851	30.7	LOS C	8.9	62.1	0.71	0.60	0.78	8.5
All Vehicles		3553	2.5	3553	2.5	1.046	57.9	LOS E	42.8	306.6	0.79	0.84	1.08	15.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	54.3	LOS E			0.95	0.95	

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.

# MOVEMENT SUMMARY



Site: 101 [3. PM Base + Dev 3 Cope Street / Raglan Street]



Network: N101 [PM Base + Prop Dev (2036)]

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	59	0.0	59	0.0	0.188	5.6	LOS A	0.7	4.3	0.47	0.58	0.47	30.3
2	T1	54	0.0	54	0.0	0.188	4.7	LOS A	0.7	4.3	0.47	0.58	0.47	41.0
3	R2	9	11.1	9	11.1	0.188	8.7	LOS A	0.7	4.3	0.47	0.58	0.47	43.5
Approach		122	0.9	122	0.9	0.188	5.4	LOS A	0.7	4.3	0.47	0.58	0.47	39.0
East: Raglan St (E)														
4	L2	18	5.9	18	5.9	0.374	4.7	LOS A	1.2	8.3	0.39	0.51	0.39	43.2
5	T1	197	2.1	197	2.1	0.374	4.6	LOS A	1.2	8.3	0.39	0.51	0.39	43.2
6	R2	9	0.0	9	0.0	0.374	7.5	LOS A	1.2	8.3	0.39	0.51	0.39	45.4
Approach		224	2.3	224	2.3	0.374	4.8	LOS A	1.2	8.3	0.39	0.51	0.39	43.4
North: Cope St (N)														
7	L2	24	0.0	24	0.0	0.291	5.1	LOS A	1.3	6.9	0.49	0.59	0.49	39.1
8	T1	79	1.3	79	1.3	0.291	4.0	LOS A	1.3	6.9	0.49	0.59	0.49	36.9
9	R2	94	0.0	94	0.0	0.291	8.3	LOS A	1.3	6.9	0.49	0.59	0.49	36.9
Approach		197	0.5	197	0.5	0.291	6.1	LOS A	1.3	6.9	0.49	0.59	0.49	37.3
West: Raglan St (W)														
10	L2	83	1.3	83	1.3	0.272	4.0	LOS A	1.5	10.6	0.19	0.45	0.19	43.6
11	T1	256	3.3	256	3.3	0.272	3.9	LOS A	1.5	10.6	0.19	0.45	0.19	44.8
12	R2	26	0.0	26	0.0	0.272	6.9	LOS A	1.5	10.6	0.19	0.45	0.19	28.0
Approach		365	2.6	365	2.6	0.272	4.1	LOS A	1.5	10.6	0.19	0.45	0.19	44.2
All Vehicles		908	1.9	908	1.9	0.374	4.9	LOS A	1.5	10.6	0.34	0.51	0.34	41.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: Z:\PCI - PROJECT WORK FILES\NSW\MIRVAC - WATERLOO METRO STATION\4. DA Stage\3. Modelling & Surveys\200604 - ptc - Waterloo Metro SIDRA Network Model.sip8

# MOVEMENT SUMMARY

 **Site: 102 [4. PM Base + Dev 3 Cope Street / Wellington Street]**

 **Network: N101 [PM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020  
AM Peak: 7:45 - 8:45  
PM Peak: 17:15 - 18:15  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	29	0.0	29	0.0	0.045	4.9	LOS A	0.2	1.4	0.39	0.52	0.39	41.6
2	T1	14	0.0	14	0.0	0.045	4.4	LOS A	0.2	1.4	0.39	0.52	0.39	41.6
3	R2	4	0.0	4	0.0	0.045	7.9	LOS A	0.2	1.4	0.39	0.52	0.39	45.2
Approach		47	0.0	47	0.0	0.045	5.0	LOS A	0.2	1.4	0.39	0.52	0.39	42.1
East: Wellington St (E)														
4	L2	8	0.0	8	0.0	0.162	4.2	LOS A	0.9	5.8	0.28	0.48	0.28	43.8
5	T1	141	1.5	141	1.5	0.162	3.8	LOS A	0.9	5.8	0.28	0.48	0.28	41.5
6	R2	47	0.0	47	0.0	0.162	7.2	LOS A	0.9	5.8	0.28	0.48	0.28	41.5
Approach		197	1.1	197	1.1	0.162	4.7	LOS A	0.9	5.8	0.28	0.48	0.28	41.7
North: Cope St (N)														
7	L2	17	0.0	17	0.0	0.103	4.1	LOS A	0.6	3.0	0.31	0.52	0.31	39.2
8	T1	24	0.0	24	0.0	0.103	2.6	LOS A	0.6	3.0	0.31	0.52	0.31	34.3
9	R2	77	2.7	77	2.7	0.103	6.4	LOS A	0.6	3.0	0.31	0.52	0.31	24.1
Approach		118	1.8	118	1.8	0.103	5.3	LOS A	0.6	3.0	0.31	0.52	0.31	32.5
West: Wellington St (W)														
10	L2	61	1.7	61	1.7	0.156	3.9	LOS A	0.7	4.7	0.16	0.46	0.16	27.1
11	T1	118	1.8	118	1.8	0.156	3.7	LOS A	0.7	4.7	0.16	0.46	0.16	43.5
12	R2	22	0.0	22	0.0	0.156	6.8	LOS A	0.7	4.7	0.16	0.46	0.16	44.7
Approach		201	1.6	201	1.6	0.156	4.1	LOS A	0.7	4.7	0.16	0.46	0.16	42.2
All Vehicles		563	1.3	563	1.3	0.162	4.6	LOS A	0.9	5.8	0.25	0.48	0.25	40.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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: TCS137 [5. PM Base + Dev 3 Botany Road / Wellington Street / Buckland Street]**  **Network: N101 [PM Base + Prop Dev (2036)]**

Traffic Surveys 12/03/2020

AM Peak: 7:45 - 8:45

PM Peak: 17:15 - 18:15

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 120 seconds (Network Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Botany Rd (S)														
1	L2	2	0.0	2	0.0	0.697	15.8	LOS B	23.3	166.6	0.68	0.63	0.68	33.3
2	T1	783	2.8	783	2.8	0.697	15.1	LOS B	23.3	166.6	0.70	0.65	0.70	35.2
3	R2	83	0.0	83	0.0	0.697	25.4	LOS B	10.2	72.2	0.74	0.74	0.78	31.1
Approach		868	2.5	868	2.5	0.697	16.1	LOS B	23.3	166.6	0.70	0.66	0.71	34.7
East: Wellington St (E)														
4	L2	149	2.8	149	2.8	0.543	47.8	LOS D	7.5	54.0	0.90	0.78	0.90	23.0
5	T1	59	0.0	59	0.0	0.332	42.9	LOS D	5.8	28.0	0.88	0.74	0.88	18.4
6	R2	58	0.0	58	0.0	0.332	47.2	LOS D	5.8	28.0	0.88	0.74	0.88	5.2
Approach		266	1.6	266	1.6	0.543	46.6	LOS D	7.5	54.0	0.89	0.76	0.89	19.4
North: Botany Rd (N)														
7	L2	21	0.0	21	0.0	0.501	10.4	LOS A	10.1	71.7	0.30	0.29	0.30	36.5
8	T1	1239	3.1	1239	3.1	0.501	6.3	LOS A	10.8	77.1	0.31	0.29	0.31	44.4
9	R2	1	0.0	1	0.0	0.501	8.5	LOS A	10.8	77.1	0.32	0.29	0.32	32.2
Approach		1261	3.1	1261	3.1	0.501	6.3	LOS A	10.8	77.1	0.31	0.29	0.31	44.4
West: Buckland St (W)														
10	L2	12	0.0	12	0.0	0.209	43.5	LOS D	4.9	30.8	0.84	0.68	0.84	23.3
11	T1	93	2.3	93	2.3	0.209	39.0	LOS C	4.9	30.8	0.84	0.68	0.84	23.3
12	R2	33	0.0	33	0.0	0.130	50.3	LOS D	1.6	11.5	0.88	0.72	0.88	29.3
Approach		137	1.5	137	1.5	0.209	42.1	LOS C	4.9	30.8	0.85	0.69	0.85	25.3
All Vehicles		2533	2.7	2532 <sup>N1</sup>	2.7	0.697	15.9	LOS B	23.3	166.6	0.53	0.49	0.54	36.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

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.

<sup>N1</sup> Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue pedestrian	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	East Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	North Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

# MOVEMENT SUMMARY

Site: 101 [6. PM Base + Dev 3 Cope Street / Shared Zone]

Network: N101 [PM Base + Prop Dev (2036)]

New Site  
Site Category: (None)  
Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Cope St (S)														
1	L2	13	0.0	13	0.0	0.060	4.4	LOS A	0.0	0.0	0.00	0.06	0.00	47.0
2	T1	111	1.0	111	1.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	44.6
Approach		123	0.9	123	0.9	0.060	0.5	NA	0.0	0.0	0.00	0.06	0.00	45.7
North: Cope St (N)														
8	T1	91	2.3	91	2.3	0.053	0.3	LOS A	0.2	1.1	0.14	0.17	0.14	35.6
9	R2	32	0.0	32	0.0	0.053	4.9	LOS A	0.2	1.1	0.14	0.17	0.14	44.8
Approach		122	1.7	122	1.7	0.053	1.5	NA	0.2	1.1	0.14	0.17	0.14	40.9
West: Shared Zone (W)														
10	L2	8	0.0	8	0.0	0.009	4.8	LOS A	0.0	0.2	0.19	0.51	0.19	43.7
12	R2	3	0.0	3	0.0	0.009	5.2	LOS A	0.0	0.2	0.19	0.51	0.19	43.7
Approach		12	0.0	12	0.0	0.009	5.0	LOS A	0.0	0.2	0.19	0.51	0.19	43.7
All Vehicles		257	1.2	257	1.2	0.060	1.2	NA	0.2	1.1	0.08	0.13	0.08	42.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).  
Vehicle movement LOS values are based on average delay per movement.  
Minor Road Approach LOS values are based on average delay for all vehicle movements.  
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road 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.

## 16.2 Appendix 2 - Pedestrian Modelling Report



Project Name:

## **Sydney Metro City & Southwest Waterloo Integrated Station Development**

Document Name:

## **Pedestrian Modelling Report – Streetscape Extract**

Document Number:

**WMQ-SITE-WSP ANZ-PD-RPT-0001**

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Function	Position	Name	Date
<i>Prepared By</i>	Senior Transport Modeller	Nita Hutapea	28.07.2020
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<i>Reviewed By</i>	Technical Executive	John Webster	28.07.2020
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## Amendment Record

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Ravi Kaberwal	B	Final (with updated design and yield)	28.07.2020



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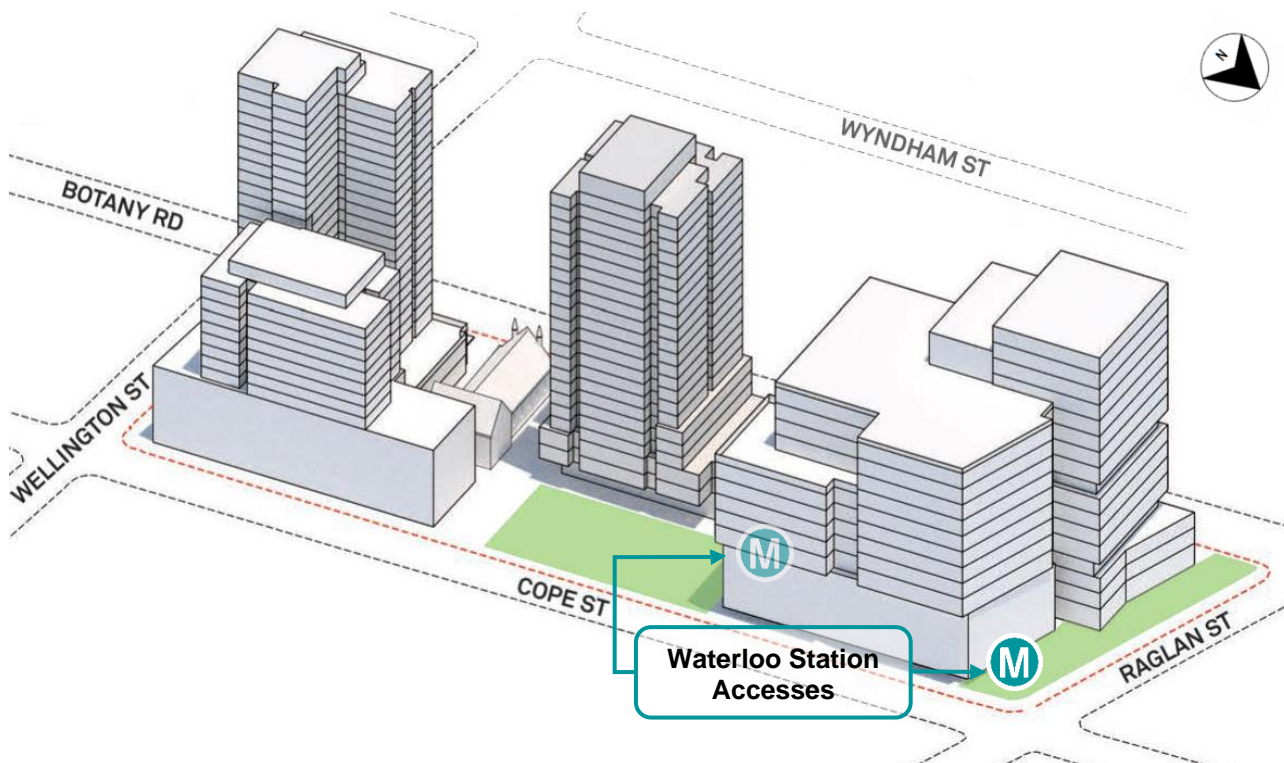
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# 1 Introduction

## 1.1 Precinct overview

Waterloo Metro Quarter (henceforth referred to as the 'precinct') is the proposed redevelopment site bounded by Botany Road, Raglan Street, Cope Street and Wellington Street. The precinct includes the proposed metro station, with station access from the corner of Cope Street and Raglan Street or within the precinct on the southern side of the building (as illustrated in Figure 1.1).

Figure 1.1 Waterloo Metro Quarter overview – proposed development



In addition to the proposed metro station, precinct customers can also access the bus network at the adjacent stops on Botany Road, and Sydney Trains (Redfern Station) is approximately 750m to the north via Wyndham Street (as illustrated in Figure 1.2).

### 1.1.1 Station overview

The metro station itself is located beneath the precinct, with the access at the corner of Cope Street and Raglan Street. The station configuration is illustrated in Figure 1.3, with the following key infrastructure:

- Single station entry at the corner of Raglan Street at Cope Street – integrated with the over station development
- Customer movements between levels are accommodated by:
  - Street Level and Concourse Level: 3 escalators and 2 lifts
  - Concourse Level and Platform Level: 4 escalators and 2 lifts
- Customer access and egress through 11 standard gates and 2 wide access gates (WAG) at Concourse Level.



Figure 1.2 Waterloo Station access and interchange diagram (Source: Waterloo Station Reference Design Report)

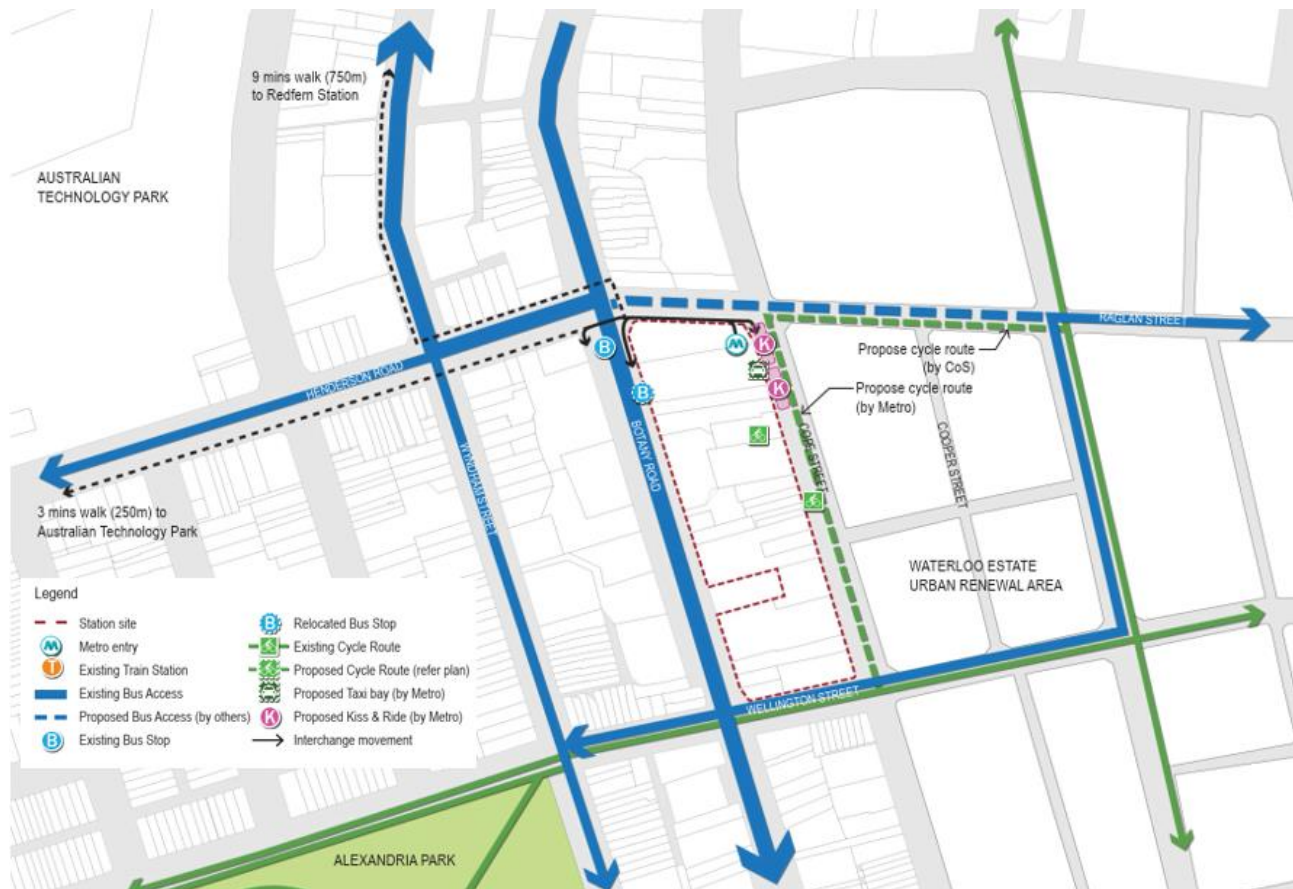
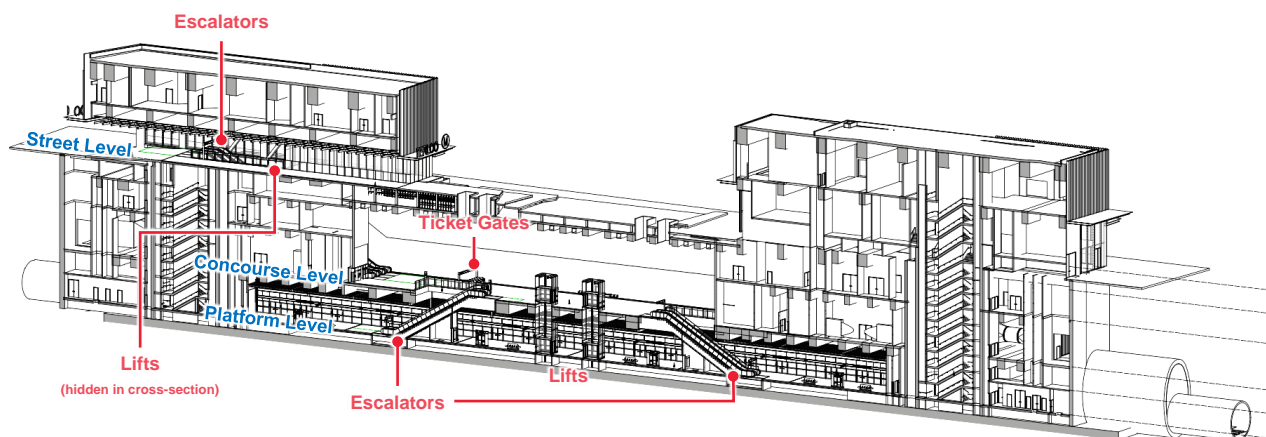


Figure 1.3 Waterloo Station overview



## 1.2 Purpose of document

This document (WMQ-SITE-WSP-PD-RPT-001), is an extract of the overall pedestrian modelling report (SMCSWSWL-WSP-SWL-TF-REP-000001) which documents both the outcomes of the pedestrian static analysis and dynamic modelling completed for the precinct and within the station.

This extract focuses on the results of the assessment for the streetscape, including walkways within the precinct and surrounding footpaths.

The station assessment considered the adequacy of the platform, vertical transport provisions, and ticket gate provisions. Whilst the precinct, or streetscape, modelling has been undertaken to consider the adequacy of footpaths and thoroughfares within and on the boundary of the precinct.

## 2 Pedestrian Demand

The pedestrian demands for the Waterloo Metro Quarter precinct consist of four key components:

- Demand related to the proposed metro station
- Demand related to the proposed over station development
- Demand related to existing land uses in the wider area, referred to as background demand
- Demand related to the Botany Road bus stops

There is an overlap between the four components, such as metro customers who are accessing the OSD or nearby land-uses and vice-versa.

The following sections summarise the source of the data and the process undertaken to define the forecast pedestrian demand for each of the above components.

The forecast demand has been defined for two design years:

- Initial design year (2026) – the requirement for the capacity to be provided from the start of operations
- Ultimate design year (2056) – the requirement for the capacity to be safeguarded to allow for long term patronage growth.

### 2.1 Waterloo Station

#### 2.1.1 Demand

The peak 1-hour customer demands at Waterloo Station summarised in Table 2.1 and Table 2.2 were provided in the document *Sydney Metro City & Southwest, Station Delivery Deed, Schedule C1 - Scope of works and technical criteria, Appendix A2.3 – service and system performance requirements*. The demands are based on 6 and 8 car sets.

It is noted the demand forecasts include an assumed level of development within the precinct, and consequently include pedestrian volumes associated with these developments. However, it is unknown how much proposed development was assumed in the forecast. Consequently, as a conservative assumption for assessing the precinct, the over station development (OSD) has been calculated separately (refer to Section 2.2) and added to the station peak hour passenger demands to forecast the total precinct demand (refer to Section 2.5)

Table 2.1 2026 AM Peak Pedestrian Demand (rounded to nearest 5)

2026 AM Peak hour 6 car set (no OSD)		Destination			
		Northbound	Southbound	Exit	Total
Origin	Northbound	-	-	565	565
	Southbound	-	-	1,445	1,445
	Entry	3,125	175	0	3,300
	Total	3,125	175	2,010	5,310

Table 2.2 2056 AM Peak Pedestrian Demand (rounded to nearest 5)

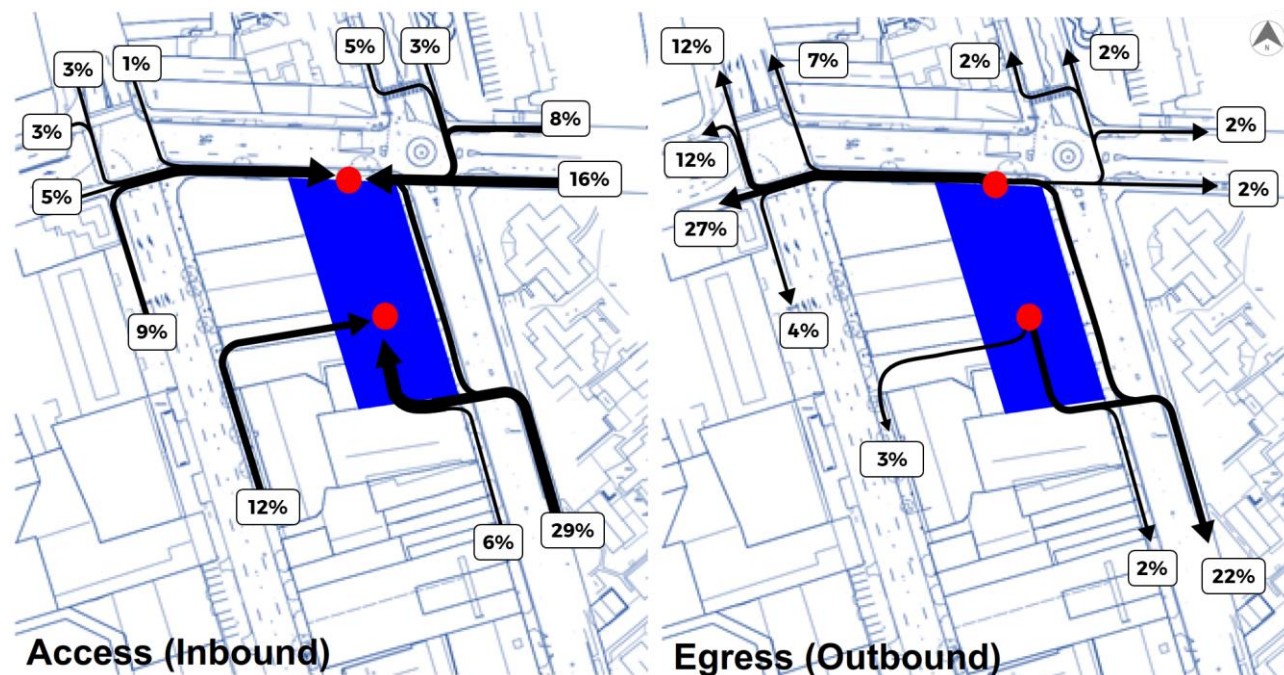
2056 AM Peak hour 8 car set (no OSD)		Destination		
		Northbound	Southbound	Exit
Origin	Northbound	-	-	700
	Southbound	-	-	1,800
	Entry	3,600	200	
	Total	3,600	200	2,500
				Total
				6,300

Demand forecasts provided are limited to the AM peak, therefore to determine the approximate demand for the PM peak, the above matrices have been transposed and multiplied by a factor of 0.91. This factor has been retained from previous Sydney Metro City & Southwest reports and is based on historical observation of the flatter customer profile during the PM peak period.

## 2.1.2 Distribution

The peak 1-hour customer demands for Waterloo Station have been assigned to the street network based on the distributions in Figure 2.1. The distributions are based on the those provided by Sydney Metro Authority, with demand splits converted to a percentage of access or egress demand.

Figure 2.1 Waterloo Station pedestrian demand distribution – AM peak hour



Source: METRON 2036 distribution data provided by Sydney Metro Authority

The distribution of customer demand to and from the OSD has been excluded from the above figures, as it is assumed the OSD demand is in addition to the station demand matrix provided. The quantum and distribution of OSD demand is discussed in Section 2.2.

Similarly, the interchange between metro and the Botany Road bus stops is not shown in the above distribution. The proportion of demand and split for the bus stops is discussed in Section 2.4.2.



## 2.2 Over Station Development

### 2.2.1 Overview

As illustrated in Figure 2.2, four Over Station Developments (OSDs) are proposed within the precinct. Building 1 is predominantly commercial, Buildings 2, 3 and 4 are predominately residential and includes affordable housing, social housing and student accommodation.

Figure 2.2 Waterloo Metro Quarter overview – proposed over station development

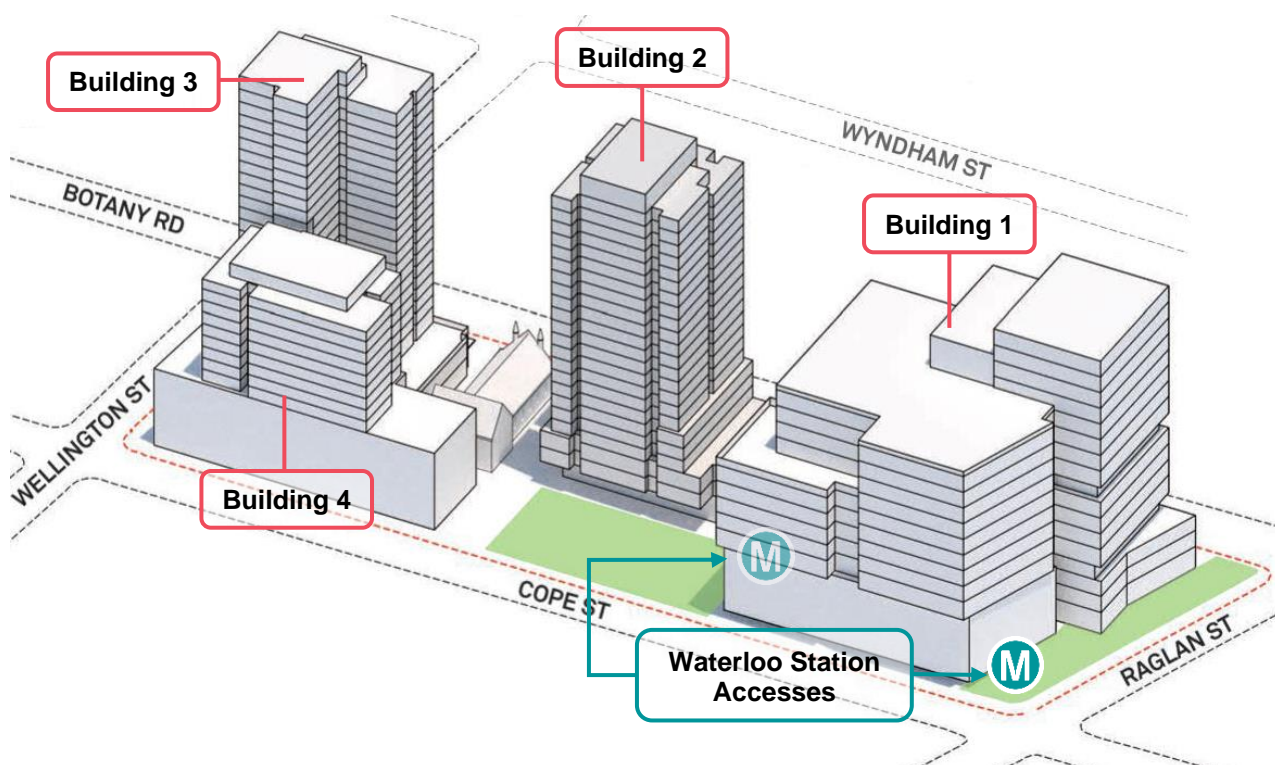


Table 2.3 summarises the proposed development by location and their respective size which have been adopted for the modelling.

Table 2.3 Proposed precinct development adopted for modelling

Building	Land Use	GFA (m <sup>2</sup> )	NLA (m <sup>2</sup> )	Yield			
				1 Bed <sup>(1)</sup>	2 Bed	3 Bed	4 Bed
1	Commercial	33,220	31,400				
2	Residential	-		82	69	10	
	Community	2,040					
3	Student housing	-		383	41		
4	Social housing	-		28	34	7	1
Precinct wide	Retail	2,415	1,932				
	Community	810 <sup>(2)</sup>					
<b>Total</b>				<b>493</b>	<b>144</b>	<b>17</b>	<b>1</b>

1. Includes studio apartments

2. Inclusive of 630m<sup>2</sup> of PDA and 180 m<sup>2</sup> potential additional

It is noted that the precinct and building designs are evolving, and hence it is expected there may be some changes in gross areas or the ratio between residential apartment sizes. As summarised in Table 2.4, the changes in area or provisions are comparatively minor, and hence do not materially change the outcomes of this assessment.

Table 2.4 Changes in proposed development between modelled and currently proposed

Land Use	Yield or provision		
	Modelled	Current	Change
Commercial	33,220 m <sup>2</sup>	34,116 m <sup>2</sup>	3%
	Studio/1 Bed	493	492
Residential, social and student housing	2 Bed	144	149
	3 Bed	17	11
	4 Bed/Penthouse	1	3
	Total Beds	836	835
Community	810 m <sup>2</sup>	812 m <sup>2</sup>	~0%
Retail	2,415 m <sup>2</sup>	2,185 m <sup>2</sup>	-10%

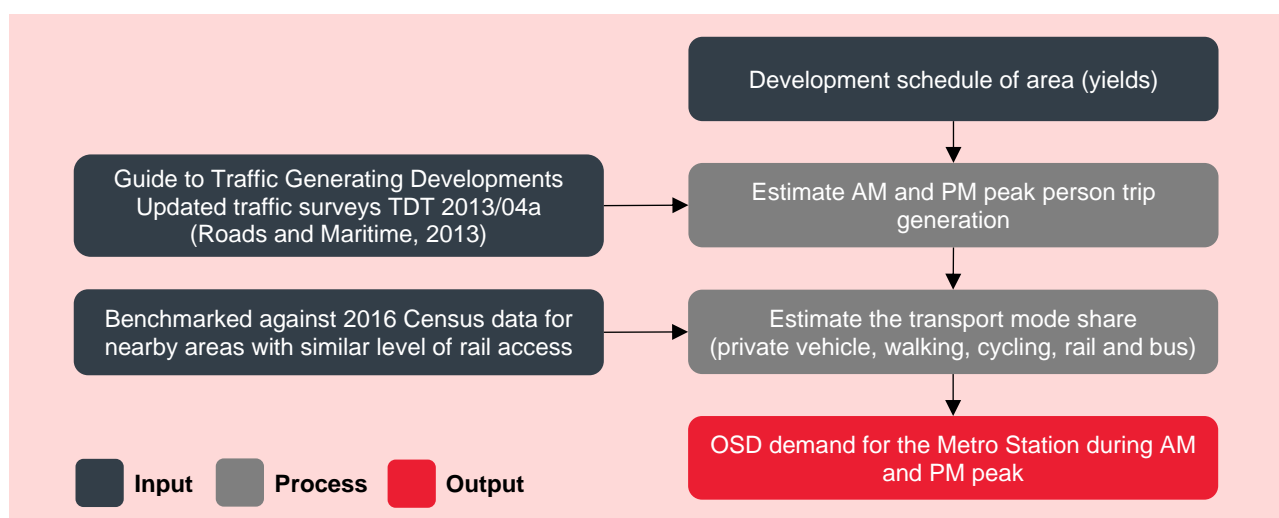
Source: WMQ Yield Schedule (28 July 2020)

## 2.2.2 Demand generation overview

The Over Station Development (OSD) demand for the station during the AM and PM peak hours was estimated using the methodology and inputs summarised in Figure 2.3, including:

1. Review the proposed development yields for the various land uses
2. Estimate the AM and PM peak person trip generation for each of the proposed land uses
3. Estimate the future mode share split for the person trips based on benchmarking against nearby areas with a similar level of rail access
4. Estimate the OSD's future peak period demand for the station.

Figure 2.3 Methodology to estimate the OSD's demand for the station



### 2.2.3 Person trip generation rates

The Guide to Traffic Generating Developments Updated traffic surveys TDT 2013/04a (Roads and Maritime, 2013) presents person trip generation rates which were surveyed at several sites across Sydney and NSW. An average of the person trip rates for the relevant Sydney sites were adopted (Table 2.5).

Table 2.5 Peak hourly person trip generation rates

Land use	Peak hourly person trip generation rates			
	AM	PM	Unit	Source and rationale
Residential	0.325	0.288	Per bedroom	TDT 2013/04a Appendix B3 (RMS, 2013) - average of the RMS surveyed sites at locations with good public transport access (St Leonards, Chatswood, Parramatta and Strathfield).
Commercial	2.49	1.85	Per 100m <sup>2</sup> GFA	TDT 2013/04a Appendix D3 (RMS, 2013) - Average of the RMS surveyed sites in Sydney
Retail	0.89	1.86	Per 100m <sup>2</sup> GLFA	TDT 2013/04a Appendix F2 (RMS, 2013) - Average of the RMS surveyed sites in Sydney Applied a 75% reduction factor to account for a large proportion of linked trips during the peak hour
Community	2.49	1.85	Per 100m <sup>2</sup> GFA	TDT 2013/04a Appendix D3 (RMS, 2013) - Average of the RMS surveyed sites in Sydney Assumes that the community uses would only generate staff during the peak hours

In addition to the person trip generation rates in Table 2.5, an additional sensitivity or resilience scenario was considered for the commercial development proposed within the precinct.

The surveyed sites, and hence trip generation rates, reflect typical commercial buildings within the Sydney Greater Metropolitan Area. Though it is noted there is an aspiration for the commercial development to be occupied at a higher density than those surveyed, which consequently may increase the peak hour trip generation (Table 2.6).

Table 2.6 Commercial peak hourly person trip generation rates – resilience scenario

Land use	Density	Peak hourly person trip generation rates			
		AM	PM	Unit	Source and rationale
Commercial	~1:20 to 1:30	2.49	1.85	Per 100m <sup>2</sup> GFA	TDT 2013/04a Appendix D3 (RMS, 2013) - Average of the RMS surveyed sites in Sydney
Commercial - resilience scenario	1:10	7.04	4.95	Per 100m <sup>2</sup> NLA	TDT Average factored to the higher proposed density

It is noted that a higher 1:8 density has been adopted in other studies to assess the resilience of the commercial building infrastructure. However, as discussed in Section 2.1.1 the metro demand forecasts already include some OSD demand. Hence the adoption of the 1:8 density would result in an overly onerous scenario for the precinct and footpaths. Therefore the 1:10 scenario (intended commercial occupancy) has been used with metro demand matrix, noting there is still a level of conservatism in this scenario.

## 2.2.4 Mode share split

The future mode share split for the OSD was benchmarked against the mode share split for other nearby areas, which have a similar level of rail access. The analysed data was adopted from the 2016 Census data (Australian Bureau of Statistics) for place of residence and place of employment. These mode share splits are considered to be suitable for the OSD's residents and employees or visitors, respectively.

It is noted that the available level of information for places of employment is less detailed than that available for the place of residence. Therefore, the data interrogated for locations of employment was limited to Redfern, Chippendale, which generally includes employment located near Redfern Station such as the nearby Australian Technology Park.

The analysed mode share split data for the locations used in the benchmarking exercise and the mode share splits that were adopted for the OSD are summarised in Table 2.7 for residents and Table 2.8 for employees and visitors.

Table 2.7 Mode share split for residents

Location	Mode share for place of residence (per cent)					
	Rail	Bus	Private vehicle	Bicycle	Walk	Other
Alexandria	39	6	38	5	11	1
Beaconsfield	36	7	46	3	7	1
Redfern	33	11	26	6	21	3
Mascot	34	8	48	1	8	1
Eveleigh	40	5	34	4	14	3
Average	36	7	38	4	12	3
<b>Adopted for OSD</b>	<b>40</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>15</b>	<b>0</b>

Table 2.8 Mode share split for visitors and employees

Location	Mode share for place of employment (per cent)					
	Rail	Bus	Private vehicle	Bicycle	Walk	Other
Redfern-Chippendale	42	4	36	3	10	5
<b>Adopted for OSD</b>	<b>45</b>	<b>5</b>	<b>35</b>	<b>5</b>	<b>10</b>	<b>0</b>

## 2.2.5 Resultant OSD demand

The OSD related demand for the metro station is summarised in Table 2.9 including:

- 1,188 customers, with 515 utilising the station during the AM peak
- 943 customers, with 400 utilising the station during the AM peak

It is noted, for the assessment of the PM peak period, a conservative assumption was adopted. In place of adopting the 400 customers as per the generation rates, a value of 468 customers was assumed based on the transposition of the AM peak movements multiplied by a factor of 0.91 for consistency with the methodology proposed in Section 2.1.1.



Table 2.9 OSD related station demand

Land use	Yield	Unit	Total person trip generation (person)		Station demand (person)	
			AM	PM	AM	PM
Residential	493	1 bedroom units	160	142	64	57
	144	2 bedroom units	94	83	37	33
	17	3 bedroom units	17	15	7	6
	1	4 bedroom units	1	1	1	0
Commercial	33,220	GFA m <sup>2</sup>	828	613	372	276
Retail	1,932	GLA m <sup>2</sup>	17	36	2	4
Community	2,850	GFA m <sup>2</sup>	71	53	32	24
<b>Total</b>	-	-	<b>1,188</b>	<b>943</b>	<b>515</b>	<b>400</b>

The OSD related station demand has been factored by the respective inbound and outbound directional splits as per Table 2.10 to determine the respective boarding and alighting demand for the metro station.

Table 2.10 OSD related station demand – directional split

Location	AM				PM			
	In	Out	In	Out	In	Out	In	Out
Residential	20%	80%	22	87	80%	20%	77	19
Commercial	80%	20%	298	74	20%	80%	55	221
Retail	50%	50%	1	1	50%	50%	3	1
Community	80%	20%	26	6	20%	80%	5	19
<b>Total</b>	-	-	<b>347</b>	<b>168</b>	-	-	<b>140<sup>(1)</sup></b>	<b>260<sup>(1)</sup></b>

1. As noted previously, a conservative estimate based on the factored transpose of the AM peak period has been used to be consistent with overall methodology.

For the resilience scenario, the OSD related pedestrian demand for the metro station is summarised in Table 2.11 including:

- 2,572 customers, with 1,138 utilising the station during the AM peak
- 1,884 customers, with 823 utilising the station during the PM peak

Table 2.11 OSD's station demand – resilience scenario

Land use	Yield	Unit	Total person trip generation (person)		Station demand (person)	
			AM	PM	AM	PM
Commercial	31,400	NLA m2	2,212	1,555	995	700
Other	-	-	360	329	142	123
<b>Total</b>	-	-	<b>2,572</b>	<b>1,884</b>	<b>1,138</b>	<b>823</b>

The resultant metro boarding and alighting demand for the resilience scenario are summarised in Table 2.12.

Table 2.12 OSD related station demand – directional split

Location	AM				PM			
	In	Out	Alight	Board	In	Out	Alight	Board
Commercial	80%	20%	910	228	20%	80%	165	658
Other	-	-	49	94	-	-	83	41
<b>Total</b>	-	-	<b>959</b>	<b>322</b>	-	-	<b>248</b>	<b>699</b>

## 2.3 Background

The background pedestrian demand consists of pedestrians who are travelling between existing land uses in the wider area, but not accessing the metro station, over station development or bus stops.

This demand has been estimated based on a combination of historical counts undertaken in the region. Table 2.13 summarises the years for which pedestrian counts were available and used by location.

Table 2.13 Pedestrian count locations

Location	2016	2018	2020
Henderson Road and Wyndham Street		✓	✓
Botany Road and Henderson Road	✓	✓	✓
Raglan Street and Cope Street	✓		✓
Cope Street and Wellington Street			✓
Botany Road and Wellington Street		✓	✓

From the above pedestrian count data, an annual growth rate of 2.1% was adopted. This conservative growth rate compared to the 1.3% per annum rate adopted for the City and Southwest Station forecasts reflects the increasing densification of Waterloo and its surrounding regions.

Table 2.14 summarises the forecast growth for the future design years based on the 2.1% per annum growth rate.

Table 2.14 Forecast growth – background pedestrian demand

Forecast year	2020	2026	2036	2056
Percentage growth	-	+15%	+40%	+110%

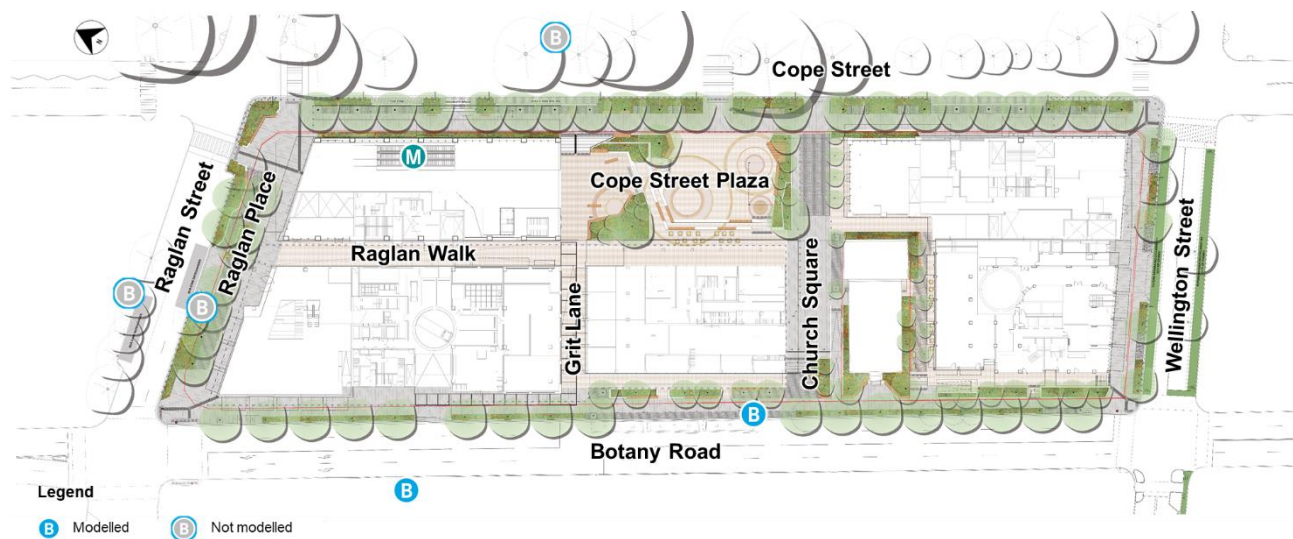
It is noted the growth rate results in a higher increase from existing demand to 2036 when compared to the 30% increase adopted by the previous study (Waterloo Interchange Planning Technical Note, Sydney Metro 2018). Hence this assessment represents a conservative scenario for the future scenarios, including 2056, by which time it is noted travel patterns may have significantly changed due to surrounding land uses.

## 2.4 Botany Road bus stop

### 2.4.1 Stop locations

In addition to the metro station, customers from the precinct and the surrounding region can access bus services from Botany Road. As shown in Figure 2.4, the northbound Botany Road bus stop has been retained, whilst the southbound stops have been consolidated and relocated to a stop between Grit Lane and Church Square.

Figure 2.4 Waterloo precinct – bus stop locations



In addition to the two Botany Road stops, the precinct design safeguards two stops on Raglan Street and does not preclude the use of the existing Cope Street stop. These three locations have not been included in the pedestrian modelling. All bus demand was consolidated to the two Botany Road stops, which represents the worst-case scenario for the Botany Road stops.

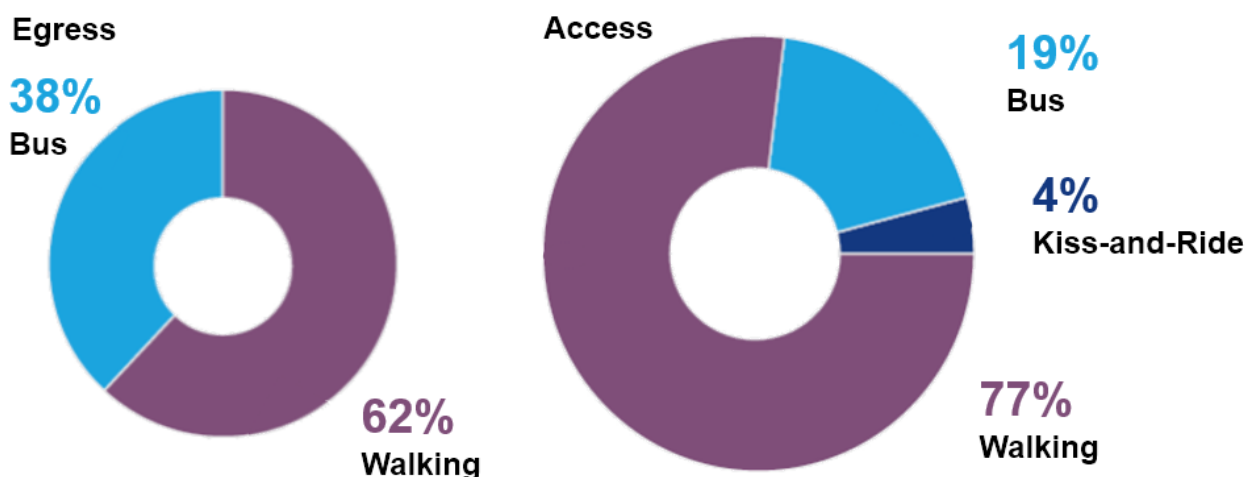
If in future, the bus stops are installed at Raglan Street, it is envisaged some bus routes would be reconfigured to serve these stops hence reducing the loading on Botany Road. The southern footpath of Raglan Street (referred to as Raglan Walk) is a sizeable thoroughfare, and already accommodates a proportion of the Botany Road bus stop customer demand and so should be able to accommodate the additional bus stop activity.

## 2.4.2 Demand

No forecast demand was provided for the bus stop; hence the stop demand has been developed based on:

- Metro station mode split as per Figure 2.5 which defines the interchange between metro and buses as a proportion of the total metro demand. Based on the demand from Section 2.1.1, Table 2.15 summarises the bus and metro interchange demand.
- OSD mode split of 5% as per Table 2.7 for residents and Table 2.8 for employees
- Nominal loading of 200/per hour customers (on and off) customers from the surrounding land use. It is noted existing bus customers are already accounted for background counts (Section 2.3), however to simulate bus stop interaction a nominal demand has been included in addition to the background demand. This demand has been:
  - Factored up to the design year consistent with the background customers
  - Assigned to street network based on the distributions in Figure 2.1

Figure 2.5 Waterloo station access and egress mode-split



Source: Sydney Metro (PTPM4.1 City and Southwest Final Business Case 2036 Project LUT Scenario - Run 144)

Table 2.15 Metro and bus interchange

Scenario	Total station demand		Interchange	
	Entry	Exit	Bus to Metro	Metro to Bus
2026 AM	3,300	2,010	625	765
2056 AM	3,800	2,500	720	950

To accommodate the above demand a bus frequency of 15 per hour in each direction has been adopted for both 2026 and 2056 based on advice from Sydney Metro. In addition to the equal frequency, an equal distribution of customer demand between the northbound and southbound stop has also been adopted.

Table 2.16 Botany Road bus stop loading - estimates

Scenario	Estimated hourly demand		Estimated per service demand	
	On	Off	On	Off
2026 AM	1,015	895	34	30
2056 AM	1,390	1,180	46	39
2056 Resilience	1,405	1,235	47	41

Should the distribution be biased toward a certain direction depending on the peak period (potentially northbound during AM peak and southbound in PM peak) it envisaged that the bus stop frequency would also be biased which would tend to keep the estimated per service demand in Table 2.14 close to the values adopted.

## 2.5 Demand summary

### 2.5.1 Design Scenario

The total customer demand during the AM peak hour through the precinct and along the surrounding footpaths are summarised in Figure 2.6 and Figure 2.7 based on the four key sources of demand discussed.

Figure 2.6 2026 AM Waterloo Metro Quarter precinct demand – total

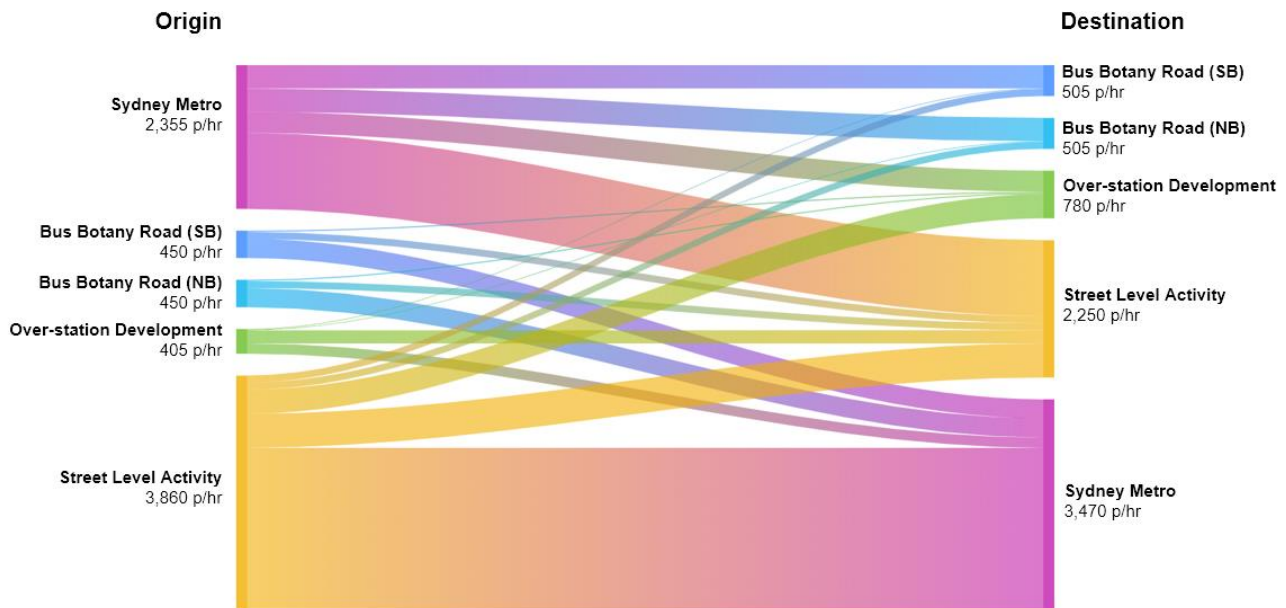
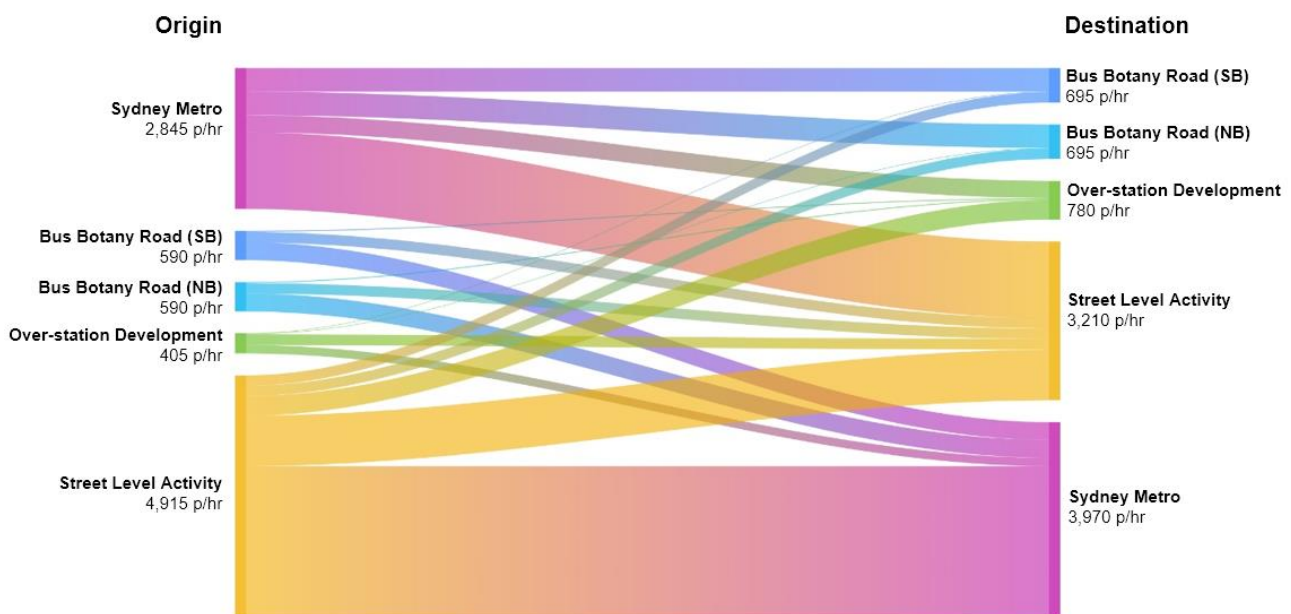


Figure 2.7 2056 AM Waterloo Metro Quarter precinct demand – total



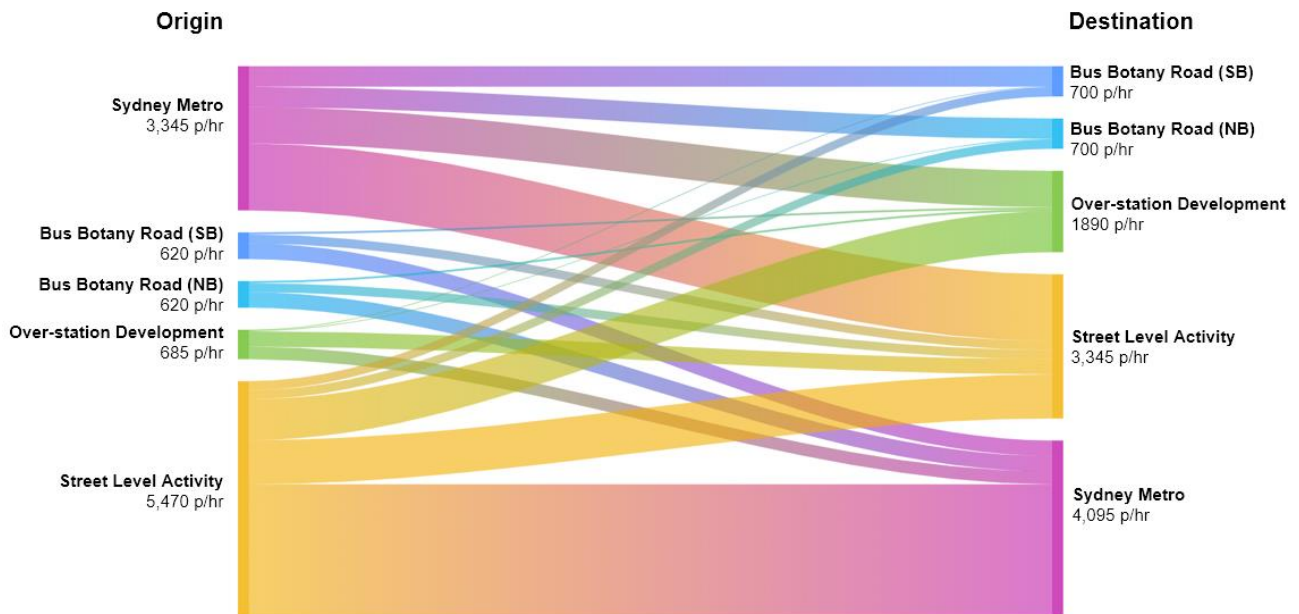
The transpose of the above customer movements are assumed during the PM peak hour, albeit reduced by a 91% factor to reflect the flatter customer profile during the PM peak period as discussed in Section 2.1.1.

## 2.5.2 Precinct reliance scenario

Customer demand for precinct during the OSD resilience scenario is summarised in In this scenario, the trip generation for the commercial development (Building 1) is significantly increased during the peak periods.

Figure 2.8. In this scenario, the trip generation for the commercial development (Building 1) is significantly increased during the peak periods.

Figure 2.8 2056 AM Waterloo Metro Quarter precinct demand – resilience scenario





### 3 Design Criteria

The planning and design criteria used to assess the station design are summarised from the documents:

- Sydney Metro City & Southwest, Station Delivery Deed, Schedule C1 - Scope of works and technical criteria
- Appendix B1.1 – Station and Buildings Spatial and Functional Requirements
- Appendix B1.4 - Station Precincts and Public Domain Spatial and Functional Requirements.

#### 3.1 Streetscape assessment

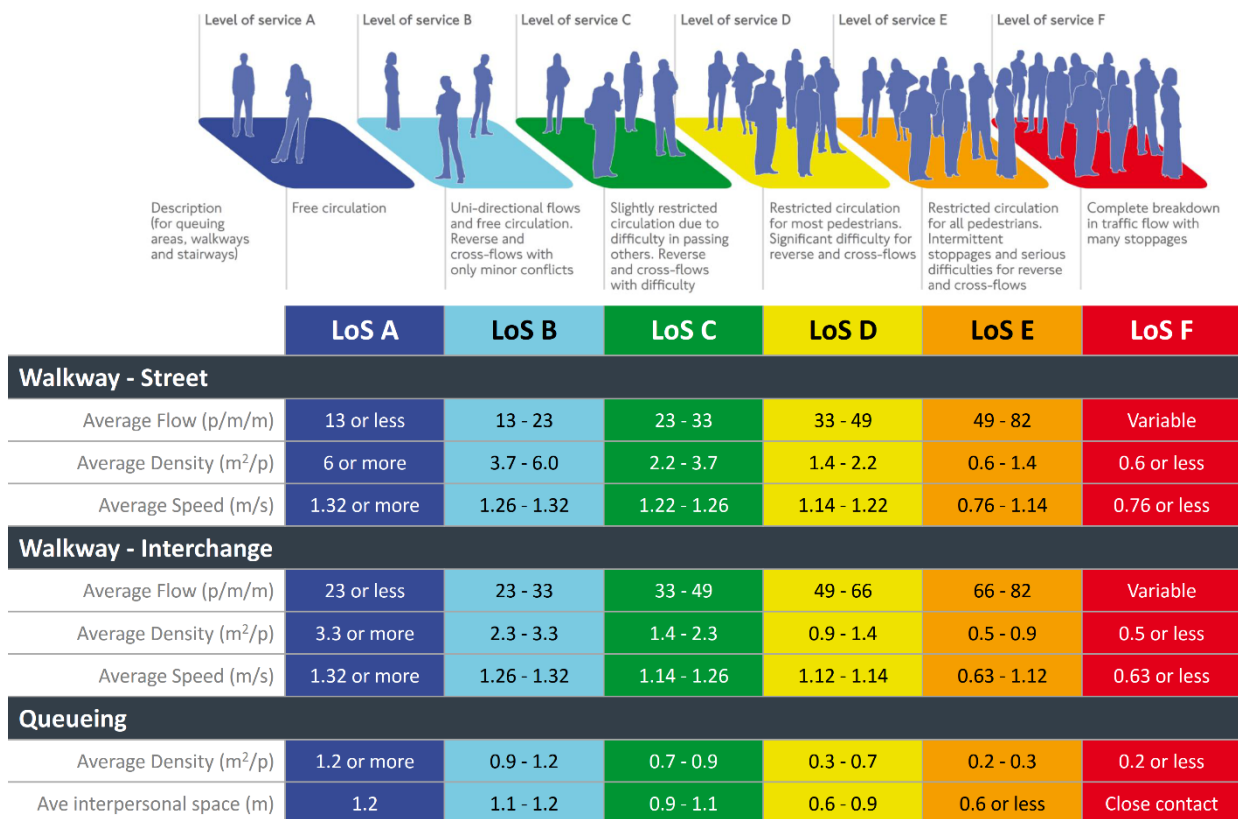
The following criteria have been prescribed for the design of the precinct streetscape:

- In the station precinct, design pedestrian spaces and thoroughfares are to deliver a minimum Level of Service (LoS) C
- Streets must be designed as urban places with a high level of pedestrian amenity, allowance for street trees and inherent traffic calming measures.

Based on these requirements, the assessment uses the Fruin LoS criterion is summarised in Figure 3.1. Typically, in a transport environment, such as an over station development site, the walkway interchange criterion is adopted.

However, to facilitate a 'high level of pedestrian amenity', the more onerous walkway criteria has been adopted. The walkway street criteria typically reflects the level of comfort customers expect when traversing footpaths in a retail or community environment.

Figure 3.1 Fruin pedestrian Level of Service (LoS) definitions



Adapted from: Fruin (1971); Bowman, Fruin and Zegeer (1989); London Underground: Station Planning Standards and Guidelines 2012 edition.



## 4 Dynamic Modelling

### 4.1 Modelling software

The microsimulation model was undertaken using PTV Viswalk, version 11.00-11. Viswalk is a module built into PTV Vissim used for pedestrian modelling. It is a microscopic, behaviour-based simulation model developed to reproduce the human walking behaviour realistically and reliably.

The outputs of the 3D microsimulation have been used to:

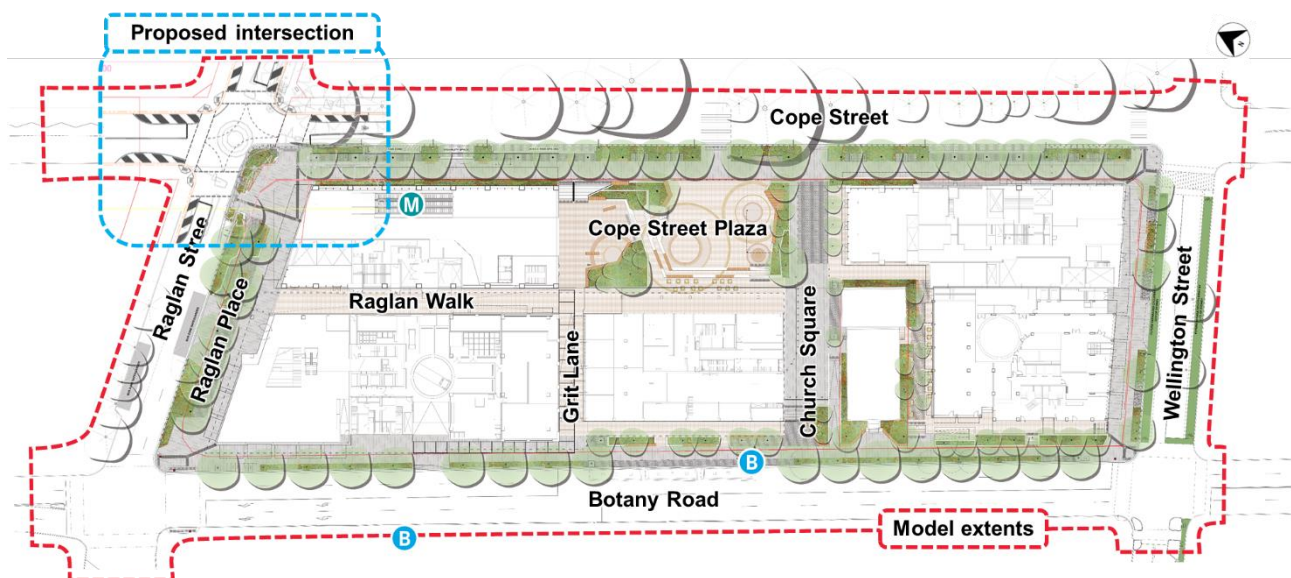
- Observe the customer movements and interactions
- Highlight key opportunities or constraints in the design
- Confirm if provisions for queueing and walkable space are satisfactory
- Produce a visual animation of the design and precinct operations for engagement.

### 4.2 Model development

The precinct model (Figure 4.1) has been developed based on precinct and station designs developed during the precinct concept design, including:

- Urban design plans dated 11 May 2020 for the precinct
- Architectural plans dated 5 February 2020 for the station design and integration with street level
- Intersection design dated 28 May 2020 for the proposed signalised crossing at Raglan Street and Cope Street.

Figure 4.1 Precinct model overview – reflective of design adopted for modelling



It is noted that designs have been updated since the modelling was undertaken. The updated design do not significantly change the layout or operation of the precinct from a pedestrian movement perspective. Key changes include:

- Design and layout of the Raglan Street and Cope Street signalised intersection focuses on road and lane allocation, hence pedestrian capacity is relatively unchanged. The kerb build-out on the south-west corner (closest to the metro station) is reduced. However this was already modelled as non-usable space (planter boxes), hence the impact to the pedestrian assessment is minimal.

- Location of north-south zebra crossing at the priority intersection of Cope Street and Wellington Street from the western side to the eastern side. This change does not change pedestrian crossing capacity. Pedestrians can still access the desire line to the south-east, albeit from a different side of the street.

Based on the above comparison of key changes, the results of this assessment are still applicable to the precinct.

#### 4.2.1 Inputs and assumptions

In addition to the assumptions adopted for the station model (refer to SMCSWSWL-WSP-SWL-TF-REP-000001 for more information), the following assumptions have been adopted for the streetscape elements of the model:

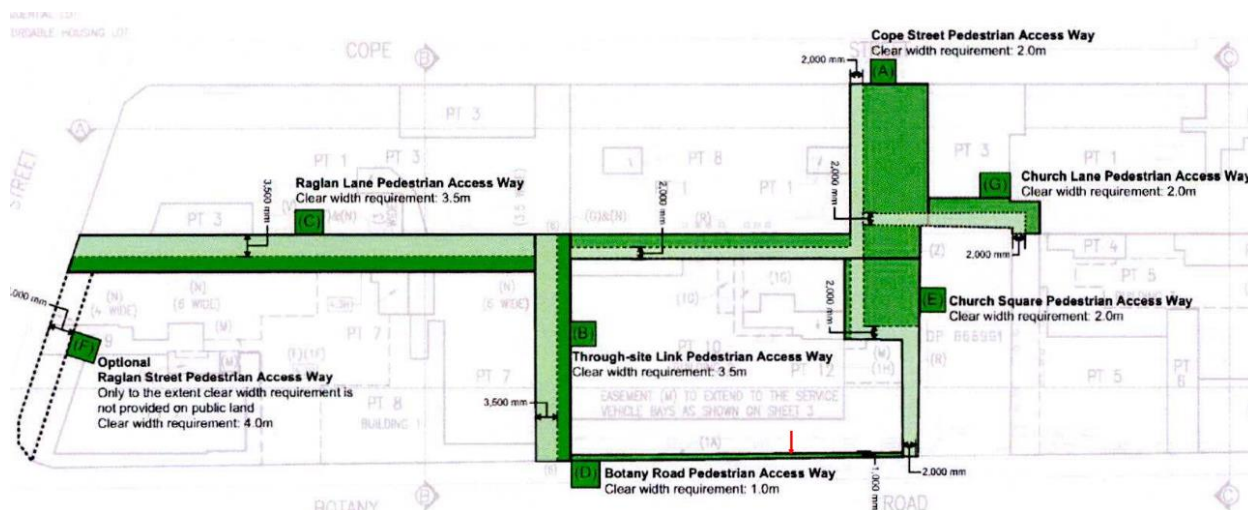
- Modelling has been undertaken for the worst-case scenario to confirm the provisions of the pedestrian infrastructure. This includes the 2056 AM peak hour design scenario and 2056 resilience scenario as per Section 2.5
- Level of Service (LoS) heatmaps are based on the Fruin LoS definitions in Figure 3.1 and represent the density averaged over 5 consecutive minutes from the 15 minutes peak
- Implementation of partial dynamic pedestrian route choice (where possible) based on a combination of shortest path and fastest route
- Walking speeds in the model assume a linear distribution for customers as per Table 4.1

Table 4.1 Customer walking speeds in model

Customer	Lower Bound	Upper Bound	Average
Male	1.0 m/sec	1.6 m/sec	1.3 m/sec
Female	0.7 m/sec	1.2 m/sec	1.0 m/sec

- Edge effects of 0.3m have been manually added to reflect that customers do not tend to walk close to the edge of the footpath, kerbside or against a wall.
- Within the precinct, clear widths have been modelled as per Figure 4.2. The figure denotes the clear width provided along Raglan Lane, Grit Lane and through Cope Street Plaza (light green). The remainder (dark green) reflects areas that may be used by retail outlets for outdoor furniture and hence have not been included in the modelling as walkable areas. It is noted that Raglan Lane has been modelled as contiguous through Grit Lane (although Figure 4.2 does not illustrate this).

Figure 4.2 Precinct thoroughfare clear width requirements



Source: MQD Design Parameters Extract provided by Mirvac

- Existing signal phasing has been retained at:
  - o Botany Road and Raglan Street
  - o Botany Road and Wellington Street
- Signal phasing for the new signalised crossing at Raglan Street and Cope Street has been based on a 110 second cycle time (based on the nearby intersections) and adopts the minimum green-and clearance time requirements for pedestrians based on the crossing lengths.
- Proposed zebra crossing across Cope Street near Cope Street Plaza has not been included in the model. By excluding this crossing where pedestrians crossing is prioritised, pedestrians instead use the signalised crossings at Raglan Street and Wellington Street, which reflects the worst-case scenario for the footpath on the precinct side of Cope Street and the queuing areas at each signalised intersection.

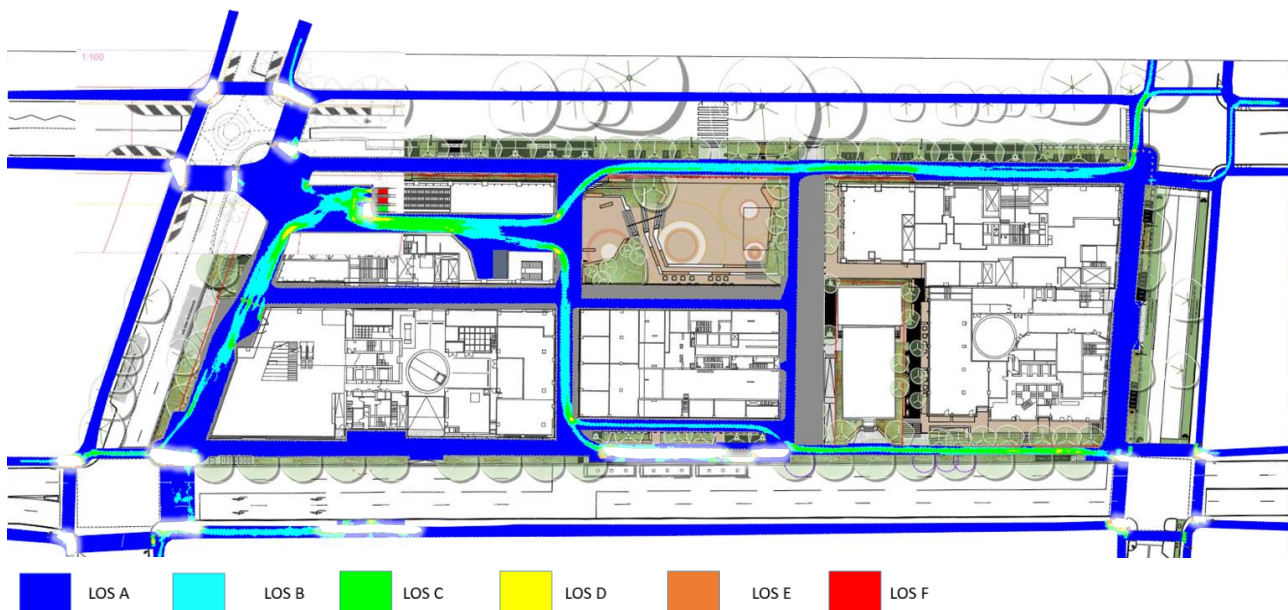
## 4.3 Assessment results

### 4.3.1 2056 AM peak

#### Overview

As illustrated in Figure 4.3, during the 2056 AM peak period, level of service (LoS) C or better is achieved throughout the precinct and surrounding footpaths. Locations where customer queueing is expected have been blanked out as these locations are instead based on the queueing LoS (refer to Figure 4.4).

Figure 4.3 Pedestrian LoS Walkways (Street) – 2056 AM



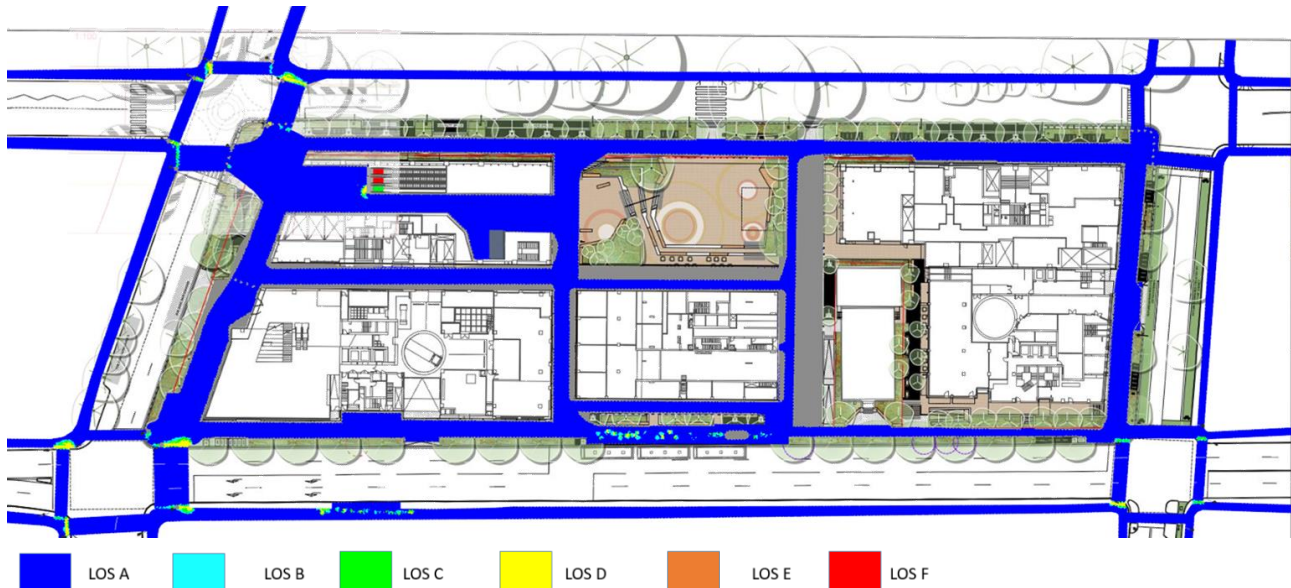
In light of current conditions due to COVID-19, the introduction of physical distancing requirements has placed additional scrutiny on densely populated pedestrian environments. The current recommendation of 4 square metres per person, equates to a walkways (street) LoS B (approaching LoS C). Although this physical distancing requirement is currently targeted at indoor environments, it can be seen that majority of the walkways could safely accommodate pedestrians at this spatial requirement should a similar situation arise in the future.

Furthermore, government advice encourages travelling outside of peak periods which is likely to flatten the peak hour profile. This will likely reduce pedestrian demand intensity, and further contribute to walkways (street) LoS B being achievable throughout the precinct.



Locations where customer queueing is expected, such as the kerbside for signalised crossings, escalator run-off and the Botany Road bus stop. At these locations, pedestrians are generally more tolerant of an increased density for a short time. This increased tolerance is reflected by the queueing LoS criteria and illustrated in Figure 4.4.

Figure 4.4 Pedestrian LoS Queueing – 2056 AM



Overall, the precinct operates at a satisfactory LoS (C or better) with some pockets of LoS D. These locations are discussed in more detail in subsequent figures.

### Raglan Place

Raglan Place accommodates one of the highest pedestrian flows within the precinct, including movements:

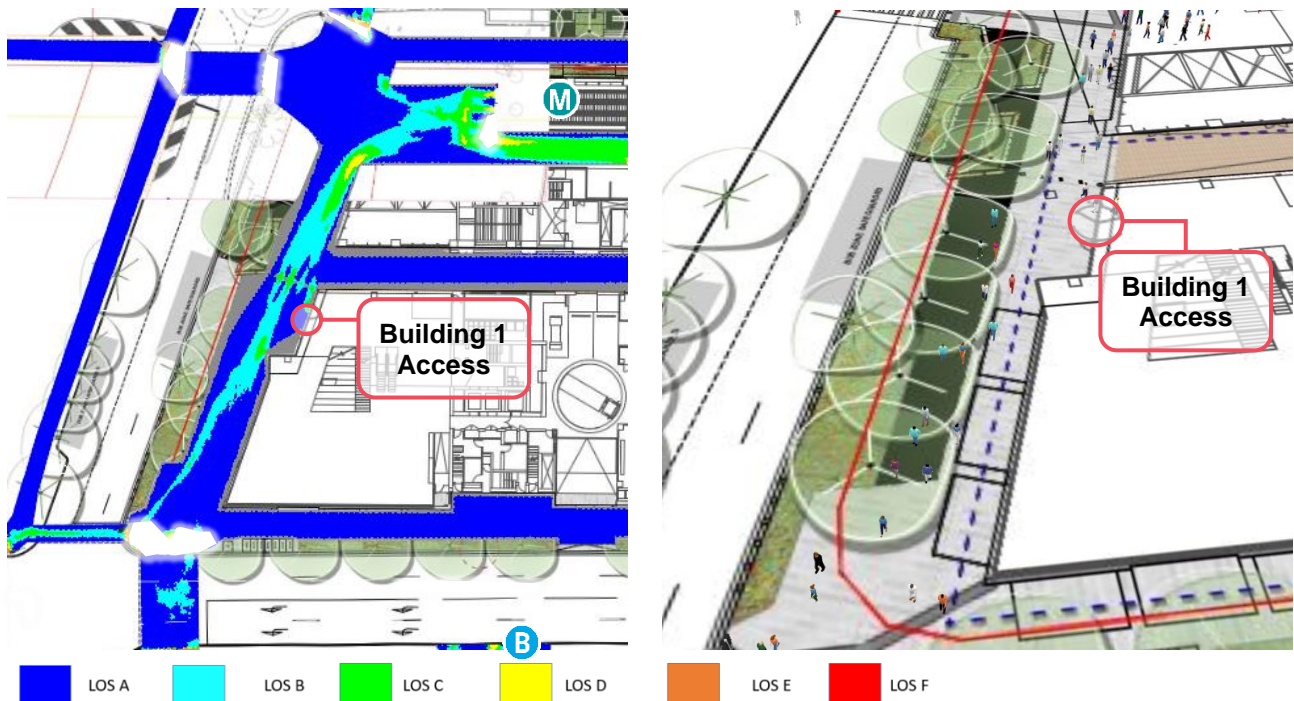
- Between metro station and other land uses locations north and west of the precinct
- To and from Building 1.

As illustrated in Figure 4.5, enough width has been provided to accommodate these pedestrian flows at a comfortable level of service (LoS C or better). Pockets of LoS D are observed where pedestrians change their direction including corners. This temporary increased density is expected as pedestrians compress and slow down to manoeuvre and change direction.

Several security bollards are included in the design along Raglan Place near the entry to Building 1. These bollards do not significantly impact pedestrian movement and flow. South of these bollards, the walkable area widens to accommodate the entry to Building 1. It is evident with the proposed footpath width, the Building 1 pedestrian flows (which are included in modelling) and the revolving door do not impede the east-west desire line along Raglan Place.

As discussed in Section 2.2.3, Building 1 is predominately commercial land use, hence Raglan Place near Building 1 is the most impacted by the increased commercial trip generation considered in the resilience scenario. Consequently, Raglan Place is also assessed for the resilience scenario in Section 4.3.2.

Figure 4.5 Pedestrian LoS and animation – 2056 AM – Raglan Place



#### Botany Road Bus Stop (southbound)

As illustrated in Figure 4.6, clear width has been maintained either side of the bus stop and planter boxes to allow unhindered access for through pedestrians, including those travelling north-south on Botany Road or accessing Grit Lane. This access is maintained immediately before the bus arriving and as pedestrian board and alight the bus, which reflects the busiest period, as shown in Figure 4.7.

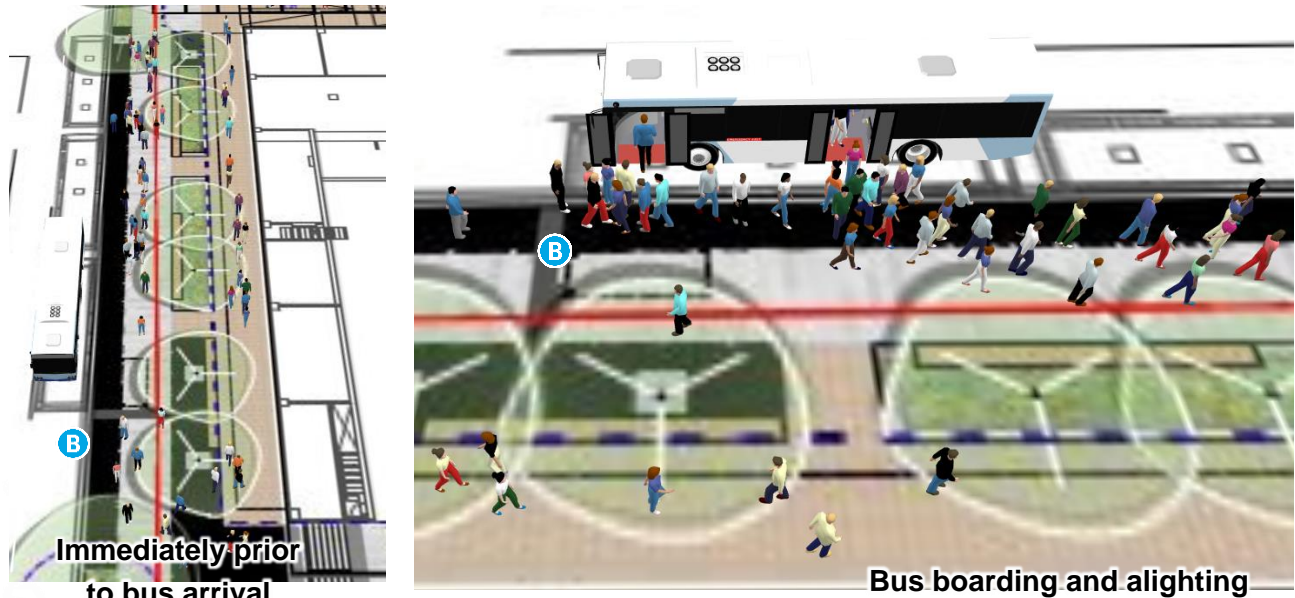
Figure 4.6 Pedestrian LoS – 2056 AM – Botany Road bus stop (southbound)





For customers queueing (or waiting) for the bus, small pockets of LoS D (Figure 4.6) are observed. This is typical of pedestrians waiting for a bus service as some individuals choose to wait in groups, and it is evident there is enough space available to queue at LOS B/C if required.

Figure 4.7 Pedestrian Animation – 2056 AM – Botany Road bus stop (southbound)



### Signalised intersections

At the intersections of Raglan Street and Botany Road and Raglan Street and Cope Street, some queueing is observed as shown in Figure 4.8 and Figure 4.9. This queueing is consistent with typical behaviour at an intersection where pedestrians are observed to queue “comfortably” at 0.65-0.75 m<sup>2</sup>/person in urban environments (LoS C/D).

The queueing does not preclude or block other pedestrian movements (refer to red arrows), which ensures pedestrians who are not utilising the pedestrian crossing are not hindered.

Figure 4.8 Pedestrian queueing LoS and animation - 2056 AM – Intersection of Botany Road and Raglan Street

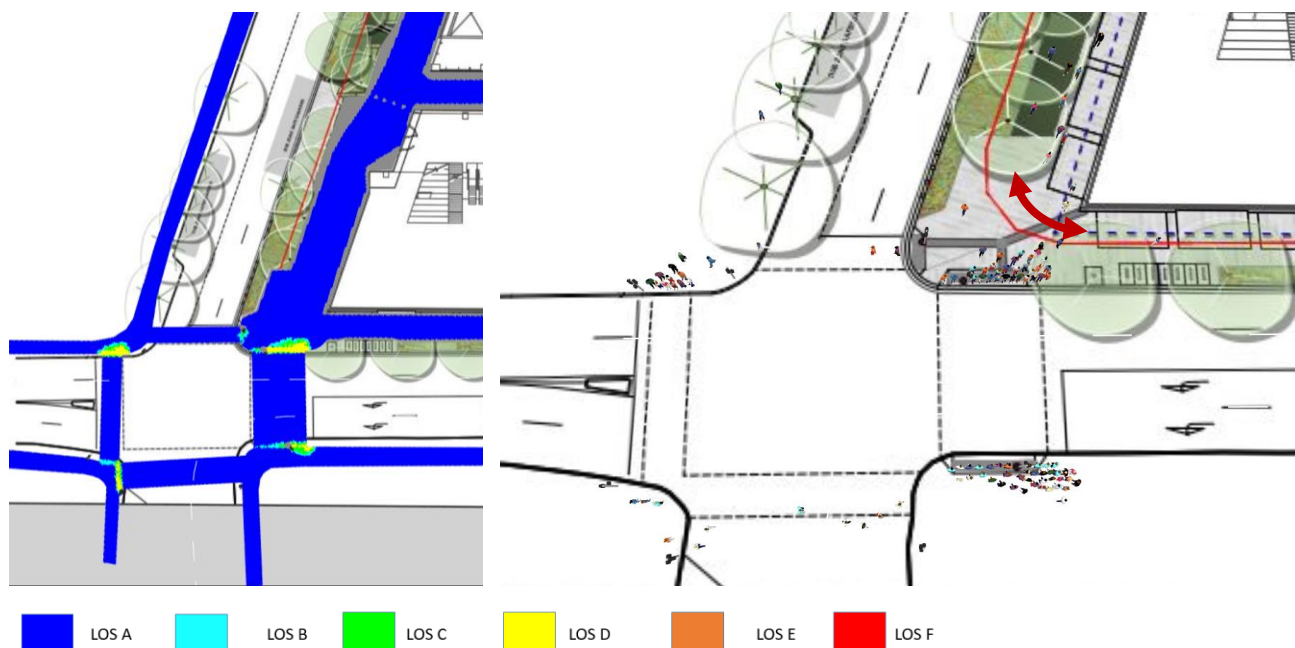
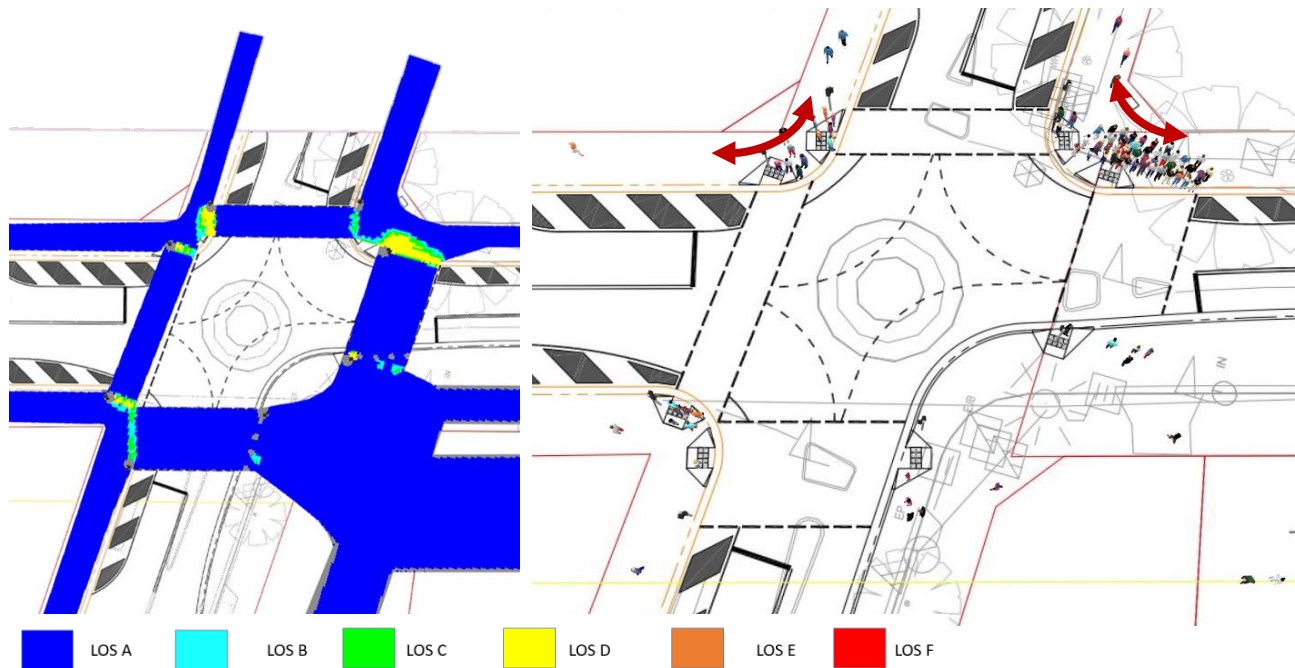


Figure 4.9 Pedestrian queueing LoS and animation - 2056 AM – Intersection of Raglan Street and Cope Street



#### 4.3.2 2056 Resilience

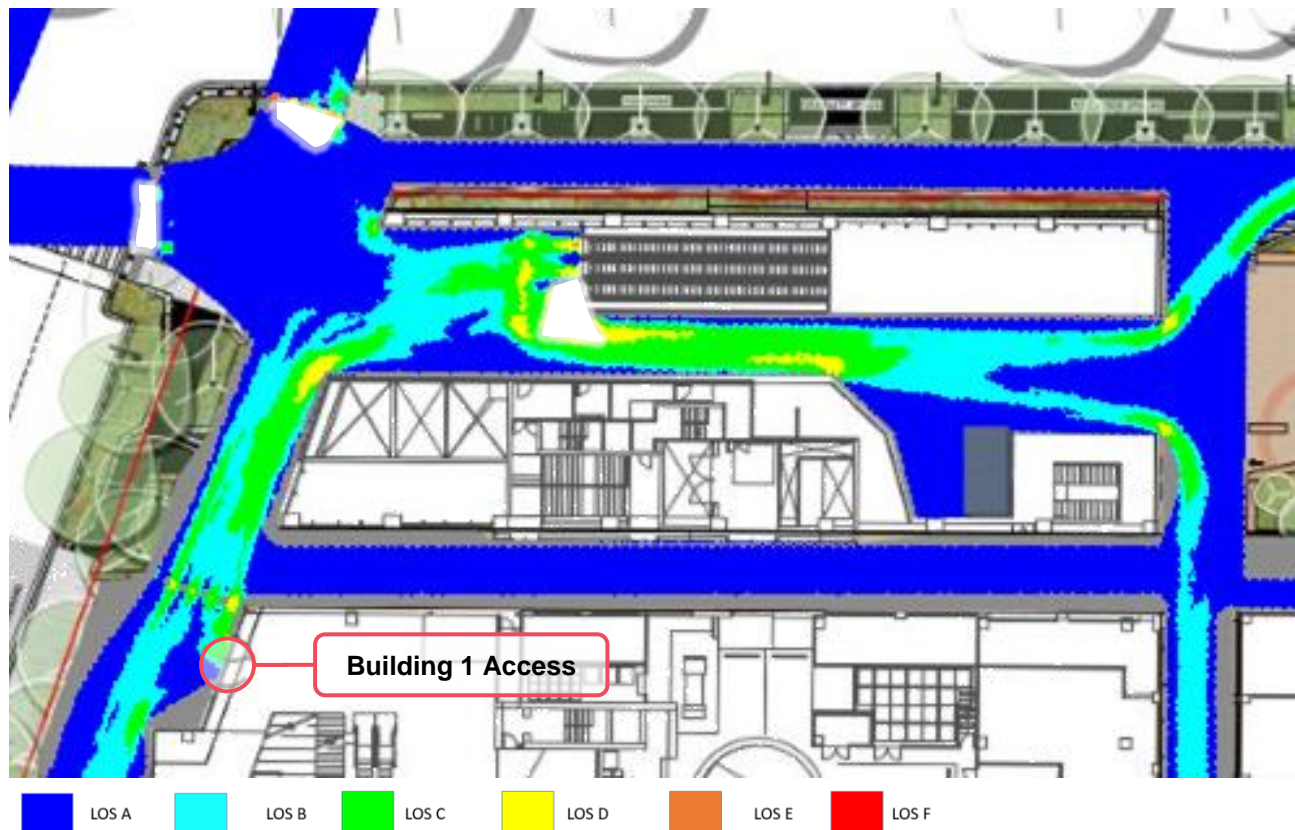
As illustrated in Figure 4.10, during the resilience scenario (with increased commercial trip generation), level of service (LoS) C or better is still achieved throughout the precinct and surrounding footpaths. The main visible change in the level of service occurs at Raglan Place and Raglan Lane (Figure 4.11).

Figure 4.10 Pedestrian LoS Walkways (Street) – 2056 AM Resilience





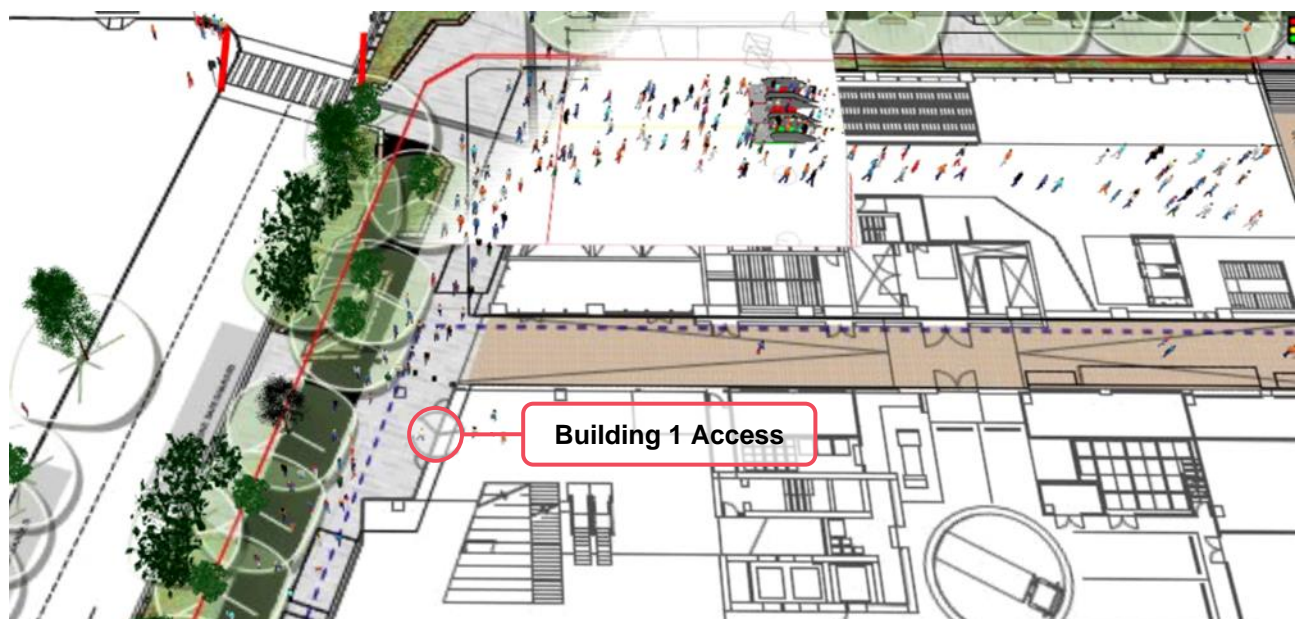
Figure 4.11 Pedestrian LoS Walkways (Street) – 2056 AM Resilience – Raglan Place and Raglan Lane



As evident in Figure 4.11, the pedestrian LoS deteriorates on Raglan Place and Raglan Lane compared to the 2056 AM scenario. However, a comfortable LoS C or better is maintained, with some pockets of LoS D near the escalator run-offs, building corners and bollards.

At each of these locations this temporary decrease in LoS is expected, as pedestrians slow and compress to manoeuvre around the obstacles or pedestrians travelling in a conflicting direction. As illustrated in Figure 4.12, space is available for customers to safely manoeuvre whilst providing space for pedestrians to temporarily pause or re-orient themselves.

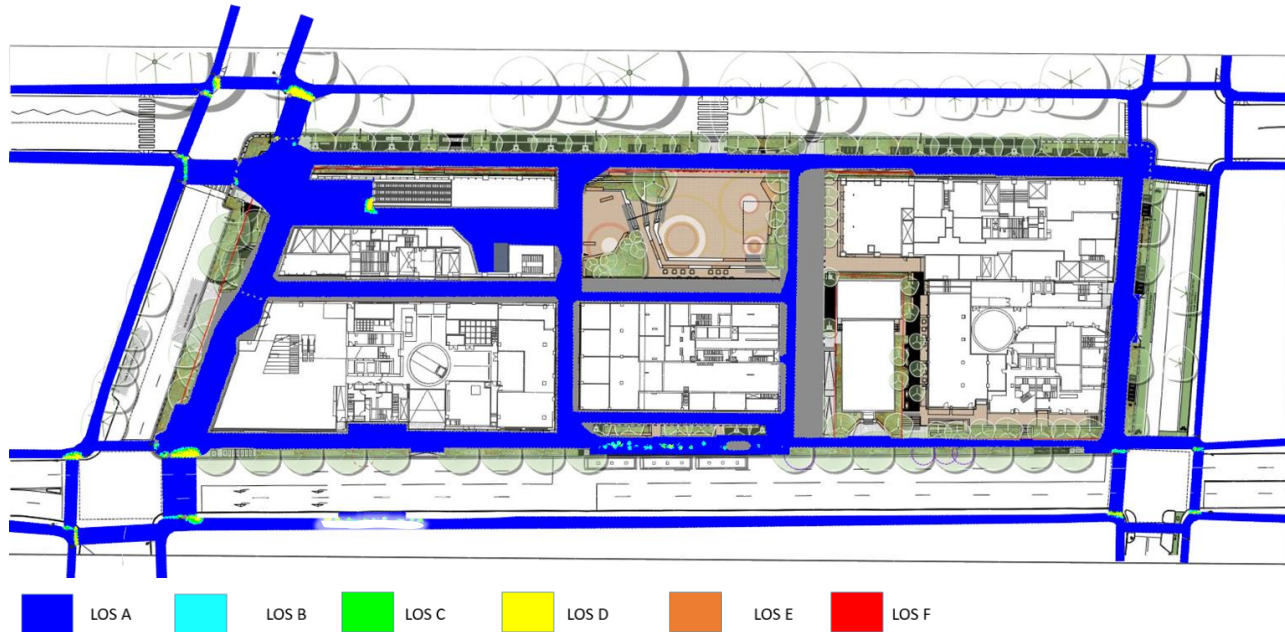
Figure 4.12 Pedestrian animation – 2056 Resilience – Raglan Place and Raglan Lane



As per the 2056 AM scenario, the Building 1 pedestrian flows and the revolving door itself do not impede the east-west pedestrian flow along Raglan Place.

Limited change is observed at queueing locations as illustrated in Figure 4.13. At these locations the queueing does not preclude or block other pedestrian movements, which ensures pedestrians who are not utilising the pedestrian crossing are not hindered.

Figure 4.13 Pedestrian LoS Queueing – 2056 AM Resilience



## 5 Conclusions

The pedestrian flows for the Waterloo Metro Quarter precinct has been assessed and summarised in this document to confirm the provisions of pedestrian infrastructure within and around the precinct.

A summary of the precinct performance and its compliance with project requirements is shown in Table 5.1. Overall, the precinct design is compliant with the project requirements.

Table 5.1 WMQ streetscape performance summary

Location	Assessment scenarios	
	2056 AM	2056 AM Resilience
<b>Precinct connectivity</b>		
Internal walkways	✓	✓
External footpaths	✓	✓
Queueing at intersections	✓	✓
<b>Botany Street Bus Stop (southbound)</b>		
Bus customers (waiting)	✓	✓
Non-bus customers (those travelling along Botany Road)	✓	✓
<b>Legend</b>	✓ Compliant	✗ Non-compliant