

Attachment A6

Traffic and Transport Assessment



Pitt and Bridge Tower, Sydney Traffic and Transport Assessment

Prepared for:

Dexus

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The Transport Planning Partnership

Pitt and Bridge Tower, Sydney Traffic and Transport Assessment

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APPENDICES

- A. TRAFFIC SURVEYS
- B. PEDESTRIAN MODELLING

1 Introduction

This traffic and transport assessment supports the Pitt and Bridge project, being a proposal for a green and global premium-grade office tower, constituting a vertical exchange of finance, knowledge sharing, innovation, education, sustainability and wellness. Dexus' vision for the project is to provide a home for the green finance sector, providing the infrastructure to attract green businesses and talent that are aligned with global sentiment around addressing climate change and resilience and which can engage with the emerging global green economy. The proposal will lead the way in meeting world-class sustainability objectives and contribute to Sydney's role as a future leader in the global green economy.

The Pitt and Bridge Planning Proposal seeks amendments to the Sydney LEP 2012 and DCP 2012 for land at 56 Pitt Street, 58 Pitt Street, 3 Spring Street and 60 Pitt Street, Sydney. It supports the City of Sydney Council's Central Sydney Planning Strategy (CSPS) by unlocking additional employment-generating floor space within a designated tower cluster and will create an international hub for the green economy.

The proposed planning envelope reaches a maximum height of RL 310 and includes a gross floor area of 90,000 m² (consistent with the outcomes envisaged in the CSPS).

The proposal introduces to the northern area of the Sydney CBD an expanded public domain which will improve the pedestrian experience and enhance the northern CBD green network by establishing a publicly accessible landscaped plaza on Bridge Street.

The proposal will provide a neighbourhood loading dock which offers a multitude of public benefits that enhance community. Firstly, it streamlines the logistics of goods delivery, reducing traffic congestion and noise pollution by consolidating commercial vehicle activity to a designated area. This contributes to safer streets and cleaner air. Furthermore, it encourages local economic activity by supporting businesses with a convenient and accessible point for shipments and deliveries, thereby promoting commerce and entrepreneurship. Ultimately, a neighbourhood loading dock serves as a vital infrastructure element that promotes sustainability, convenience, and economic vitality for the community as a whole.

The concept reference design demonstrates Dexus' vision for a world-class and leading design within the planning envelope. An architectural design competition will be undertaken upon the finalisation of the Planning Proposal, with the winning design to be the subject of a detailed Development Application.

The remainder of the report is set out as follows:

- Chapter 2 discusses the existing conditions including a description of the subject site
- Chapter 3 provides a brief description of the proposed development
- Chapter 4 assesses the proposed on-site parking provision and internal layout

- Chapter 5 examines the traffic generation and resultant traffic implications arising from the proposed development
- Chapter 6 presents a framework for the implementation of a framework travel plan for the site.
- Chapter 7 Loading Dock Management Plan
- Chapter 8 Future Transport Network
- Chapter 9 presents the conclusions of the assessment.

Also included in this document are the appendices including the pedestrian modelling in Appendix B.

2 Existing Conditions

2.1 Site Location

The subject site is located at 56, 58, 60 Pitt Street and 3 Spring Street and falls within the local government area of the City of Sydney. The site is bounded by Bridge Street to the north, Pitt Street to the west, Gresham Street to the east and Spring Street to the south.

The subject site and its surroundings are shown in Figure 2.1.

Figure 2.1: Site Location



Basemap Source: Nearmap

2.2 Existing Developments and Land Use

The site is currently occupied by four buildings:

- 56 Pitt Street
- 58 Pitt Street
- 60 Pitt Street
- 3 Spring Street

The buildings are predominately office buildings with some ground floor retail. A summary of the existing building yields are shown in Table 2.1

Table 2.1: Existing land use gross floor areas

Site	Office commercial (m ²)	Retail (m ²)
56 Pitt Street	19,637	235
58 Pitt Street	1,728	364
60 Pitt Street	3,485	659
3 Spring Street	7,281	-
Total	32,131	1,258

Land uses surrounding the site predominately comprise of mixed commercial, retail, restaurant and hotel uses along Pitt Street and Bridge Street. In addition to this, it is noted that the site is centrally located within the Sydney CBD and near high-frequency public transport services, notably Bridge Street Light Rail Station and Circular Quay Light Rail station and Circular Quay Station. It is also noted that the NSW State Government is constructing the Metro West station would be located in Hunter Street.

2.3 Abutting Road Network

The roads in the study area are within the Sydney CBD and fall within the 40km/h CBD speed limit. The key roads are:

Bridge Street is a collector road that connects Grosvenor Street to Macquarie Street. It has two traffic lanes westbound and three lanes eastbound. It forms part of an east-west connection across the CBD between the Cahill Expressway to the Sydney Harbour Bridge approaches. Bridge Street is also significantly used by buses.

Pitt Street is a one-way street that runs north-south through the Sydney CBD. In the study area, Pitt Street is one-way southbound. It has four lanes with two traffic lanes and restricted parking lanes kerb side.

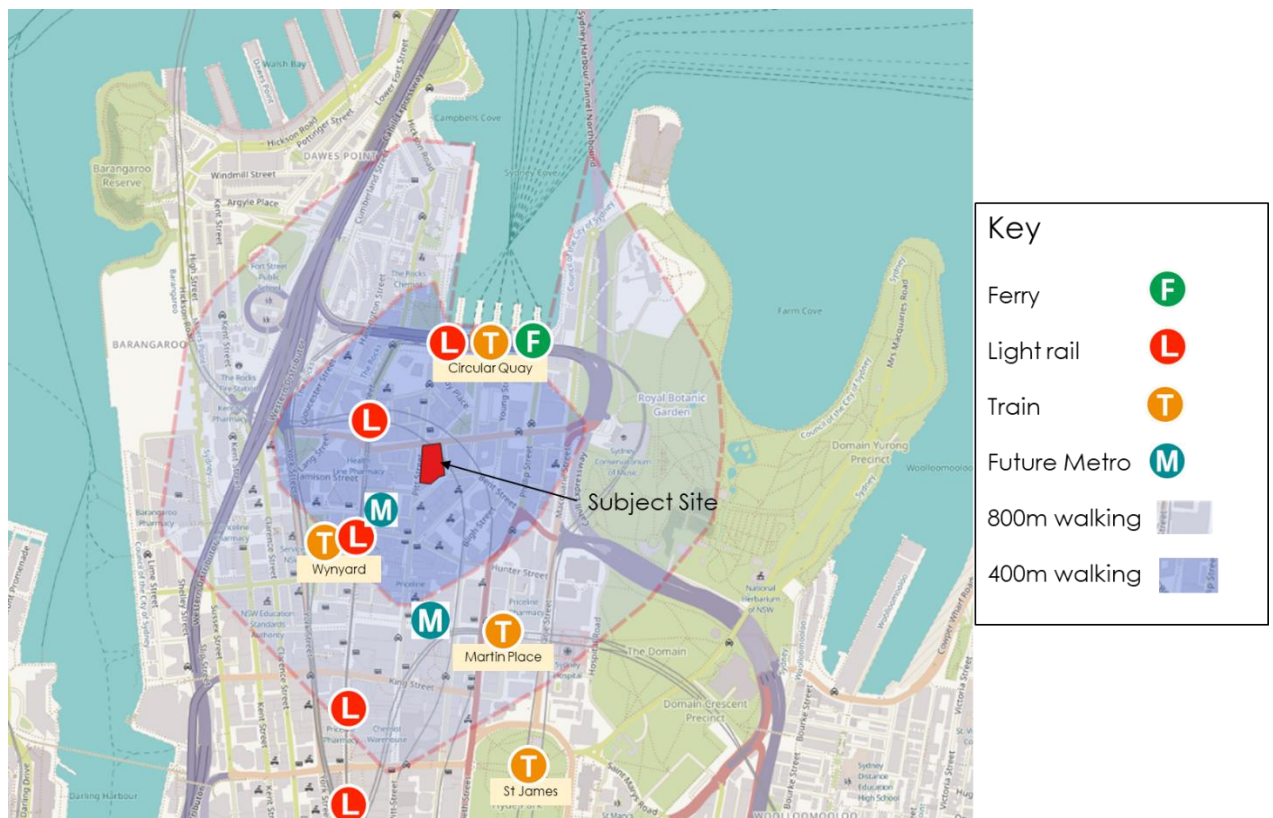
Spring Street is a two-way local street that connects Pitt Street to Gresham Street and Bent Street. It has a traffic lane in each direction. Limited restricted kerb side parking is provided on either side. The eastbound slip lane at Pitt Street has been closed to traffic. City of Sydney plans to close Spring Street as part of the City North Public Domain Plan.

Gresham Street is a two-way local street that connects Bridge Street to Bent Street. No kerbside parking is provided on either side.

2.4 Pedestrian Infrastructure and Walking Catchment

The subject site is centrally located within the Sydney CBD and near high frequency public transport services including Sydney light rail, ferry and train stations. The 400m and 800m walking catchment surrounding the site is shown in Figure 2.2.

Figure 2.2: Walking Catchment



In addition to this, well-established pedestrian facilities are provided within the vicinity of the site to provide good pedestrian access within the Sydney CBD. Paved pedestrian footpaths are provided on both sides of surrounding streets to provide good pedestrian connectivity between the site and the wider Sydney CBD pedestrian network. In addition to this, a signalised pedestrian crossing is provided on all legs at the Bridge Street – Pitt Street intersection while marked pedestrian crossings (zebra crossing) are provided at the northeast, southeast and southwest corners of the subject site.

2.5 Public transport

The subject site has good access to abundant public transport services in the CBD area. A description of the surrounding public transport services is provided in the following section.

2.5.1 Buses

Multiple bus services are located directly opposite the site's frontages along Pitt Street, Spring Street and Gresham Street. In addition to this, over 60 bus routes currently operate within the vicinity of the site, including several high frequency bus routes. The existing bus network map is shown in Figure 2.3.

Figure 2.3: Existing Bus Network Map



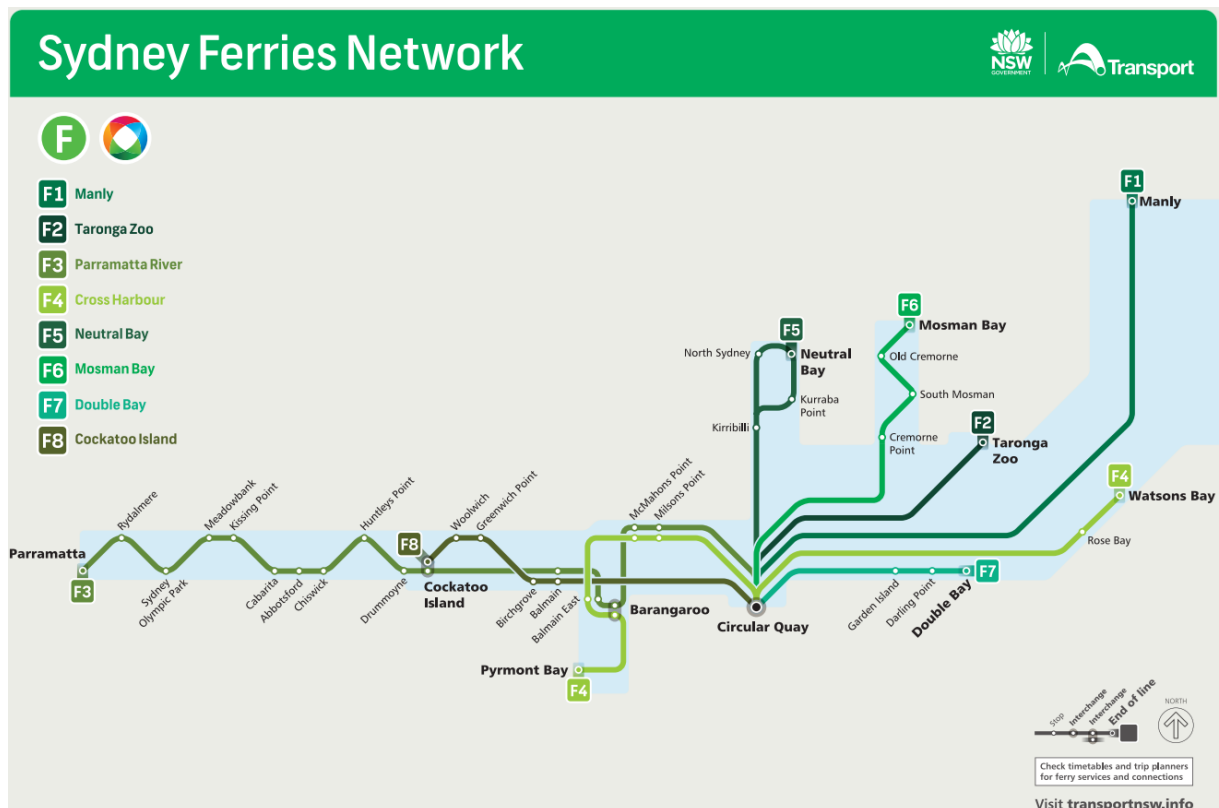
Source TfNSW Bus Network Map

2.5.2 Ferry

The subject site is located within a 400m walking catchment (as shown in Figure 2.2) to frequent ferry services located at Circular Quay Wharf. Circular Quay provides service with frequencies generally every 30min – 1 hour.

The Sydney Ferries Network is shown in Figure 2.4.

Figure 2.4: Sydney Ferries Network



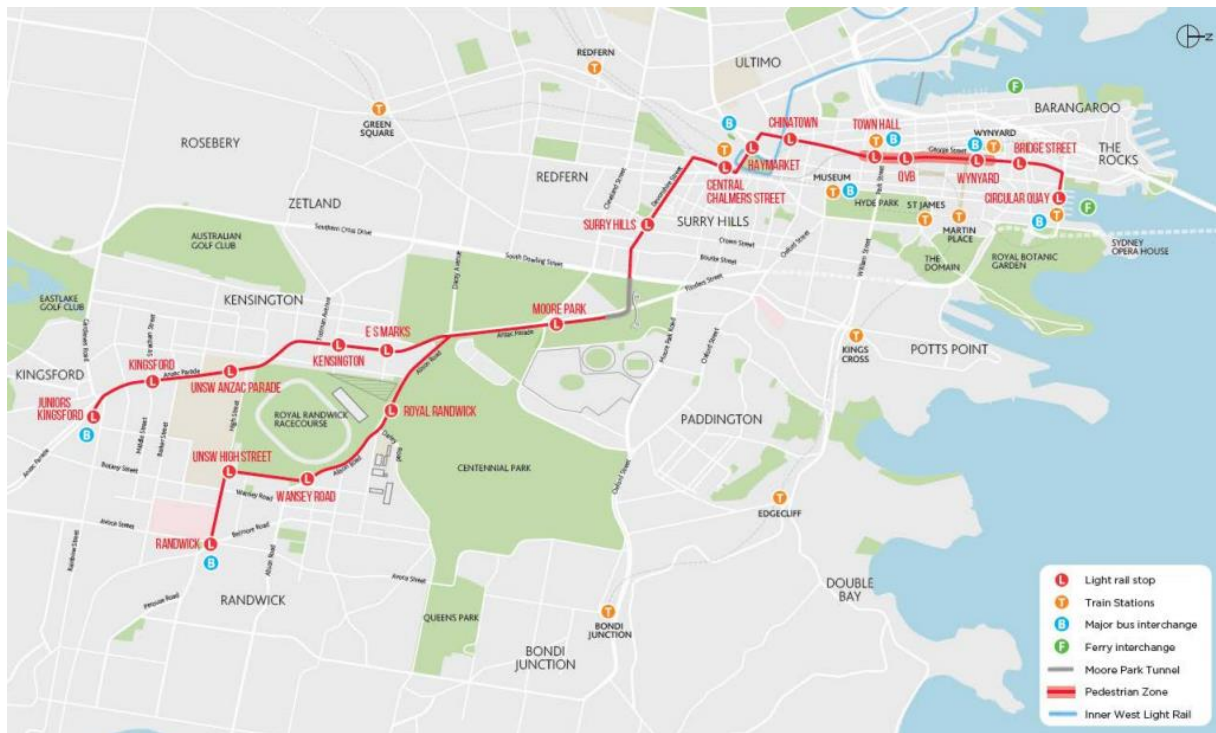
Source: TfNSW

2.5.3 Light Rail

The CBD and South East Light Rail began operation of the L2 Randwick Line between Circular Quay and Randwick via Central and Kensington. High frequency turn-up-and-go service runs every 4-8 minutes between Circular Quay and Central, and every 8-12 minutes between Central and Randwick and Kensington.

The CBD and South East Light Rail route and stop locations are shown in Figure 2.5.

Figure 2.5: CBD and South East Light Rail Route



Source: mysydneycbd.nsw.gov.au

The Bridge Street Light Rail stop is located approximately 150m (two-minute walk) west of the subject site.

2.5.4 Heavy Rail

The subject site is located near city circle train services and is within 4-5-minute walking distance (400m) from Wynyard Station and Circular Quay Station. Additionally, the site is within a 550m (or 6-minute) walk to Martin Place Station. Wynyard Station, Circular Quay Station and Martin Place Station are well connected to the Sydney rail network and are collectively serviced by the following Sydney train lines:

- T1 North Shore & Western Line
- T2 Inner West & Leppington Line
- T3 Bankstown Line
- T4 Eastern Suburbs & Illawarra Line
- T8 Airport & South Line
- T9 Northern Line

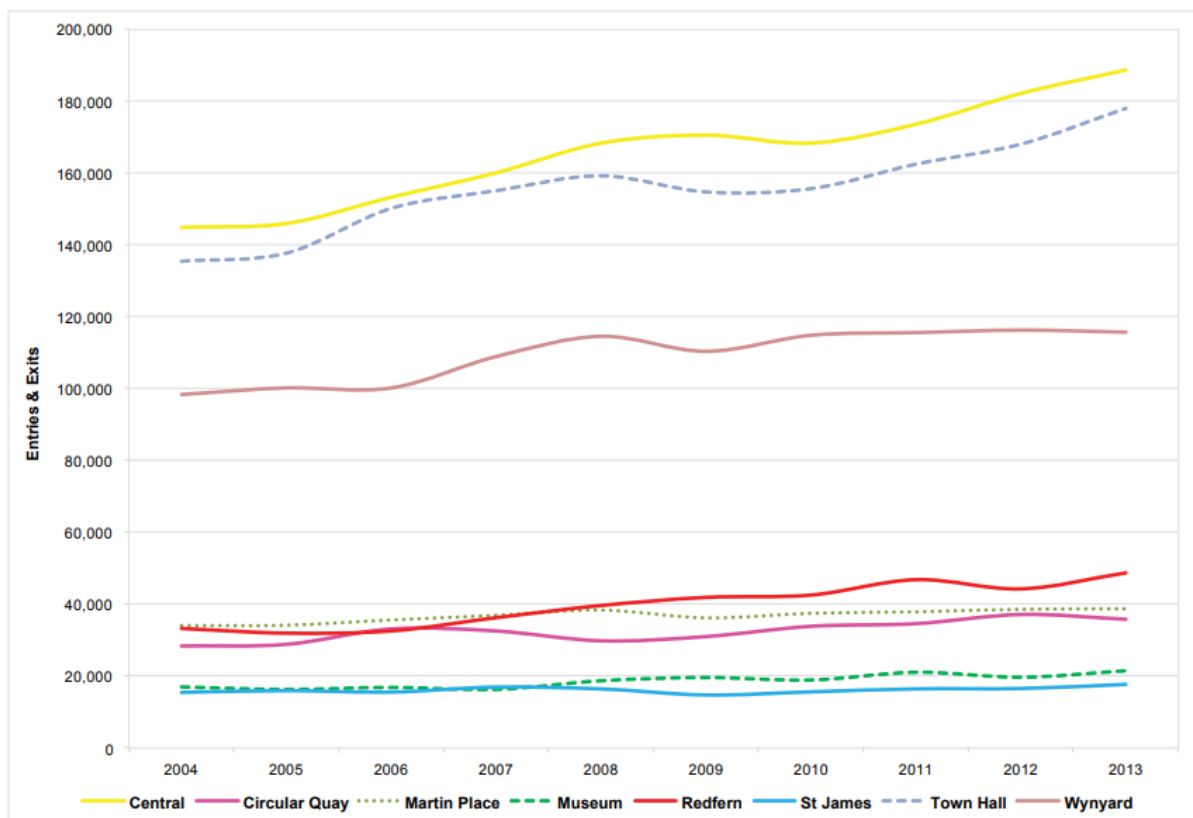
High-frequency train services are available at Wynyard Station with one train stopping every two to three minutes on some lines during peak hours.

2.5.4.1 Existing Train Loads

Wynyard Station is one of the busiest on Sydney's rail network after Central and Town Hall stations and is the gateway to Sydney's financial district and CBD.

A summary of the growth in total passenger movements through CBD barriers on a typical busy weekday between Year 2004 and 2013 is shown Figure 2.6.

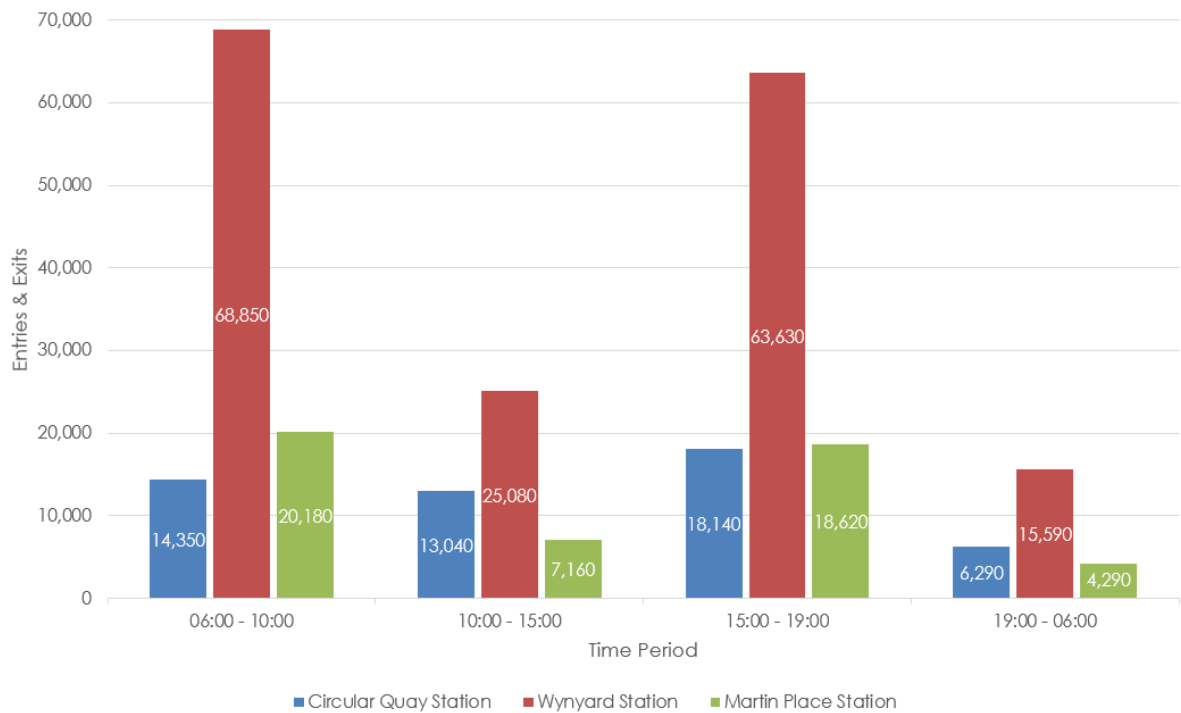
Figure 2.6: Sydney CBD station entries and exits 2004-2013



Source: Rail Station Barrier Counts 2004 to 2013, Bureau of Transport Statistics, TfNSW.

In addition to the above, recent existing train station entry and exit data have been obtained from TfNSW, Performance and Analytics via TfNSW's open data website. A summary of the existing entries and exit data collected in May 2018 for Wynyard Station, Circular Quay Station and Martin Place station is summarised in Figure 2.7.

Figure 2.7: Entries and Exits 2018



More recent peak train load data has also been obtained from TfNSW's open data website. A summary of the existing morning and evening Peak train load data collected in March 2019 is shown in Figure 2.8 and Figure 2.9 respectively.

Figure 2.8: Existing AM Peak Train Loads

AM Peak Train Loads by Line, March 2019

CBD cordon

Line	Station	AM Peak busiest hour (08:00 to 9:00 at Central)			
		Scheduled Trains	Average Passengers	Average Load Factor	Maximum Load Factor
T1 North Shore	Milsons Point	14	13,867	113%	180%
Central Coast & Newcastle via Shore	Milsons Point	4	3,988	115%	126%
T1 Northern ^A	Central / Redfern ^A	8	9,082	138%	180%
T1 Western ^A	Redfern ^A	16	20,731	150%	180%
T2 Inner West ^A	Redfern ^A	6	5,928	110%	158%
T2 Leppington ^A	Redfern ^A	8	9,587	133%	167%
T3 Bankstown ^A	Redfern ^A	10	10,054	128%	169%
T4 Eastern Suburbs	Kings Cross	18	10,663	71%	108%
T4 Illawarra ^{A~}	Redfern ^A	15	18,684	150%	180%
T5 Cumberland (Southwest)	Harris Park	2	1,544	171%	180%
T8 Airport	Green Square	10	13,309	148%	180%
T8 South ^A	Redfern ^A	4	5,130	141%	166%
Total Suburban		115	122,567	125%	
Blue Mountains ^A	Emu Plains ^A	4	1,339	40%	47%
Central Coast & Newcastle via Strathfield	Woy Woy	4	1,843	54%	67%
South Coast	Helensburgh	3	1,756	68%	72%
Total Intercity		11	4,938	53%	

Average load factor = number of passengers / number of seats

Central hour varies slightly for each line to accurately reflect the number of trains in the busiest hour of the peak as per the intent of the timetable.

All services captured for 04-08 March 2019 arriving Central Station approx. between 8am and 9am

Max Load Factor services are captured for Wednesday 06 March 2019 arriving/departing stations approx. between 8am and 9am

A load factor of 100 per cent means there is a seat for each customer. At 135 per cent, an additional 5 people are standing on each level and 15 in each vestibule.

^A Loads on arrival. All other lines are loads on departure.

* Trains heading towards Blacktown from Leppington.

~ The service from Thirroul is included in the T4 Illawarra Line, and excluded from the South Coast Line due to its stopping pattern.

Figure 2.9: Existing PM Peak Train Loads

PM Peak Train Loads by Line, March 2019

CBD cordon

Line	Station	PM Peak busiest hour (17:00 to 18:00 at Central)			
		Scheduled Trains	Average Passengers	Average Load Factor	Maximum Load Factor
T1 North Shore	North Sydney	12	9,427	89%	135%
Central Coast & Newcastle via Shore	North Sydney	4	3,884	112%	134%
T1 Northern	Central / Redfern	8	7,000	103%	180%
T1 Western	Redfern	16	17,411	125%	180%
T2 Inner West	Redfern	4	3,476	97%	118%
T2 Leppington	Redfern	8	9,308	130%	180%
T3 Bankstown	Redfern	8	7,338	102%	131%
T4 Eastern Suburbs	Martin Place	16	7,702	58%	90%
T4 Illawarra	Redfern	15	13,190	107%	149%
T5 Cumberland (Southwest)	Parramatta [*]	2	969	107%	123%
T8 Airport	Green Square ^A	10	9,269	103%	126%
T8 South	Redfern	4	4,026	112%	128%
Total Suburban		107	93,000	101%	
Blue Mountains	Penrith	4	1,125	38%	47%
Central Coast & Newcastle via Strathfield ^A	Woy Woy ^A	4	1,446	43%	52%
South Coast	Sutherland	3	1,565	60%	77%
Total Intercity		11	4,136	48%	

Average load factor = number of passengers / number of seats

Central hour varies slightly for each line to accurately reflect the number of trains in the busiest hour of the peak as per the intent of the timetable.

All services captured for 04-08 March 2019 departing Central Station approx. between 5pm and 6pm

Max Load Factor services are captured for Wednesday 06 March 2019 arriving/ departing stations approx. between 5pm and 6pm

A load factor of 100 per cent means there is a seat for each customer. At 135 per cent, an additional 5 people are standing on each level and 15 in each vestibule.

^A Loads on arrival. All other lines are loads on departure.

* Trains from Blacktown heading towards Leppington.

A nominal capacity of 135 per cent is generally the benchmark beyond where passengers begin to experience crowding and dwell times, which can impact on-time running of rail services. Based on the above, the maximum load factor of the majority of trains to the City in the AM Peak generally operate above the nominal capacity. As such, it is clear that additional public transport capacity will need to be considered to meet the existing demand of the rail service, as well as to accommodate future growth and development. This is further discussed in Section 2.5.5 below.

2.5.5 Future Public Transport Infrastructure

2.5.5.1 Sydney Metro

The first stage of the Sydney Metro Northwest project opened on 26 May 2019, linking Rouse Hill to Chatswood. The second stage of the project Sydney Metro City and Southwest will deliver new stations at Crow's Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo with new underground platforms at Central Station and connections through to the Bankstown line which is also being upgraded. The extension to Sydenham Station is due to open in 2024.

The Sydney Metro will run a train every four minutes in the peak and every ten minutes at all other times. It is anticipated to provide additional capacity, with an increase of some 60% capacity across the network, to help meet existing and future demand, particularly to key rail bottleneck locations such as Bankstown.

The Sydney Metro route is shown in Figure 2.10.

Figure 2.10: Sydney Metro Route



Basemap Source: mysydney.nsw.gov.au

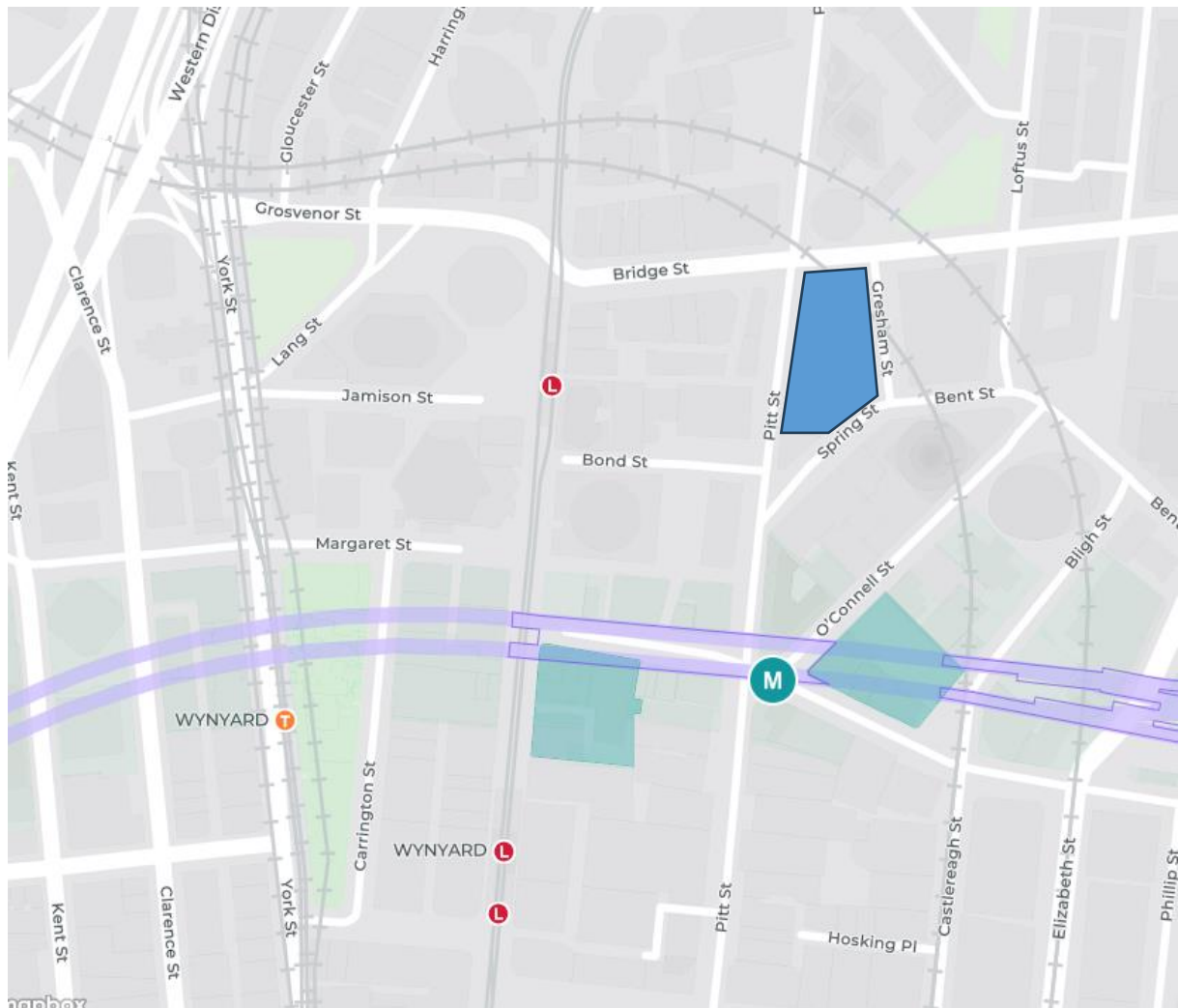
More specifically, the Martin Place metro station will be located south of Hunter Street between Castlereagh and Elizabeth Streets, approximately 300m south-east of the site (four-minute walk). Pedestrian access to the station will be provided off Castlereagh, Hunter and Elizabeth Streets and Martin Place.

The Sydney Metro will improve access to the site, particularly from north-western and western suburbs, including Rouse Hill and Bankstown suburbs.

In recognition of the above, TfNSW intends to deliver additional public transport capacity on the Sydney network to address existing deficiencies, as well as future growth and development in the CBD area.

In addition, Sydney Metro West is currently under construction and will have a station in Hunter Street as shown in Figure 2.11. The Sydney Metro West will provide high frequency services between Westmead and the Sydney CBD connecting Parramatta CBD, Olympic Park and White Bay to the Sydney CBD.

Figure 2.11: Sydney Metro West



Source: Sydney Metro

2.6 Cycle Infrastructure

City of Sydney have created a permanent cycleway permanent along Pitt Street from King Street to circular Quay. This was implemented in 2022 as an upgrade to the 'pop up' cycleway that was introduced during the Covid-19 pandemic. The cycleway features separated bidirectional cycle lanes along western side of Pitt Street separated by a concrete median.

The cycleway network including the Pitt Street Cycleway are shown in Figure 2.12.

Figure 2.12: Existing Cycling Route Map



Source: City of Sydney Council

2.7 Traffic Volumes

TTPP commissioned intersection surveys on Wednesday 5 February 2020 between 7:00am and 9:00am and between 4:00pm and 6:00pm at the following key surrounding intersections:

- Pitt Street – Bridge Street
- Bridge Street – Gresham Street
- Spring Street – Bent Street – Gresham Street
- Pitt Street – Bond Street – Spring Street

It should be noted that since these surveys were undertaken that the left turn from Pitt Street to Spring Street has been closed, however, Spring Street remains two-way.

Based on these traffic surveys, the following network peak periods were identified:

- 8:00am and 9:00am (morning peak period)
- 5:00pm and 6:00pm (evening peak period)

A summary of the network peak traffic flows surrounding the site is shown in Figure 2.13 and Figure 2.14 for the morning and evening peaks, respectively.

Figure 2.13: Network Morning Peak Hour Volumes

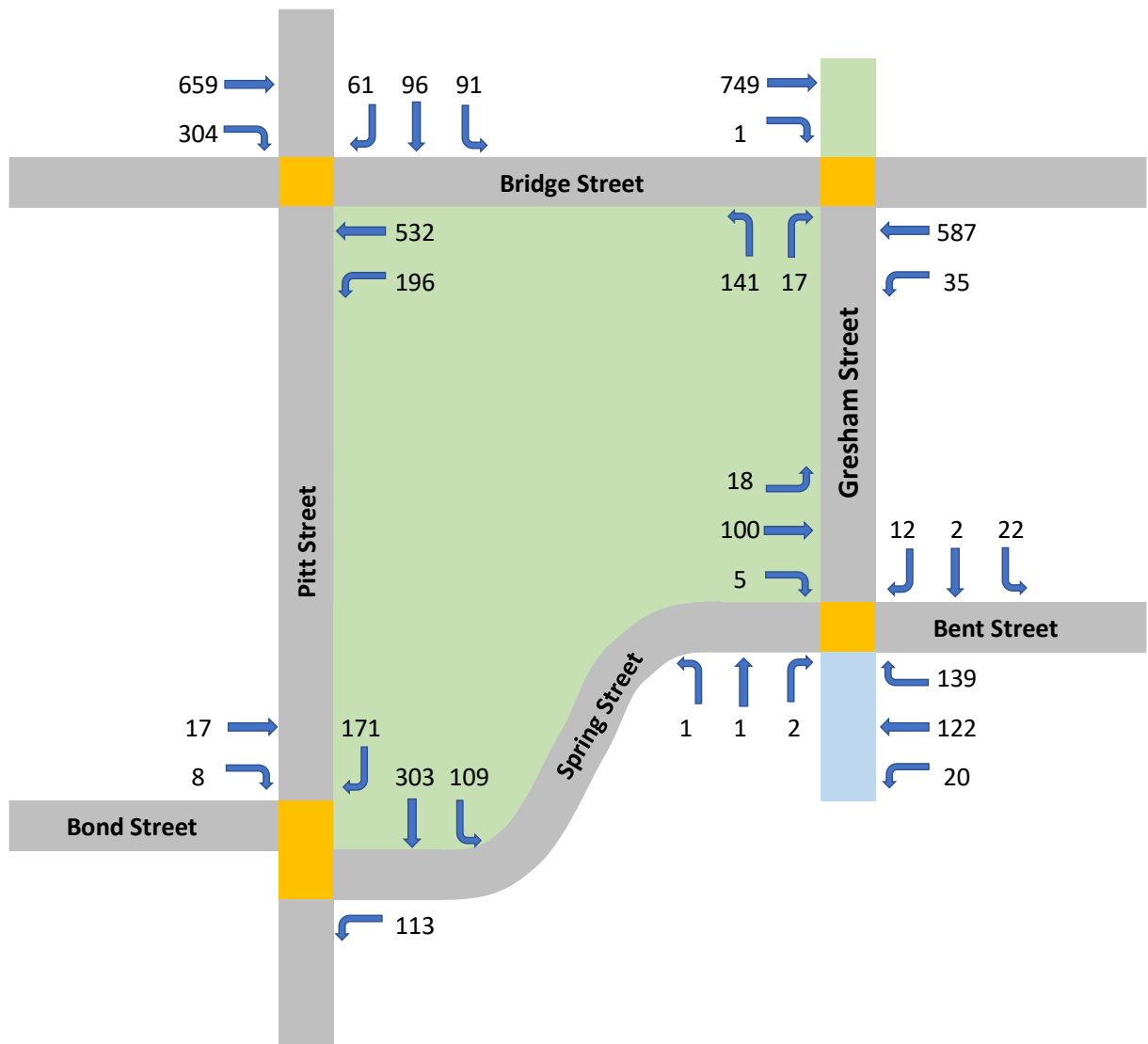
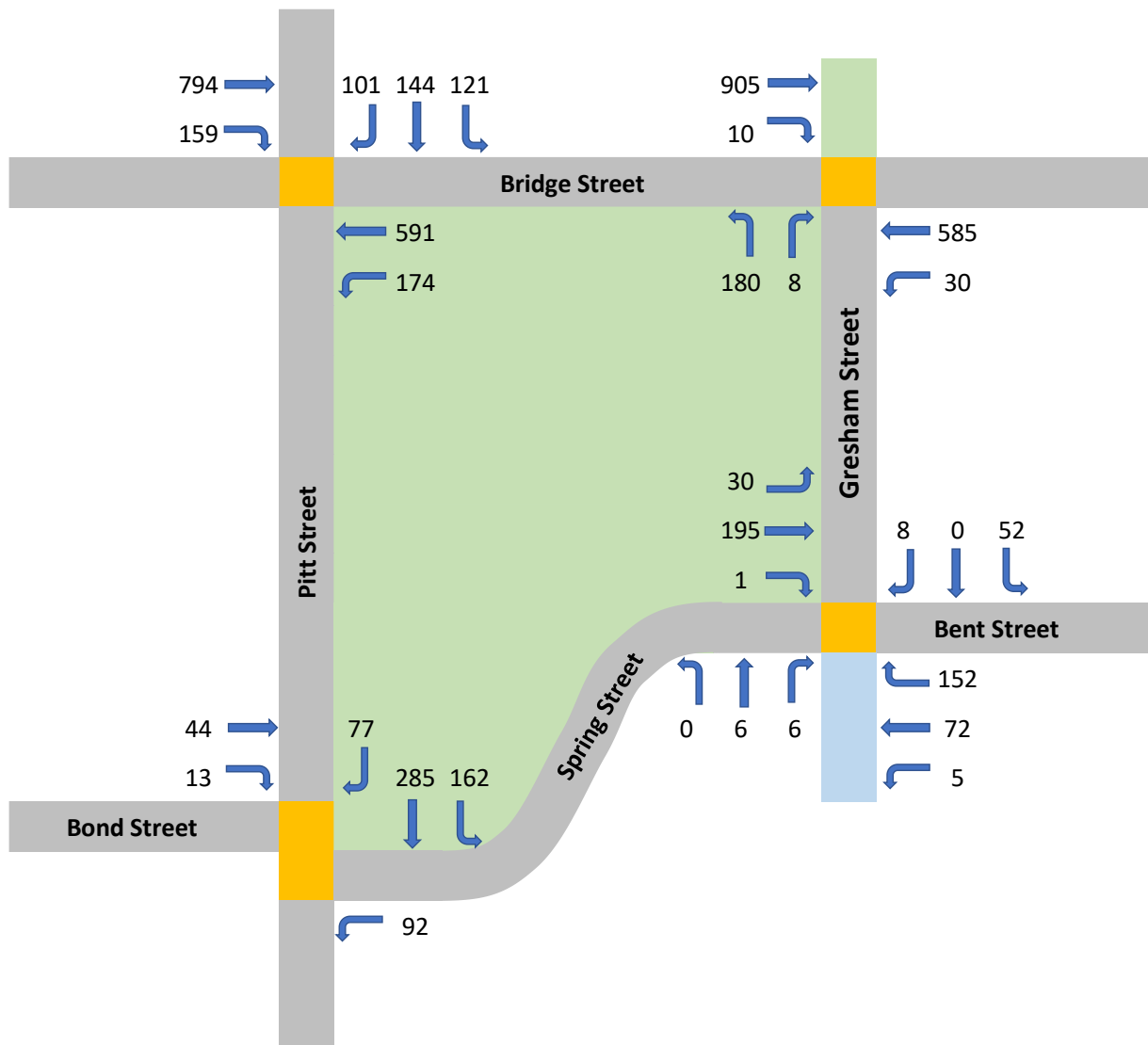


Figure 2.14: Network Evening Peak Hour Volumes



2.8 Parking

2.8.1 Off-Street parking

The site currently has a total 82 car spaces in two separate basement car parks. The existing car parking is shown in Table 2.2.

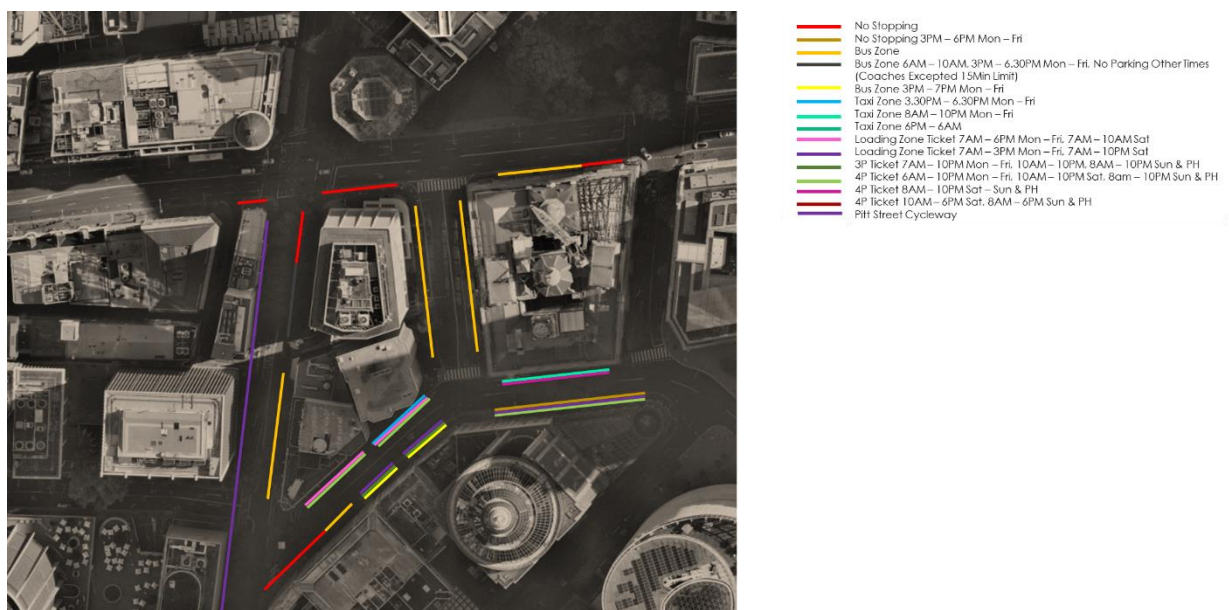
Table 2.2: Existing car parking provision

Site	Car spaces
56 Pitt Street	69
58 Pitt Street	-
60 Pitt Street	-
3 Spring Street	13
Total	82

2.8.2 On-street parking

Limited on-street parking is provided on streets immediately surrounding the subject site. The parking restrictions generally provided surrounding the subject site is shown in Figure 2.15.

Figure 2.15: Surrounding On-Street Parking Map



2.9 Existing Traffic Generation

As the site vehicle trip generation is limited by the number of available car spaces it is assumed that the existing peak hour trip generation is 80% of the available car spaces. This results in 66 car trips per hour in the peak hours.

The rates from the Roads and Maritime technical direction (TDT 2013 / 04) can also be applied:

- 1.6 trips per 100m² GFA morning peak
- 1.2 trips per 100 m² GFA evening peak

If these rates are used for the 32,000m² floor area of the existing development, this would result in 512 vehicles per hour in the morning peak and 384 trips per hour in the evening peak. Clearly, this exceeds the 82 available car spaces for the buildings.

However, if the rates provided in the Roads and Maritime technical direction for a site in North Sydney are used (which has 136 parking spaces), where the generation rate was 0.17 trips per 100m² and 0.14 trips per 100m² in the morning and evening peaks respectively, this results in 54 trips per hour in the morning peak and 45 trips per hour in the evening peak. This is less than the trips estimated by using the number of car spaces.

The cafés and small retailers on site are assumed to generate only a minimal number of vehicle trips.

2.10 City North Public Domain Plan

The City of Sydney's City North Public Domain Plan was updated in March 2023. Elements of the plan will have an impact on road network surrounding the subject site. This includes:

- Closure of Loftus Street to vehicular traffic between Spring Street and Bridge Street
- Modifications to Gresham Street
- Full closure of Spring Street at Pitt Street (Currently one-way out)

2.10.1 Loftus Street Pedestrianisation

The proposal is to pedestrianise Loftus Street by closing it to vehicular traffic. The benefits are to address the narrow footpaths and provide better connections between the Hunter Street metro station and Circular Quay.

2.10.2 Spring Street Full Closure

Spring Street will be closed to traffic at Pitt Street. This will provide additional pedestrian amenity at this location.

3 Proposed Development

3.1 Proposal Description

Dexus Office Trust Australia (Dexus) is the owner of the properties at 56, 58, 60 Pitt Street and 3 Spring Street, which currently contains four high rise commercial buildings.

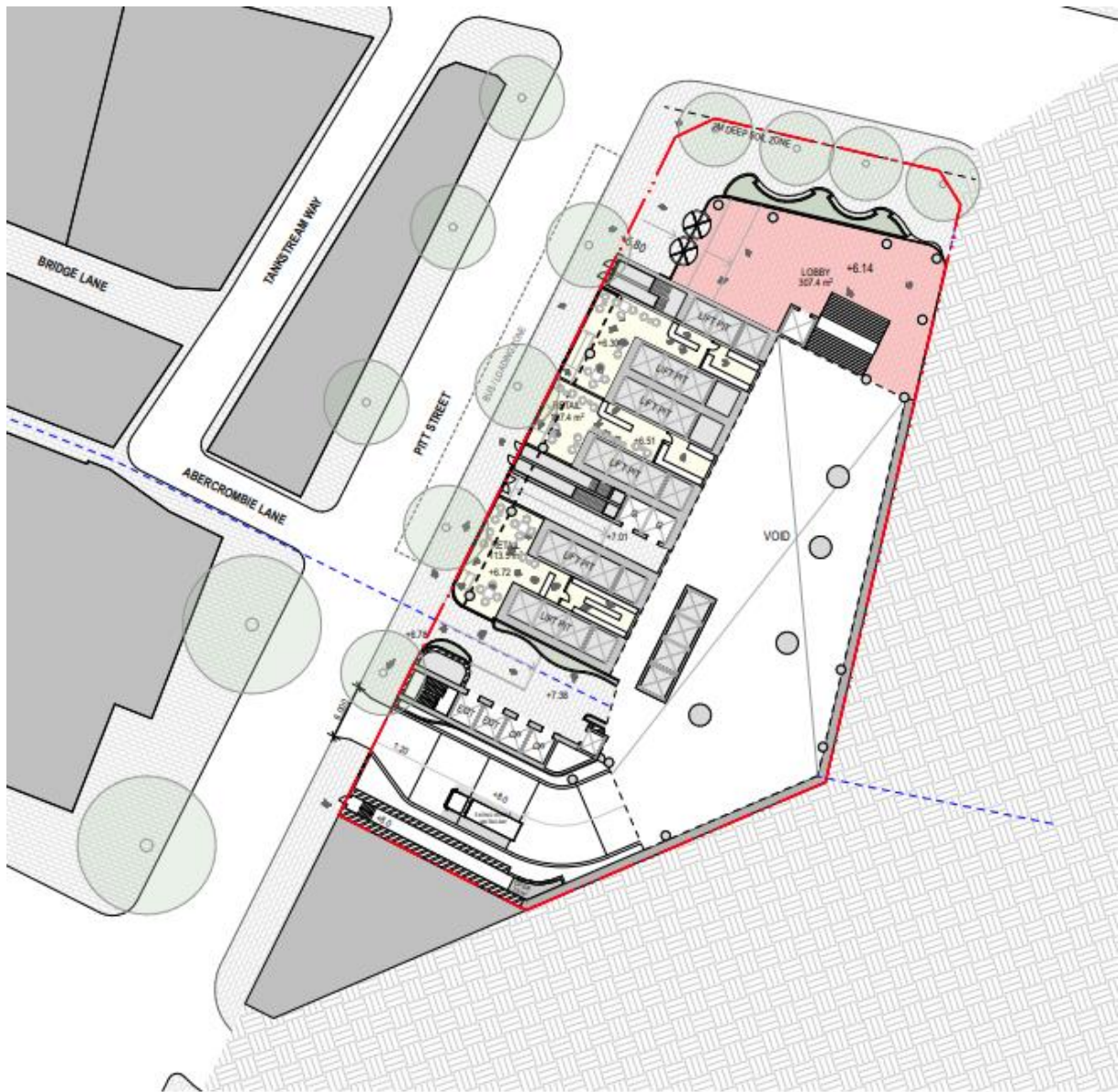
It is proposed to consolidate and redevelop the site into a 90,000 m² GFA tower with office and ground floor retail. The proposed concept comprises the following uses:

- Commercial Office 89,583 m² GFA¹
- Retail 417 m² GFA

The proposed indicative ground floor plan is shown in Figure 3.1.

¹ Includes the 'Sky Garden'

Figure 3.1: Ground Floor Plan



3.2 Vehicle Access

Vehicular access to the site will be via a driveway and ramp from Pitt Street as shown in Figure 3.1. This will replace the three driveways that service the existing buildings. The driveway will be shared by the car park and loading dock minimising the crossover area of the footpath.

4 Parking Assessment

4.1 Car Parking Requirements

The car parking requirements for the proposed development have been assessed against the following guidelines:

- Sydney Local Environmental Plan 2012 (SLEP 2012)
- Sydney Development Control Plan 2012 (SDCP 2012)
- The Transport for NSW Urban Freight Forecast Model (Used for predicting demand of service vehicles.)

Based on this, the car parking requirement for the proposed development is summarised in Table 4.1.

Table 4.1: Car Parking Requirements

Land Use		Size	Maximum Car Parking Rate	Maximum Car Parking Requirement
Office, Business or Retail Premise	Commercial	89,583m ² GFA	M = (G x A) ÷ (50 x T)	66 spaces
	Retail Space	417 m ² GFA		
Total Maximum Car Parking Requirement				66 car spaces

* where M = maximum car parking
 G = GFA of proposed office and business (89,583 m² / retail premises (417 m² GFA)
 A = Site Area (3,288m²)
 T = Total GFA of all buildings on the site (90,000m² GFA)

Table 4.1 indicates a maximum of 66 car parking spaces could be provided to serve the proposed development. The LEP 2012 on-site parking rates are set as maximum parking rates. No minimum parking rates are required. It is proposed to provide 16 car parking spaces to serve the proposed development. Therefore, the proposed provision of 16 on-site car parking is considered satisfactory for the proposed development.

Access to the car parking levels will be provided by car lifts located on the basement 1 level. Two car lifts are provided. Typical lift service times have been found to be in the order of 77 seconds. An example lift service time for the Das-schneider brand lift is shown in Table 4.2.

Table 4.2: Typical Lift Service Time

	Des-schneider
Lift Speed	0.73m/s
Doors Open	7
Vehicle On	7
Doors Close	7
Travel Time for Loaded Lift (11m)	15
Lift Acceleration / Deceleration	5
Open Doors	7
Vehicle Off	7
Door Close	7
Travel Time Unloaded	15
Total Round Trip	77

Based on queueing theory and the following assumptions:

- 2 x car lifts
- Lift round trip takes on average 77 seconds
- 80% of car park enters in one hour (80% x 16 = 13 vehicles per hour)

The 98th percentile queue waiting for the car lift is estimated to be 0.97 vehicles (excluding the vehicle being serviced) and an average queue of less than 0.02 vehicles. Therefore, provision of a queuing area for 1 vehicle on arrival would be sufficient and could be accommodated within the basement car park.

4.2 Bicycle Parking Requirements

The parking area allowed for bicycles would accommodate some 835 bicycle spaces. The bicycle parking rates stipulated in the DCP are minimum bicycle parking requirements. The bicycle parking requirements for the proposed development are summarised in Table 4.3.

Table 4.3: On-site bicycle parking requirement

Land Use	Category	Size	Parking Rate	Minimum Requirement
Commercial	Staff	89,583 m ² GFA	1 per 150m ² GFA	597
	Visitors		1 per 400m ² GFA	224
Retail	Staff	417 m ² GFA	1 space per 250m ² GFA	2
	Visitors		2 spaces plus 1 space per 100m ² over 1000m ² GFA	2
Total				825

Table 4.3 indicates that the proposed 90,000m² GFA development would require at least 825 bicycle parking spaces in accordance with Council DCP requirements.

The proposal has allocated a space of 1,392 m² for bicycle parking.

Bicycle parking is to be provided on the basement 3 level with end of trip facilities located on level 1. Access to the bicycle parking will be via lifts accessible from the lower ground floor.

4.3 Motorcycle Parking Requirements

In accordance with the City of Sydney's DCP 2012, motorcycle parking spaces are to be provided at a rate of 1 motorcycle parking space for every 12 car parking spaces. Based on the car parking space provision of 16 spaces, 2 motorcycle parking spaces are required as per Council's requirement. The development proposes 2 spaces for motorcycles.

4.4 Service Vehicle Requirements

The following section addresses the provision of spaces for service vehicles considering the DCP requirement, service vehicle demand and provision of a neighbourhood loading dock.

- The proposal will provide 29 spaces for service vehicles, this meets the minimum requirement of the City of Sydney DCP.
- The Transport for NSW Urban Freight Forecasting Model estimates that 18 spaces are required to meet the demand and the development will exceed this estimate by 5 spaces.
- Empirical data based on surveys of development would require 14 service vehicle spaces.

4.4.1 City of Sydney DCP

The service vehicle loading bay requirements for the proposed development are set out in the City of Sydney's DCP 2012. The service vehicle loading bay requirement for the proposed development is summarised in Table 4.4.

Table 4.4: Service Vehicle Loading Bay Requirements

Land Use	Size	Minimum Service Vehicle Parking Rate	Minimum Service Vehicle Parking Requirement
Commercial Office	89,583 m ² GFA	(i) 1 space per 3,300m ² GFA, or part thereof, for the first 50,000 m ² ; plus (ii) 1 space per 6,600m ² , or part thereof, for additional floor area over 50,000m ² and under 100,000m ² ; plus (iii) 1 space per 13,200m ² , or part thereof, for additional floor area over 100,000m ²	21 loading spaces
Retail	417 m ² GFA	(iv) 1 space per 350m ² GFA, or part thereof, up to 2,000m ² (v) 1 space per 800m ² GFA, above 2000m ²	2 loading spaces
Total			23 loading spaces

Table 4.4 indicates that the proposed development would require at least 23 loading spaces to serve all the proposed uses of the site independently.

According to Section 7.8.1 (3) of Schedule 7 of the City of Sydney DCP, loading spaces can be reduced for developments greater than 50,000 m² where the reduction can be justified. These principles could be applied to this development as it is expected that the demand for loading spaces will be lower than the number of spaces provided.

It is proposed to provide a total of 29 spaces for service vehicles comprising:

- 23 spaces for small rigid vehicles (SRV)
- 2 spaces for medium rigid vehicles (MRV)
- 4 spaces for couriers and delivery vans.

Medium rigid trucks would be able to access the lower basement floors via a truck lift that would also serve the proposed consolidated waste services being considered for the project.

A heavy vehicle turntable is to be provided within the basement loading dock to assist in manoeuvring for larger vehicles.

In addition to the building requirement four (4) courier / van spaces and two (2) SRV spaces are proposed to be allocated as public neighbourhood loading spaces. These would supplement the potential loss of six (6) spaces in Spring Street a result of the eventual closure of Spring Street. This is further discussed in Section 6.

4.4.2 Transport for NSW Urban Freight Forecasting Model

Transport for NSW have developed a tool for estimating the demand of service vehicles in urban developments. The Urban Freight Forecasting Model (UFFM) is an interactive web model to support the forecasting of urban freight activity generated by buildings and

developments. The model can be used to test various scenarios to understand the freight requirements for a building.

The capacity of the loading dock was assessed using the Transport for NSW, Urban Freight Forecasting model. Entering in the following details

- Number of Floors 69 floors
- Commercial Area 89,583 m²
- Retail Area 417 m²
- Dedicated Goods Lift Yes

Model then recommended the number of loading bays as shown in Table 4.5.

Table 4.5: Transport for NSW Urban Freight Forecasting Model

Vehicle	Suggest Trasport for NSW Urban Freight Forecast Model	Provided
Small B99 Vans	10	23
Medium SRV	5	4
Large MRVS	3	2
Total	18	29

The Urban Freight Forecasting Model suggests that the development should provide 18 spaces for loading bays including 10 small spaces, 5 medium spaces and 3 large truck spaces.

The provision of loading exceeds the estimated requirement by the Transport for NSW Urban Freight Forecast model by 9 loading spaces. It is considered an acceptable tool to understand loading dock requirements for a development and an alternative method to statutory documents such as the Sydney DCP 2012.

4.4.3 Alternative Loading Analysis

From previous surveys in the CBD of other sites, the demand for loading was found to be much lower than DCP rates. The survey results are shown in Table 2.

Table 4.6: CBD Loading Dock Survey Results

Building	Net Floor Area (m ²)	Peak Loading Bay Occupancy					Occupancy Rate
		Courier Bays	SRV Bays	MRV Bays	HRV Bays	Total	
Commercial							
- 1 Bligh Street	42,800m ²	9	0	0	0	9	1 per 4,800m ²
- CitiGroup Centre	61,000m ²	23	2	2	1	27	1 per 2,300m ²
Retail							
- QVB	13,700m ²	10	2	1	0	13	1 per 1,000m ²
- CitiGroup Centre	13,000m ²	6	0	2	0	8	1 per 1,600m ²

Source: GTA Consultants, 1 Carrington Street, Sydney – Traffic Impact Assessment Report (dated 30/04/14)

Based on the above, the following average loading rates were recorded for the following uses:

- Commercial: 1 loading bay per 5,500m² NLA
- Retail: 1 loading bay per 1,000m² NLA

Based on this assumption and using NLA the minimum would be 14 as shown in Table 4.6.

Table 4.7: Loading Requirements Based on Case Study

Use	Area (NLA)	Rate 1 (first 50,000m ²)	Loading Spaces
Office	70,000 m ²	1 per 5,500 m ²	13
Retail	309 m ²	1 per 1000 m ²	1
Total			14

The number of loading docks required for the Pitt and Bridge Street Tower development based on the empirical data is 14 loading bays which is 9 fewer than the DCP required rates. (Note this is based on NLA which is less than GFA) . Also, the data shows that most of the activity is associated with the courier bays.

4.4.4 Service Vehicle Provision Conclusion

The proposed loading docks and service vehicle provision will provide a public benefit of a neighbourhood loading dock as well as meeting the demands for the building.

According to the proposal, there will be 29 service vehicle spaces provided to meet the DCP requirement. However, a more detailed analysis of empirical data and the Transport for NSW Freight Forecasting Model suggests that this would exceed the building's demand by 9 and 5 vehicles respectively.

Therefore, the proposal includes the provision of seven (7) service vehicles spaces that can be used by the public. This is to compensate for the potential loss of six (6) spaces on Spring Street in the future, following the City of Sydney's public domain strategy.

The analysis indicates that the proposed supply of service vehicles is suitable for the demands of the building and providing a public benefit of neighbourhood loading docks.

5 Traffic Impact Assessment

5.1 Traffic Generation and Impacts

The proposed development would have 16 car spaces provided in the basement car park. This is less than the existing 82 car spaces. It is therefore expected that the development will generate less vehicle traffic than the existing buildings. The estimated traffic generation is some 16 vehicles per hour. The location of the driveway on Pitt Street and removal of driveways along Gresham Street is likely to decrease traffic volumes in Gresham Street.

5.2 Pedestrian Impacts

A pedestrian study was undertaken by Ason Group. This is attached as Appendix B. This modelling was based on previous planning proposal for the site which had a higher yield in terms of floor area and projected number of people using the building.

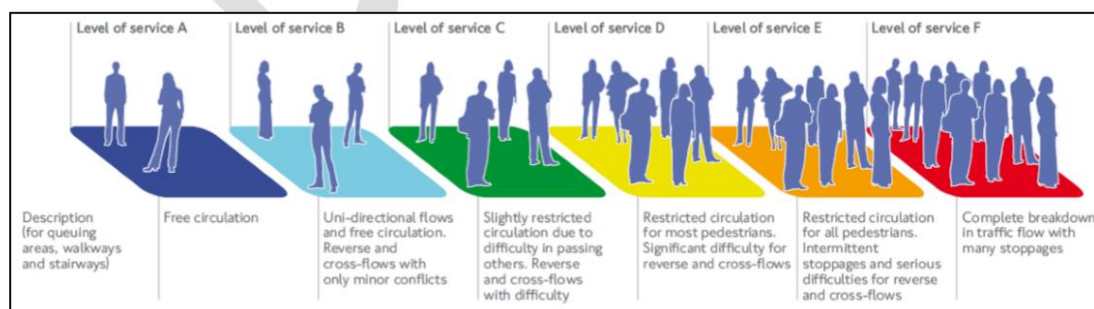
The results of the pedestrian modelling assessment were reviewed to analyse the predicted passengers and level of service for the surrounding footpaths to the new development. Table 5.1 summarises the performances of the footpaths in different scenarios and peak periods. Three scenarios were tested: *the base model* representing the existing conditions; *Scenario 1* which includes the development pedestrian trips; and *Scenario 2* which includes the development pedestrians and assumed 15% growth in background pedestrian numbers. The level of service (LoS) is based London Underground station planning and guidelines 2012 (see Figure 5.1) and ranges from 'A' to 'F' with 'A' being free circulation and F congested conditions and flow breakdown.

Table 5.1: Pedestrian LoS results for footpaths

Footpath		Base	Scenario 1	Scenario 2
Pitt Street	Morning	A	B	B
	Evening	A	A	A
Bridge Street	Morning	B	B	B
	Evening	A	A	A
Gresham Street	Morning	A	B	B
	Evening	A	A	A
Spring Street	Morning	A	A	B
	Evening	A	A	A
New pedestrian link	Morning	-	B	B
	Evening	-	A	A

Source: Ason Group 2020

Figure 5.1: Level of Service Criteria



Source: Transport for London, London Underground Station planning standards and guidelines, 2012 p.10

It can be concluded from the table above that the surrounding footpaths will perform acceptably, and the future person-trip generated from the new development will have minimal impact on the footpath's capacity.

5.3 Impacts on Public Transport

While the planning proposal will increase the demand on public transport. The future increase in capacity in the Sydney CBD as a result of the Sydney Metro and the Sydney Light Rail are

expected to increase capacity of the network to meet the need of future development within the Sydney CBD.

5.4 Cumulative Impacts

Cumulative impacts on the road network are expected to be minimal given that the Sydney CBD has limited the supply of car parking. Construction activities will need to be considered in conjunction with other construction projects in the area including the Sydney Metro.

Further the proposed development will reduce the demand on private vehicles as it will both reduce the existing parking on the site and have provision for cyclists in order to promote alternative transport modes.

6 Neighbourhood Shared Loading Strategy

The Neighbourhood Shared Loading Dock is envisioned as a communal loading dock designed to offer a centralised loading facility for public use. It's aim is to deliver practical loading facilities to properties within the precinct, and will benefit existing surrounding buildings that are constrained by:

- Inadequate or insufficient off-street loading facilities due to heritage factors or absence of loading facilities, and
- Reliance on on-street loading spaces, particularly businesses that rely on the Spring Street loading zones which are proposed to be removed due to the closure of Spring Street, as identified by the City North Public Domain Plan which seeks to pedestrianise Spring Street, and thereby remove a net total of six on-street loading and servicing spaces within the immediate vicinity of the site.

6.1 Shared Loading Arrangement

The Neighbourhood Shared Loading Dock is considered to offer a benefit to the City in the long term by:

- minimising on-street loading activities and reducing driveway crossovers, therefore promoting pedestrian and cyclist safety;
- increasing the future viability of neighbouring retail offerings that may be disadvantaged by the existing arrangement of on-street loading infrastructure;
- facilitating the reduction of kerbside parking, and enabling the option of the extension of footpaths for pedestrians and space for outdoor dining/ seating;
- enabling adjacent laneways and rear courtyards to be adapted from service lanes to future outdoor public amenity;
- streamlining the logistics of goods delivery;
- reducing traffic congestion and noise pollution by consolidating commercial vehicle activity to a designated area, contributing to a safer streetscape and improved environment amenity; and
- encourages local economic activity by supporting businesses with a convenient accessible point for logistics and deliveries.

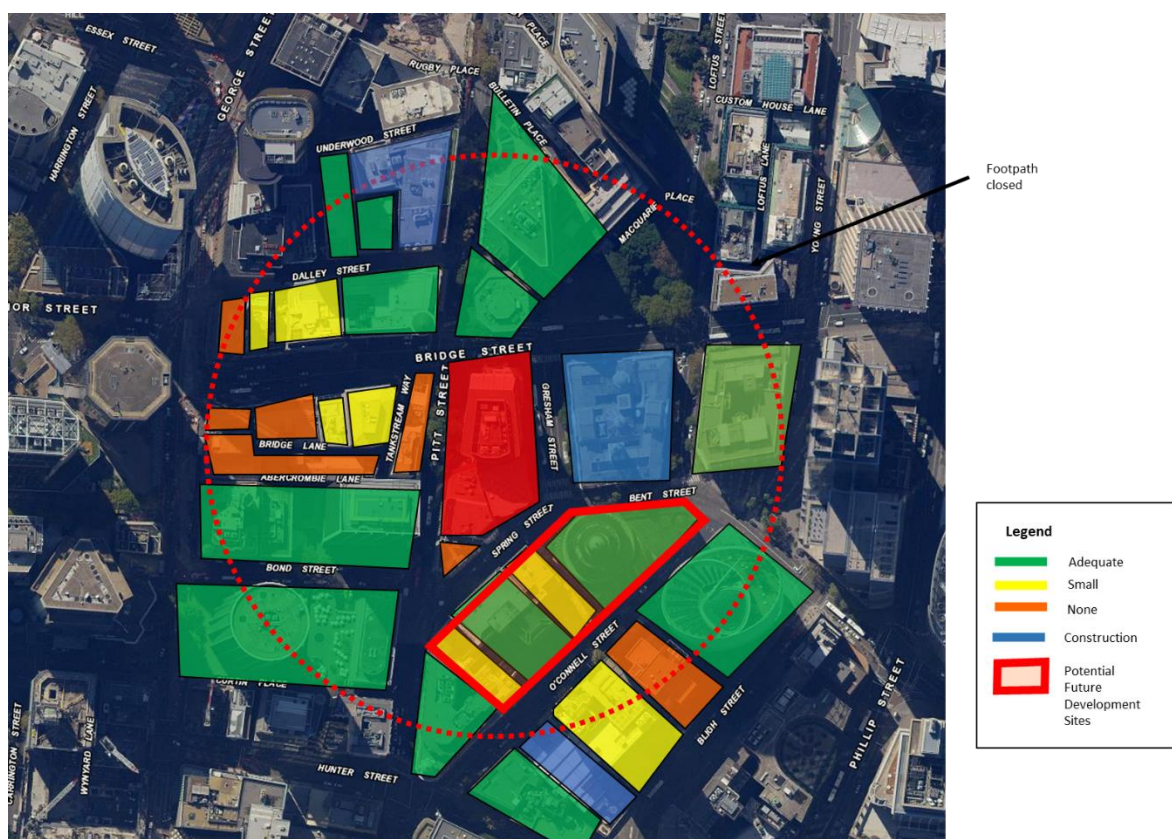
6.2 Loading and Servicing Details

6.2.1 Demand

To understand the demand for the neighbourhood loading dock, TPP have undertaken an analysis of the surrounding catchment of the site (within an 150m radius) to the quality of the existing off-street loading facilities. As outlined in figure 6.1, the analysis of the catchment zone found that the surrounding buildings were subject to the following findings: :

- Having access to adequate off-street loading facilities;
- Having access to a mall loading dock that would probably not be able to service the building sufficiently; or
- Having no access to off-street loading facilities available on that site.

Figure 6.1: Level of Service Criteria



The sites with small loading areas are:

- 33 Bridge Street – Has a small loading dock off Gresham Street however the gate was locked and did not appear to be in use.
- 16 and 8 Spring Street have only low clearance driveways suitable for cars and vans.
- 234 George Street

- 37 Pitt Street

The sites that do not appear to have any loading are:

- 62 Pitt Street
- 75-77 Pitt Street
- 73 Pitt Street
- 17-19 Bridge Street
- 6-8 Underwood Street
- 5-11 Bridge Street
- 244 George Street
- 252 George Street
- 6-10 O'Connell Street

It is noted that many of these sites are due to be redeveloped in the near future and it is assumed that the redevelopments would include provision of off-street loading areas. This includes the sites opposite in Pitt Street at 75-77 Pitt Street and 33 Bridge Street.

It is assumed that a shared neighbourhood loading dock for the surrounding buildings would only be practical for smaller deliveries as larger bulky items would require transporting across roads and footpaths.

Further to the above, TPP also reviewed the current surrounding on-street loading spaces against the proposed public domain works identified within the City North Public Domain Plan (as endorsed in March 2023). As part of the Spring Street proposal identified in the Plan, it is proposed to close Spring Street to provide a new sheltered public space for seating and respite, which will be fully pedestrianised and unavailable for through-traffic movement. Meaning that a total of six (6) on-street loading spaces will be permanently lost as a result of this proposal.

Taking the above into consideration and the results of the empirical data and Transport for NSW Urban Freight Forecasting model, as outlined in Section 4.4, a total of 29 loading and servicing spaces are proposed as part of this development, including 22 spaces dedicated for the Pitt & Bridge Street development, and allocation of the remaining seven (7) spaces available to the public as a neighbourhood loading dock. Refer to Figure 6.2 below. The 29 total loading spaces exceed the City of Sydney's DCP requirements.

The shared or neighbourhood spaces include:

- 5 car spaces
- 2 Small Rigid Vehicle (SRV) spaces

Figure 6.2: Loading Dock Layout



6.3 Loading Management

The Neighbourhood Loading dock will operate under a future loading dock management plan, which will consider the following:

- A system that will be managed by the dock manager that will accommodate booking and access, including process to manage after-hours access if required.
- Security and access considerations to the loading dock outside of standard business operation hours.

- Procedure and protocol requirements for the public use vehicles to adhere to, including intended use and timing thresholds to encourage reasonable turnover in a fair and equitable manner.
- The hours of operation of the shared loading dock will be 6:00am – 6:00pm Monday to Friday and 7:00am – 10:00am Saturdays.
- Eligibility will be similar to that for on-street loading zones (i.e. commercial vehicle registration) and subject to vehicle size requirements, as outlined in Section 4.
- Charges for users within the loading dock will be equivalent to and no more than the City of Sydney's current on-street charges. (If Spring Street is closed by the time of Pitt & Bridge construction period an equivalent street in central Sydney.)
- Upkeep will remain the responsibility of the owner and without the burden of City of Sydney Resources.

A detailed loading dock management plan will be developed as part of a future detailed Development Application and will be prepared in consultation with Council.

7 Framework Travel Plan

7.1 Overview

The key role of a Framework Travel Plan (FTP) is to bring about better transport arrangements to manage travel demands, particularly promoting more sustainable modes of travel, modes which have a low environmental impact such as walking, cycling, public transport and better management of car use.

As indicated previously, it is envisaged that any approval of the proposed development would include a condition of consent requiring an FTP to be prepared to promote sustainable travel. This FTP would be prepared to mainly target office workers (and to a lesser extent visitors) of the proposed development. This section provides a framework for the implementation of such a travel plan, noting that the full FTP document will be provided at a later stage.

7.2 Framework Travel Plan (FTP)

The transport sector is a large contributor of Australia's energy-related greenhouse gas emissions through fossil fuels such as petrol, oil, diesel and gas. Whilst transport is a necessary part of life, the effects can be managed through the implementation of a travel plan.

An FTP is a package of coordinated strategies and measures to promote and encourage sustainable travel, such as walking, cycling and public transport etc. Such plans aim to influence the way people move to/from a business, residential complex or any other organisation to deliver better environmental outcomes and provide a range of travel choices, whilst also reducing the reliance on private car usage, particularly single occupancy car trips.

The planning of the new development would need to accommodate innovative ideas to better manage the transport demand of the project. It will be necessary to introduce new measures to ensure that trips generated by the proposed development are not solely private car based, particularly single occupancy trips.

7.3 Potential Measures

The subject site is located within 400m of Wynyard and Circular Quay railway station as well as future metro stations, servicing high frequency rail services. The FTP would put in place measures to encourage a modal shift away from car usage.

Notably, TTPP staff have been involved in a number of green travel plans (much like FTPs) for an array of different land uses, including sites at the Australia Technology Park, UTS and Harold Park in Sydney.

At these sites, the following measures are provided:

- compliance with the stringent parking controls applicable to the site
- creation of street networks and associated cycle ways, footpaths and links to encourage cycling and walking
- provision of a Transport Access Guide (TAG) which would be given to all residents, staff and visitors
- provision of public transport noticeboards to make residents, staff and visitors more aware of the alternative transport options available to them. The format would be based upon the TAG
- provision of yearly membership to a GoOccasional car share which would have dedicated cars and dedicated parking spaces reasonably close to the proposed development
- provision of Opal cards (pre-loaded with credits) for the initial occupation of the development so that staff and residents will be encouraged to make public transport their modal choice from the day they occupy the property
- provision of bicycle facilities including bicycle parking for residents, staff and visitors, bicycle racks for visitors and shower and change room facilities
- more advanced and convenient end of trip facilities
- provision of a half yearly newsletter to staff, residents and visitors to promote local travel initiatives
- connect staff working at the site to carpool together by creating a Carpooling club or registry/forum on the company website.

Much like these sites, the proposed development would benefit greatly from the implementation of the above measures to promote the use of more sustainable modes of travel, pertinently public transport, car-share, walking and cycling.

7.4 Monitoring of the FTP

Whilst there is no standard methodology for monitoring an FTP, it is recommended that the FTP be monitored on a regular basis to ensure that the desired benefits are achieved or otherwise, suitable measures be implemented to reduce the private car usage (particularly single car occupancy trips). At this early stage, it is not possible to identify what additional modifications may be required to reach the desired outcomes of the FTP as this would be dependent upon the particular circumstances at the time.

Thus, it is recommended that the FTP be monitored on a regularly basis, e.g. yearly, through travel surveys or similar. Travel surveys would show how staff/visitors travel to/from the site and assist identify whether the proposed initiatives and measures outlined in the FTP are effective or are required to be replaced or modified to ensure that the best outcomes are achieved. Regular consultation with staff and visitors would also be beneficial to help understand people's reasons for travelling the way they do and help identify any potential barriers to change their travel behaviours.

In order to ensure successful implementation of the FTP, a Travel Plan Coordinator (TPC) or the Building Manager should be appointed to oversee the measures and resultant impacts of the FTP.

7.5 Summary

Although it is difficult to predict what measures might be achievable until the building is occupied, the above paragraphs provide a framework for the development and implementation of a future travel plan for the site.

On the basis of all such measures being fully incorporated into the development, it is anticipated that the subject site would generate significantly less traffic than other mixed-use development sites in the vicinity. Subsequently, this would have the positive effect in reducing the traffic impact associated with the proposed development on the surrounding road network.

8 Conclusion

TTPP has been commissioned by Dexus to assess the traffic and transport effects of the planning proposal for the Pitt Street and Bridge Street tower. Dexus Office Trust Australia (DOTA) is the owner of the properties at 56 Pitt, 58 Pitt, 60 Pitt and 3 Spring Street, which are four existing and separate office buildings located in the Sydney CBD. The proposal seeks to amalgamate the existing site to develop a circa 90,000m² GFA of office tower. The consolidated site area is approximately 3,288m².

The existing site is occupied by high density commercial offices with a gross floor area of 32,000 m² and 82 car spaces shared between the existing basement car parks.

The existing site is estimated to generate 66 car trips in the morning and evening peak hours based on 80% of the current car spaces generating trips in the peak.

The proposal would reduce the number of car spaces provided on site to 16 car spaces.

The findings of the study were:

- The site is centrally located for access to public transport with easy and convenient access to heavy rail, light rail, buses and ferries (which are all within walking distance).
- Future Sydney Metro would be within 400m of the site and provide additional public transport capacity.
- The project is likely to generate less vehicular traffic (ie in the order of 45 vehicles per hour) than the existing developments
- Access to the site will be from Pitt Street.
- A pedestrian study was undertaken by Ason Group. The study found that that the pedestrian footpaths would operate at Level of Service B or better.

The proposal would provide an overall benefit to the area by:

- Reducing the amount of car parking and therefore reducing the private vehicle demand in the CBD.
- Providing additional pedestrian areas and improving pedestrian amenity.
- Introducing a neighbourhood loading dock with six (6) spaces for public use.

Appendix A

Traffic surveys

Intersection of Bridge Street and Gresham Street, Sydne

GPS -33.86355344295901,151.209490264008

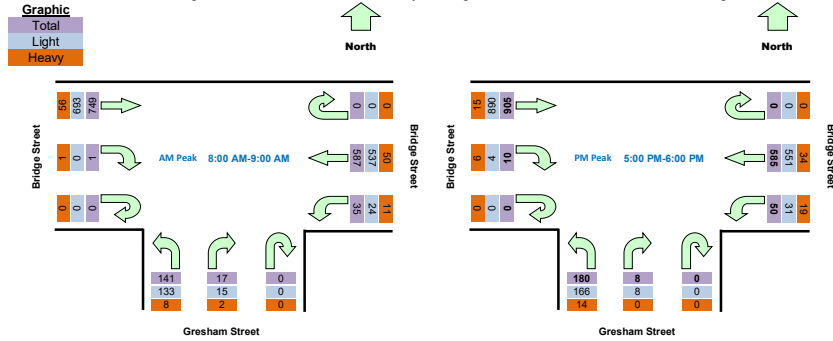
Date: Wed 05/02/20	North: N/A
Weather: Overcast	East: Bridge Street
Suburban: Sydney	South: Gresham Street
Customer: TTPP	West: Bridge Street

Survey	AM: 7:00 AM-9:00 AM
Period	PM: 4:00 PM-6:00 PM
Traffic	AM: 8:00 AM-9:00 AM
Peak	PM: 5:00 PM-6:00 PM

Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street			Hourly Total	
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
7:00	7:15	0	88	7	0	4	32	0	1	125	1241	
7:15	7:30	0	124	8	0	3	25	0	5	148	1344	
7:30	7:45	0	116	2	0	1	34	0	0	147	1423	
7:45	8:00	0	154	4	0	1	32	0	1	179	1520	
8:00	8:15	0	149	8	0	8	32	0	0	163	1530	Peak
8:15	8:30	0	149	7	0	4	30	0	0	202		
8:30	8:45	0	152	5	0	3	38	0	0	199		
8:45	9:00	0	137	15	0	2	41	0	1	185		
16:00	16:15	0	100	6	0	0	34	0	2	146	1250	
16:15	16:30	0	107	4	0	3	35	0	1	163	1364	
16:30	16:45	0	107	8	0	3	37	0	0	155	1486	
16:45	17:00	0	114	4	0	6	36	0	1	178	1636	
17:00	17:15	0	127	16	0	3	50	0	1	205	1738	Peak
17:15	17:30	0	155	10	0	2	41	0	5	222		
17:30	17:45	0	164	17	0	2	38	0	2	237		
17:45	18:00	0	139	7	0	1	51	0	2	241		

Peak Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street			Peak total
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Peak total
8:00	9:00	0	587	35	0	17	141	0	1	749	1530
17:00	18:00	0	585	50	0	8	180	0	10	905	1738

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.



Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
7:00	7:15	0	82	6	0	3	29	0	0	113
7:15	7:30	0	108	5	0	3	23	0	5	136
7:30	7:45	0	100	1	0	1	30	0	0	133
7:45	8:00	0	141	2	0	1	30	0	1	166
8:00	8:15	0	138	5	0	6	31	0	0	147
8:15	8:30	0	136	3	0	4	27	0	0	190
8:30	8:45	0	136	4	0	3	36	0	0	181
8:45	9:00	0	127	12	0	2	39	0	0	175
16:00	16:15	0	93	3	0	0	32	0	1	143
16:15	16:30	0	97	2	0	3	29	0	1	161
16:30	16:45	0	100	2	0	3	33	0	0	147
16:45	17:00	0	112	2	0	4	30	0	1	171
17:00	17:15	0	121	9	0	3	46	0	1	202
17:15	17:30	0	144	7	0	2	39	0	2	221
17:30	17:45	0	157	12	0	2	34	0	0	230
17:45	18:00	0	129	3	0	1	47	0	1	237

Peak Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street			Peak total
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Peak total
8:00	9:00	0	537	24	0	15	133	0	0	693	1402
17:00	18:00	0	551	31	0	8	166	0	4	890	1650

Heavy Vehicles

Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
7:00	7:15	0	4	0	0	0	1	0	0	12
7:15	7:30	0	8	1	0	0	1	0	0	10
7:30	7:45	0	9	0	0	0	2	0	0	13
7:45	8:00	0	4	1	0	0	0	0	0	11
8:00	8:15	0	4	0	0	2	0	0	0	15
8:15	8:30	0	3	0	0	0	1	0	0	9
8:30	8:45	0	5	0	0	0	1	0	0	13
8:45	9:00	0	4	2	0	0	0	0	0	9
16:00	16:15	0	4	0	0	0	1	0	0	1
16:15	16:30	0	2	0	0	0	2	0	0	2
16:30	16:45	0	0	0	0	0	0	0	0	4
16:45	17:00	0	0	0	0	1	1	0	0	4
17:00	17:15	0	1	1	0	0	0	0	0	2
17:15	17:30	0	2	0	0	0	0	0	0	1
17:30	17:45	0	0	0	0	0	0	0	0	3
17:45	18:00	0	1	0	0	0	0	0	0	1

Peak Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street			Peak total
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	
8:00	9:00	0	50	11	0	2	8	0	1	56	128
17:00	18:00	0	34	19	0	0	14	0	6	15	88

Bus

Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
7:00	7:15	0	2	1	0	1	2	0	1	0
7:15	7:30	0	8	2	0	0	1	0	0	2
7:30	7:45	0	7	1	0	0	2	0	0	1
7:45	8:00	0	9	1	0	0	2	0	0	2
8:00	8:15	0	7	3	0	0	1	0	0	1
8:15	8:30	0	10	4	0	0	2	0	0	3
8:30	8:45	0	11	1	0	0	1	0	0	5
8:45	9:00	0	6	1	0	0	2	0	1	1
16:00	16:15	0	3	3	0	0	1	0	1	2
16:15	16:30	0	8	2	0	0	4	0	0	0
16:30	16:45	0	7	6	0	0	4	0	0	4
16:45	17:00	0	2	2	0	1	5	0	0	3
17:00	17:15	0	5	6	0	0	4	0	0	1
17:15	17:30	0	9	3	0	0	2	0	3	0
17:30	17:45	0	7	5	0	0	4	0	2	4
17:45	18:00	0	9	4	0	0	4	0	1	3

Peak Time		East Approach Bridge Street			South Approach Gresham Street			West Approach Bridge Street			Peak total
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	
8:00	9:00	0	34	9	0	0	6	0	1	10	60
17:00	18:00	0	30	18	0	0	14	0	6	8	76

Intersection of Spring Street and Pitt Street, Sydney

GPS -33.8646509051644, 151.20876654108

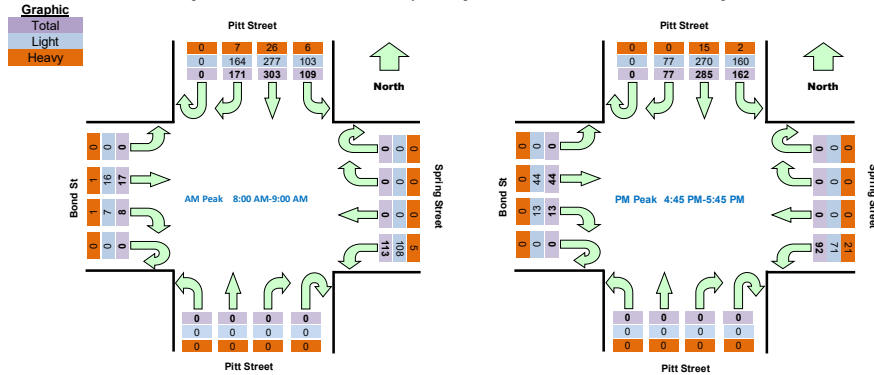
Date:	Wed 05/02/20	North:	Pitt Street
Weather:	Overcast	East:	Spring Street
Suburban:	Sydney	South:	Pitt Street
Customer:	TTPP	West:	Bond St

Survey Period	AM: 7:00 AM-9:00 AM
	PM: 4:00 PM-6:00 PM
Traffic Peak	AM: 8:00 AM-9:00 AM
	PM: 4:45 PM-5:45 PM

Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	40	62	14	0	0	0	20	0	0	0	0	0	2	1	0	611	
7:15	7:30	0	46	74	20	0	0	0	16	0	0	0	0	0	3	1	0	647	
7:30	7:45	0	47	62	18	0	0	0	22	0	0	0	0	0	4	2	0	645	
7:45	8:00	0	47	55	29	0	0	0	18	0	1	0	0	0	2	5	0	684	
8:00	8:15	0	43	75	30	0	0	0	23	0	0	0	0	0	0	4	0	721	Peak
8:15	8:30	0	42	62	18	0	0	0	30	0	0	0	0	0	3	3	0		
8:30	8:45	0	42	95	32	0	0	0	19	0	0	0	0	0	3	3	0		
8:45	9:00	0	44	71	29	0	0	0	41	0	0	0	0	0	2	7	0		
16:00	16:15	0	19	53	35	0	0	0	20	0	0	0	0	0	4	11	0	588	
16:15	16:30	0	20	39	40	0	0	0	14	0	0	0	0	0	4	12	0	618	
16:30	16:45	0	18	53	39	0	0	0	11	0	0	0	0	0	5	9	0	658	
16:45	17:00	0	20	80	45	0	0	0	23	0	0	0	0	0	3	11	0	673	Peak
17:00	17:15	0	27	71	44	0	0	0	15	0	0	0	0	0	6	9	0	643	
17:15	17:30	0	17	68	45	0	0	0	27	0	0	0	0	0	2	10	0		
17:30	17:45	0	13	66	28	0	0	0	27	0	0	0	0	0	2	14	0		
17:45	18:00	0	12	54	44	0	0	0	16	0	0	0	0	0	5	21	0		

Peak Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	171	303	109	0	0	0	113	0	0	0	0	0	8	17	0	721
16:45	17:45	0	77	285	162	0	0	0	92	0	0	0	0	0	13	44	0	673

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.



Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	39	54	10	0	0	0	19	0	0	0	0	0	1	1	0
7:15	7:30	0	44	64	16	0	0	0	13	0	0	0	0	0	3	1	0
7:30	7:45	0	44	55	17	0	0	0	21	0	0	0	0	0	2	1	0
7:45	8:00	0	46	52	26	0	0	0	15	0	0	0	0	0	1	5	0
8:00	8:15	0	40	68	30	0	0	0	21	0	0	0	0	0	0	4	0
8:15	8:30	0	40	60	16	0	0	0	29	0	0	0	0	0	3	3	0
8:30	8:45	0	41	89	29	0	0	0	19	0	0	0	0	0	2	3	0
8:45	9:00	0	43	60	28	0	0	0	39	0	0	0	0	0	2	6	0
16:00	16:15	0	17	50	35	0	0	0	20	0	0	0	0	0	4	11	0
16:15	16:30	0	17	35	40	0	0	0	14	0	0	0	0	0	4	12	0
16:30	16:45	0	17	49	38	0	0	0	9	0	0	0	0	0	5	9	0
16:45	17:00	0	20	74	45	0	0	0	17	0	0	0	0	0	3	11	0
17:00	17:15	0	27	68	43	0	0	0	10	0	0	0	0	0	6	9	0
17:15	17:30	0	17	65	44	0	0	0	22	0	0	0	0	0	2	10	0
17:30	17:45	0	13	63	28	0	0	0	22	0	0	0	0	0	2	14	0
17:45	18:00	0	11	48	43	0	0	0	13	0	0	0	0	0	5	20	0

Peak Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	164	277	103	0	0	0	108	0	0	0	0	0	7	16	0	675
16:45	17:45	0	77	270	160	0	0	0	71	0	0	0	0	0	13	44	0	635

Heavy Vehicles

Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	1	7	4	0	0	0	1	0	0	0	0	0	1	0	0
7:15	7:30	0	2	9	3	0	0	0	3	0	0	0	0	0	0	0	0
7:30	7:45	0	3	6	1	0	0	0	0	0	0	0	0	0	2	1	0
7:45	8:00	0	1	2	3	0	0	0	3	0	1	0	0	0	1	0	0
8:00	8:15	0	2	4	0	0	0	0	1	0	0	0	0	0	0	0	0
8:15	8:30	0	2	2	2	0	0	0	1	0	0	0	0	0	0	0	0
8:30	8:45	0	1	3	3	0	0	0	0	0	0	0	0	0	1	0	0
8:45	9:00	0	1	8	1	0	0	0	1	0	0	0	0	0	0	1	0
16:00	16:15	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	16:30	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
16:45	17:00	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
17:00	17:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Peak Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	7	26	6	0	0	0	5	0	0	0	0	0	1	1	0	46
16:45	17:45	0	0	15	2	0	0	0	21	0	0	0	0	0	0	0	0	38

Bus

Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
7:45	8:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0
16:00	16:15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	16:30	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	1	2	1	0	0	0	1	0	0	0	0	0	0	0	0
16:45	17:00	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
17:00	17:15	0	0	2	1	0	0	0	5	0	0	0	0	0	0	0	0
17:15	17:30	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
17:30	17:45	0	0	3	0	0	0	0	5	0	0	0	0	0	0	0	0
17:45	18:00	0	0	6	1	0	0	0	3	0	0	0	0	0	0	0	0

Peak Time		North Approach Pitt Street				East Approach Spring Street				South Approach Pitt Street				West Approach Bond St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	1	9	0	0	0	0	2	0	0	0	0	0	0	0	0	12
16:45	17:45	0	0	13	2	0	0	0	19	0	0	0	0	0	0	0	0	34

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au

Intersection of Bridge Street and Pitt Street, Sydney

GPS -33.8636118552574,151.2089611115774

Date:	Wed 05/02/20
Weather:	Overcast
Suburban:	Sydney
Customer:	TTPP

North:	Pitt Street
East:	Bridge Street
South:	Pitt Street
West:	Bridge Street

Survey Period	AM: 7:00 AM-9:00 AM
	PM: 4:00 PM-6:00 PM
Traffic Peak	AM: 8:00 AM-9:00 AM
	PM: 5:00 PM-6:00 PM

All Vehicles

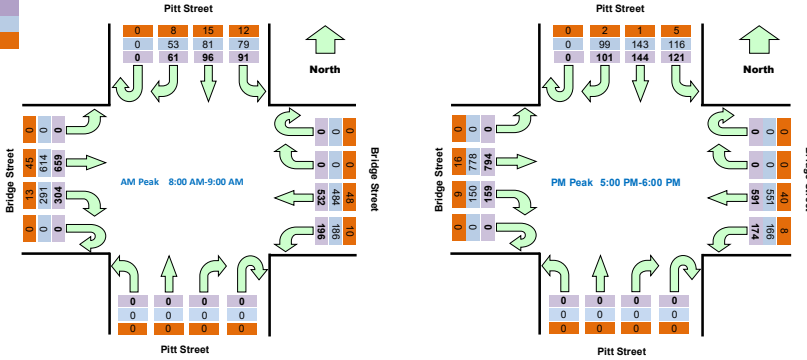
Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	11	18	16	0	0	86	34	0	0	0	0	0	0	66	110	0	1615
7:15	7:30	0	9	14	17	0	0	105	44	0	0	0	0	0	0	79	136	0	1730
7:30	7:45	0	20	25	21	0	0	114	36	0	0	0	0	0	0	69	126	0	1813
7:45	8:00	0	13	24	23	0	0	134	52	0	0	0	0	0	0	56	157	0	1924
8:00	8:15	0	20	18	22	0	0	119	62	0	0	0	0	0	0	74	141	0	1939
8:15	8:30	0	15	21	21	0	0	145	34	0	0	0	0	0	0	70	181	0	
8:30	8:45	0	14	31	25	0	0	137	53	0	0	0	0	0	0	88	174	0	
8:45	9:00	0	12	26	23	0	0	131	47	0	0	0	0	0	0	72	163	0	
16:00	16:15	0	17	35	23	0	0	97	37	0	0	0	0	0	0	38	125	0	1620
16:15	16:30	0	30	21	13	0	0	116	26	0	0	0	0	0	0	48	151	0	1741
16:30	16:45	0	20	34	18	0	0	107	37	0	0	0	0	0	0	44	137	0	1871
16:45	17:00	0	24	40	24	0	0	103	47	0	0	0	0	0	0	53	155	0	2010
17:00	17:15	0	31	36	31	0	0	116	61	0	0	0	0	0	0	43	175	0	2084
17:15	17:30	0	21	41	25	0	0	161	35	0	0	0	0	0	0	50	202	0	
17:30	17:45	0	26	39	30	0	0	166	36	0	0	0	0	0	0	30	209	0	
17:45	18:00	0	23	28	35	0	0	148	42	0	0	0	0	0	0	36	208	0	

Peak Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	61	96	91	0	0	532	196	0	0	0	0	0	304	659	0	1939
17:00	18:00	0	101	144	121	0	0	591	174	0	0	0	0	0	159	794	0	2084

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

- Total
- Light
- Heavy



Light Vehicles

Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
7:00	7:15	0	11	11	13	0	0	78	33	0	0	0	0	0	0	60	100	0
7:15	7:30	0	7	9	13	0	0	93	38	0	0	0	0	0	0	73	128	0
7:30	7:45	0	18	19	16	0	0	97	33	0	0	0	0	0	0	68	117	0
7:45	8:00	0	11	23	20	0	0	121	50	0	0	0	0	0	0	54	147	0
8:00	8:15	0	18	14	17	0	0	110	59	0	0	0	0	0	0	70	130	0
8:15	8:30	0	12	18	21	0	0	130	33	0	0	0	0	0	0	68	169	0
8:30	8:45	0	12	28	21	0	0	122	50	0	0	0	0	0	0	85	160	0
8:45	9:00	0	11	21	20	0	0	122	44	0	0	0	0	0	0	68	155	0
16:00	16:15	0	17	35	22	0	0	92	33	0	0	0	0	0	0	36	122	0
16:15	16:30	0	30	20	13	0	0	103	23	0	0	0	0	0	0	46	149	0
16:30	16:45	0	20	33	15	0	0	98	35	0	0	0	0	0	0	42	132	0
16:45	17:00	0	24	39	23	0	0	98	44	0	0	0	0	0	0	50	149	0
17:00	17:15	0	30	36	31	0	0	107	60	0	0	0	0	0	0	41	172	0
17:15	17:30	0	21	40	24	0	0	150	33	0	0	0	0	0	0	49	199	0
17:30	17:45	0	25	39	26	0	0	157	34	0	0	0	0	0	0	29	204	0
17:45	18:00	0	23	28	35	0	0	137	39	0	0	0	0	0	0	31	203	0

Peak Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	53	81	79	0	0	484	186	0	0	0	0	0	291	614	0	1788
17:00	18:00	0	99	143	116	0	0	551	166	0	0	0	0	0	150	778	0	2003

Heavy Vehicles

Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	7	3	0	0	4	1	0	0	0	0	0	5	9	0
7:15	7:30	0	2	5	3	0	0	3	6	0	0	0	0	0	4	7	0
7:30	7:45	0	2	6	5	0	0	8	3	0	0	0	0	0	0	8	0
7:45	8:00	0	2	1	3	0	0	2	2	0	0	0	0	0	1	8	0
8:00	8:15	0	1	4	4	0	0	3	1	0	0	0	0	0	2	11	0
8:15	8:30	0	3	3	0	0	0	3	1	0	0	0	0	0	2	9	0
8:30	8:45	0	2	3	4	0	0	4	2	0	0	0	0	1	9	0	0
8:45	9:00	0	1	4	2	0	0	1	3	0	0	0	0	2	7	0	0
16:00	16:15	0	0	0	0	0	0	1	4	0	0	0	0	0	1	0	0
16:15	16:30	0	0	1	0	0	0	3	1	0	0	0	0	0	0	2	0
16:30	16:45	0	0	1	2	0	0	0	0	0	0	0	0	0	2	0	0
16:45	17:00	0	0	1	1	0	0	1	0	0	0	0	0	1	3	0	0
17:00	17:15	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0	0
17:15	17:30	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0
17:30	17:45	0	1	0	2	0	0	0	0	0	0	0	0	0	1	1	0
17:45	18:00	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0

Peak Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	8	15	12	0	0	48	10	0	0	0	0	0	13	45	0	151
17:00	18:00	0	2	1	5	0	0	40	8	0	0	0	0	0	9	16	0	81

Bus

Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	0	0	0	0	4	0	0	0	0	0	0	1	1	0
7:15	7:30	0	0	0	1	0	0	9	0	0	0	0	0	0	2	1	0
7:30	7:45	0	0	0	0	0	0	9	0	0	0	0	0	0	1	1	0
7:45	8:00	0	0	0	0	0	0	11	0	0	0	0	0	1	2	0	0
8:00	8:15	0	1	0	1	0	0	6	2	0	0	0	0	2	0	0	0
8:15	8:30	0	0	0	0	0	0	12	0	0	0	0	0	0	0	3	0
8:30	8:45	0	0	0	0	0	0	11	1	0	0	0	0	2	5	0	0
8:45	9:00	0	0	1	1	0	0	8	0	0	0	0	0	2	1	0	0
16:00	16:15	0	0	0	1	0	0	4	0	0	0	0	0	2	2	0	0
16:15	16:30	0	0	0	0	0	0	10	2	0	0	0	0	2	0	0	0
16:30	16:45	0	0	0	1	0	0	9	2	0	0	0	0	2	3	0	0
16:45	17:00	0	0	0	0	0	0	4	3	0	0	0	0	2	3	0	0
17:00	17:15	0	0	0	0	0	0	8	1	0	0	0	0	2	1	0	0
17:15	17:30	0	0	1	0	0	0	9	2	0	0	0	0	1	3	0	0
17:30	17:45	0	0	0	2	0	0	9	2	0	0	0	0	1	4	0	0
17:45	18:00	0	0	0	0	0	0	10	3	0	0	0	0	4	4	0	0

Peak Time		North Approach Pitt Street				East Approach Bridge Street				South Approach Pitt Street				West Approach Bridge Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	1	1	2	0	0	37	3	0	0	0	0	6	9	0	59	
17:00	18:00	0	0	1	2	0	0	36	8	0	0	0	0	8	12	0	67	

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au

Intersection of Bent Road and Gresham Street, Sydney

GPS -33.8641777304096, 151.209607492811

Date:	Wed 05/02/20	North:	Gresham Street
Weather:	Overcast	East:	Bent Road
Suburban:	Sydney	South:	South Access
Customer:	TTPP	West:	Spring Street

Survey Period	AM: 7:00 AM-9:00 AM PM: 4:00 PM-6:00 PM
Traffic Peak	AM: 8:00 AM-9:00 AM PM: 5:00 PM-6:00 PM

All Vehicles

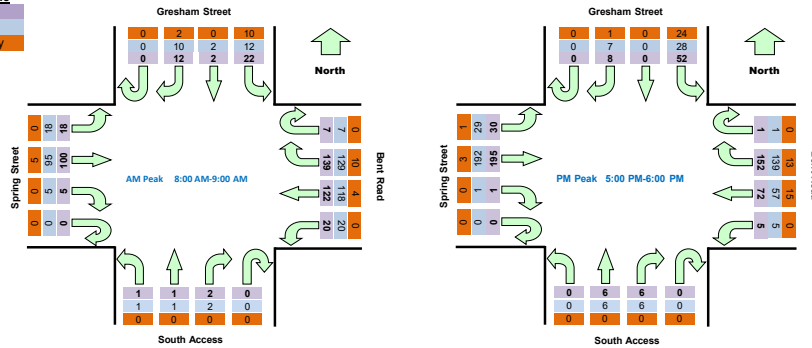
Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street				Hourly Total	Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	1	1	6	0	35	21	4	0	0	0	1	0	0	14	1	338	
7:15	7:30	0	1	2	10	0	24	19	2	0	0	0	1	0	2	14	4	356	
7:30	7:45	0	0	0	2	1	31	21	3	0	0	0	1	0	2	15	4	373	
7:45	8:00	0	2	0	3	1	30	18	1	0	1	0	2	0	2	32	3	404	
8:00	8:15	0	5	0	3	1	31	26	2	0	0	0	0	0	2	23	9	451	Peak
8:15	8:30	0	1	0	6	1	31	33	2	0	1	1	0	0	0	18	2		
8:30	8:45	0	0	1	4	3	37	21	9	0	0	0	1	0	1	30	4		
8:45	9:00	0	6	1	9	2	40	42	7	0	1	0	0	0	2	29	3		
16:00	16:15	0	1	1	6	2	26	21	2	0	2	2	0	0	0	47	6	447	
16:15	16:30	0	1	0	4	1	34	14	1	0	1	2	0	0	0	48	2	467	
16:30	16:45	1	1	0	6	0	30	12	1	0	1	1	0	0	0	39	8	495	
16:45	17:00	0	0	0	5	0	33	21	2	0	2	0	1	0	0	50	9	517	
17:00	17:15	0	1	0	16	1	42	15	1	0	1	2	0	0	1	47	9	528	Peak
17:15	17:30	0	2	0	13	0	38	21	1	0	3	2	0	0	0	53	3		
17:30	17:45	0	4	0	15	0	33	20	2	0	0	1	0	0	0	41	6		
17:45	18:00	0	1	0	8	0	39	16	1	0	2	1	0	0	0	54	12		

Peak Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Peak total
8:00	9:00	0	12	2	22	7	139	122	20	0	2	1	1	0	5	100	18	451
17:00	18:00	0	8	0	52	1	152	72	5	0	6	6	0	0	1	195	30	528

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	1	1	4	0	31	20	4	0	0	0	1	0	0	9	1
7:15	7:30	0	1	2	7	0	23	18	1	0	0	0	0	0	2	11	3
7:30	7:45	0	0	0	1	1	27	19	3	0	0	0	1	0	2	12	4
7:45	8:00	0	2	0	1	1	28	16	1	0	1	0	2	0	2	28	3
8:00	8:15	0	4	0	1	1	28	25	2	0	0	0	0	0	2	23	9
8:15	8:30	0	1	0	2	1	28	32	2	0	1	1	0	0	0	15	2
8:30	8:45	0	0	1	3	3	35	21	9	0	0	0	1	0	1	29	4
8:45	9:00	0	5	1	6	2	38	40	7	0	1	0	0	0	2	28	3
16:00	16:15	0	1	1	2	2	24	20	2	0	2	2	0	0	0	47	6
16:15	16:30	0	1	0	2	1	28	14	1	0	1	2	0	0	0	47	2
16:30	16:45	1	0	0	1	0	27	10	0	0	1	1	0	0	0	39	7
16:45	17:00	0	0	0	3	0	25	16	2	0	2	0	0	0	0	50	9
17:00	17:15	0	0	0	10	1	39	10	1	0	1	2	0	0	1	47	8
17:15	17:30	0	2	0	7	0	36	18	1	0	3	2	0	0	0	52	3
17:30	17:45	0	4	0	8	0	29	16	2	0	0	1	0	0	0	41	6
17:45	18:00	0	1	0	3	0	35	13	1	0	2	1	0	0	0	52	12

Peak Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Peak total
8:00	9:00	0	10	2	12	7	129	118	20	0	2	1	1	0	5	95	18	420
17:00	18:00	0	7	0	28	1	139	57	5	0	6	6	0	0	1	192	29	471

Heavy Vehicles

Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	0	0	0	1	1	0	0	0	0	0	0	0	5	0
7:15	7:30	0	0	0	1	0	0	1	1	0	0	0	1	0	0	2	1
7:30	7:45	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3	0
7:45	8:00	0	0	0	1	0	0	2	0	0	0	0	0	0	0	4	0
8:00	8:15	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	1	1	0	0	0	0	0	0	0	3	0
8:30	8:45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
8:45	9:00	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0
16:00	16:15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0
16:30	16:45	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0
17:00	17:15	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Peak Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	2	0	10	0	10	4	0	0	0	0	0	0	0	5	0	31
17:00	18:00	0	1	0	24	0	13	15	0	0	0	0	0	0	0	3	1	57

Bus

Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	0
7:30	7:45	0	0	0	1	0	2	1	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	4	0	2	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	2	0	2	1	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	4	0	1	1	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	1	0	5	0	3	1	0	0	0	0	0	0	0	0	1
16:45	17:00	0	0	0	2	0	6	4	0	0	0	0	0	0	0	0	0
17:00	17:15	0	1	0	5	0	3	5	0	0	0	0	0	0	0	0	1
17:15	17:30	0	0	0	6	0	2	3	0	0	0	0	0	0	0	1	0
17:30	17:45	0	0	0	7	0	4	4	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	5	0	4	3	0	0	0	0	0	0	0	1	0

Peak Time		North Approach Gresham Street				East Approach Bent Road				South Approach South Access				West Approach Spring Street				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	1	0	9	0	6	1	0	0	0	0	0	0	0	0	0	17
17:00	18:00	0	1	0	23	0	13	15	0	0	0	0	0	0	0	2	1	55

Appendix B

Pedestrian Modelling

Pedestrian Modelling Study

Pitt Street and Bridge Street
Commercial Precinct

THE TRANSPORT PLANNING PARTNERSHIP

Ref: 1238r02
13/03/2020

Document Control

Project No: 1238r02

Project: Pitt Street

Client: The Transport Planning Partnership

File Reference: p1238_Pitt_Street_Ped_Modelling_Report_R2_Draft Final.docx

Revision History

Revision	Date	Details	Author	Approved by
01	05/03/2020	Draft	Thaison Tran	Edmund Cheung
02	07/03/2020	Draft Final	Thaison Tran	Edmund Cheung

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Appendices

Appendix A:	Balanced Pedestrian Flows
Appendix B:	Classified-Intersection Count of Bridge Street and Pitt Street
Appendix C:	Origin-Destination Matrices
Appendix D:	Origin-Destination Model GEH

1 Introduction

1.1 Overview

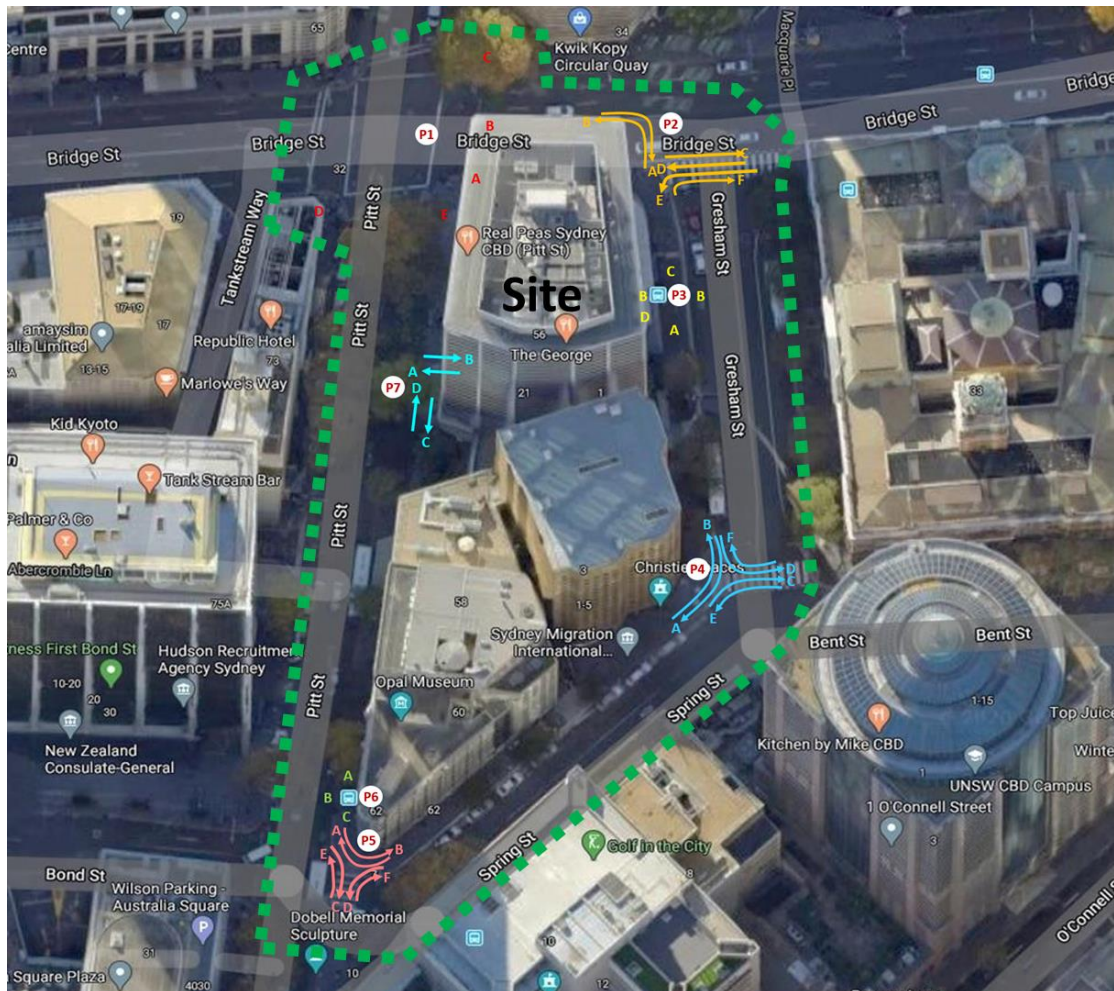
Dexus Office Trust Australia (DOTA) is the owner of the properties at 56 Pitt, 58 Pitt, 60 Pitt and 3 Spring Street, which are four existing and separate office buildings located in the Sydney CBD. The proposal seeks planning approval to amalgamate the existing site to develop a circa 120,000m² NLA of office tower. The consolidated site area is approximately 3,288m². Dexus will be preparing planning proposal seeking approval to amend the relevant planning controls application to the site to facilitate the above development options. On this basis, Dexus requires traffic engineering input during the concept stage and preparation of supporting documentation for the planning proposal.

This document presents the results of the capacity analysis undertaken to assess the operational performance of the current and proposed design in terms of Level of Service provided to pedestrian circulation on the block and adjacent streets. It should be noted that these metrics used for train station analysis will apply for on-street analysis as well.

1.2 Existing Site

The scope of the assessment for the study site is shown in **Figure 1.1**. The dynamic pedestrian modelling assessment have been undertaken using the AM (8am-9am) and PM (5pm-6pm) peak pedestrian volumes observed during a survey campaign conducted on 5th of February 2020 by Matrix Pty Ltd.

Figure 1.1 : 56 Pitt Street current aerial and area of scope

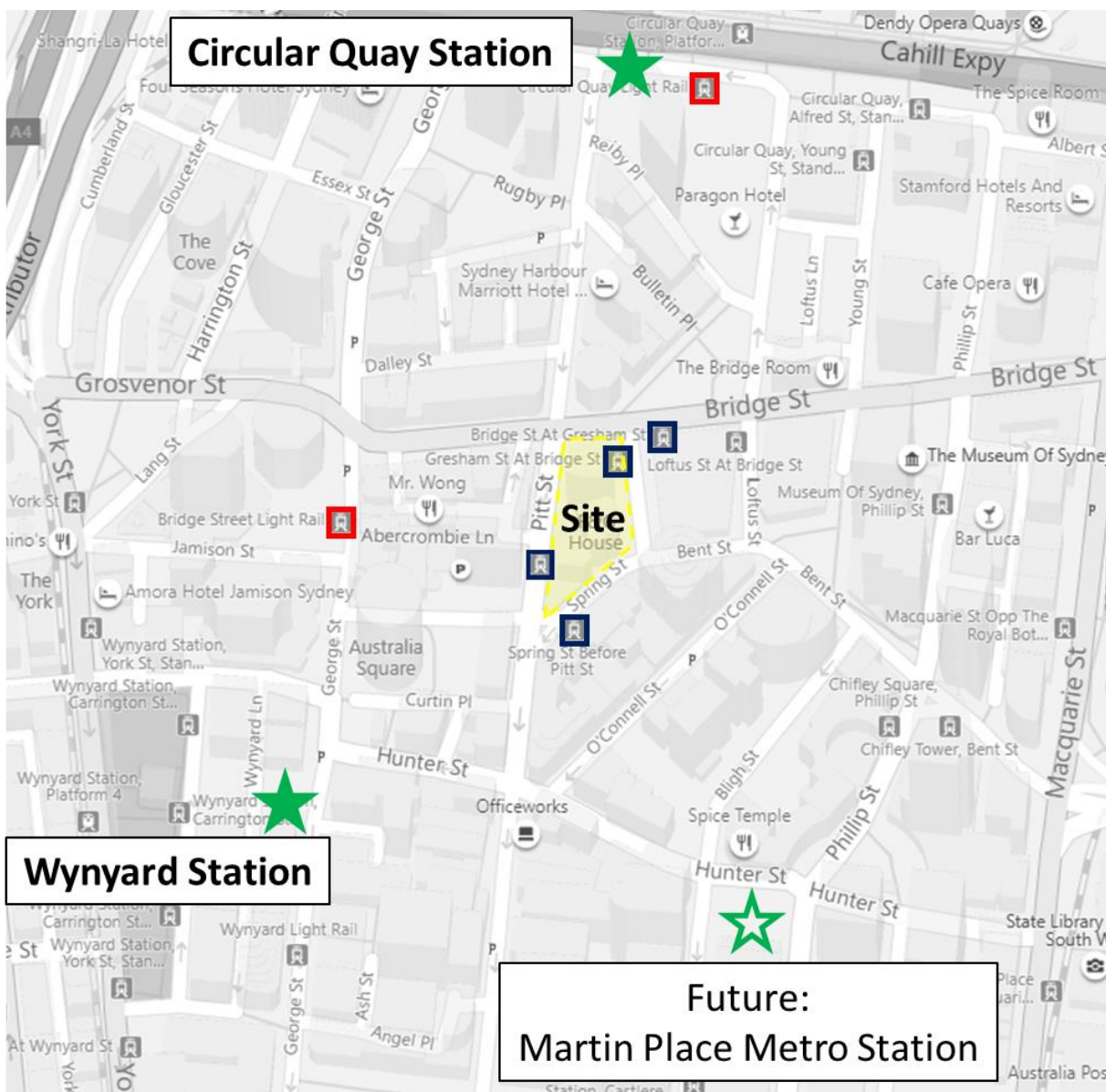


1.3 Public Transport

A summary of the public transport surrounding the site is presented in **Figure 1.2** below to show where the pedestrians come from and their likely travel mode.

- **North:** Circular Quay Station and Light Rail
- **South:** Wynyard station, residential apartments and some of the future Martin Place Metro Station
- **East:** Bridge Street Light Rail
- **West:** Bus users and some of the future Martin Place Metro Station

Figure 1.2 : Public Transport Locations – Red = Light Rail, Blue = Bus Stop, Green = Metro/ Train Station



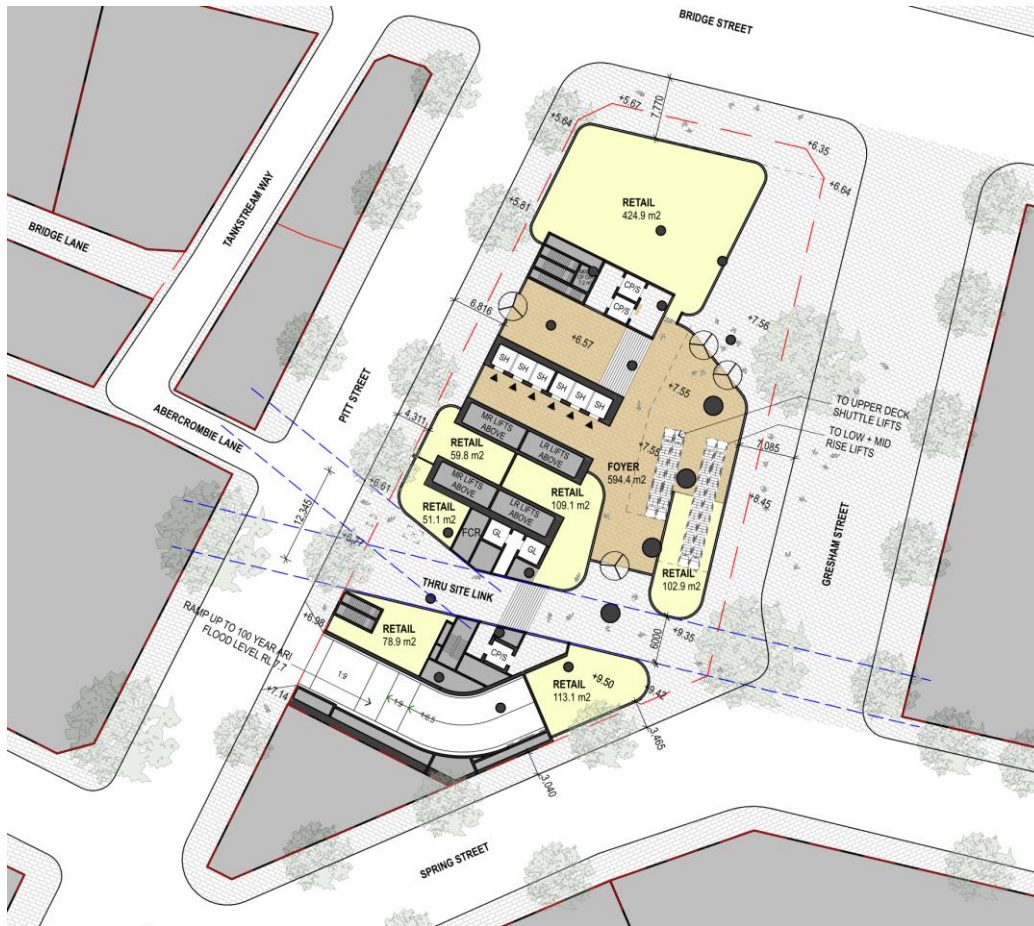
1.4 Proposed Design

The proposed design is a complete reconstruction of the existing site presented in **Figure 1.3** and the proposed building yields in **Table 1.1**.

Table 1.1 : Proposed building yields

Total Area (sqm) including podium	176,667 GBA (120,110 NLA)
Total Height (m)	309.3
Total Storey	75
Site Area	3,288

Figure 1.3 : Architectural drawing of the proposed design's ground floor and building access.



Source: SK-2.19.1 Ground Plane.pdf

2 Model Development

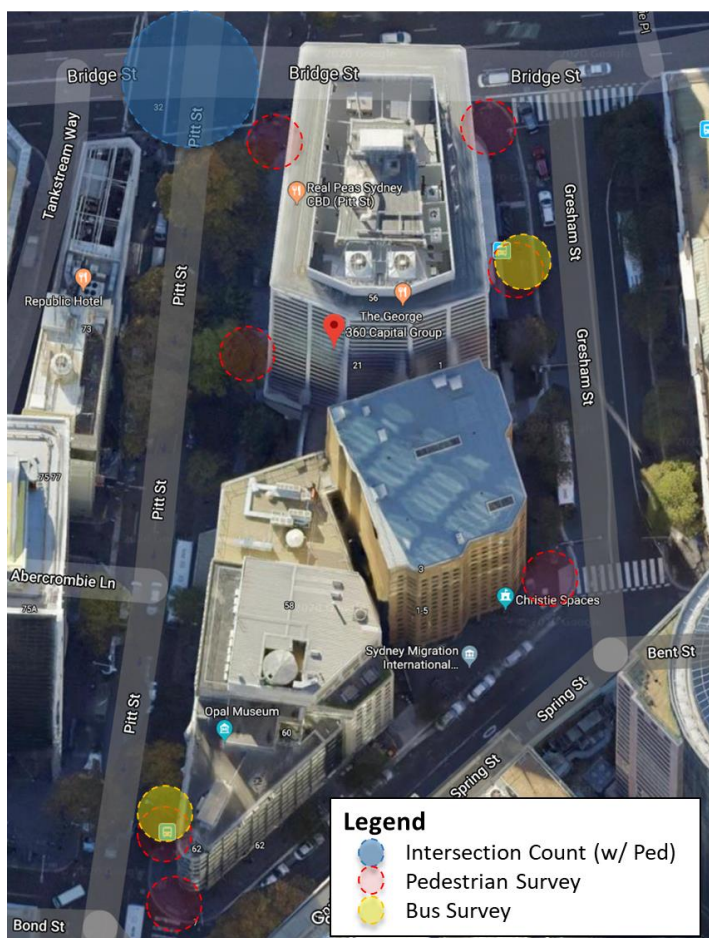
2.1 Survey Data

A pedestrian survey was undertaken to collect relevant pedestrian flows at the surrounding block of the 56 Pitt Street Building, location of survey is shown in **Figure 2.1**. This was conducted on the 7:30-9:30 AM and 4:30-6:30 PM periods on 5th of February 2020 to collect information regarding:

- The number of pedestrians performing corner turning movements and crossings;
- Midblock count for local store users mid-block crossing analysis;
- The number of pedestrians entering and exiting the main 56 Pitt Street Building;
- Bus boarding and alighting numbers as well as arrival and departure time;
- Current signal timings at the existing pedestrian crossings;
- Traffic volumes for Bridge and Pitt Street to study mid-block crossing behaviours.

A full comprehensive pedestrian traffic flow figures for AM and PM peaks are located in **Appendix A**.

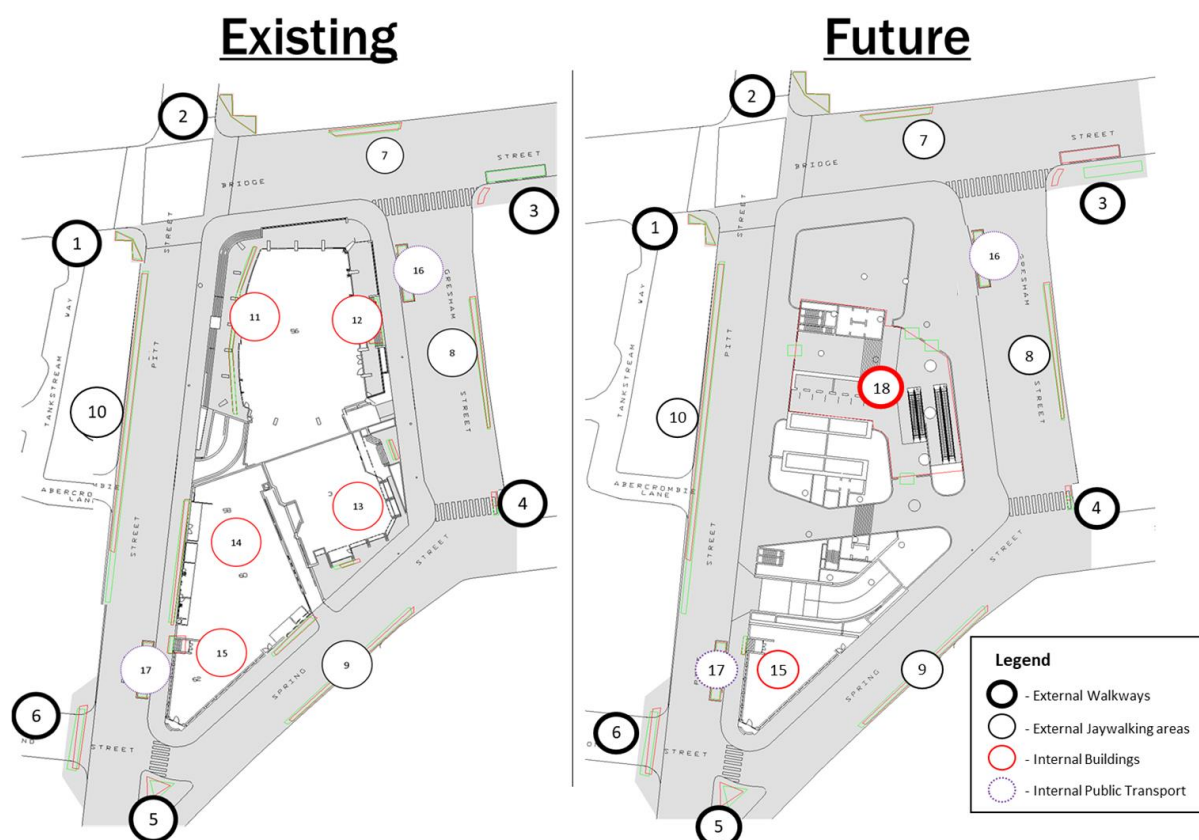
Figure 2.1 : Locations of pedestrian, bus and traffic survey



2.2 Origin-Destination matrix

An hourly OD matrix was created with centroids representing pedestrian crossings, buildings, bus arrivals and mid-blocking crossing locations as shown in the **Figure 2.2**.

Figure 2.2 : Centroids in base and future scenarios



The centroids groups are summarised below:

- External Streets: 1 to 6;
- Mid-block Crossings: 7 to 10;
- Existing Building: 11 to 15;
- Public Transport: 16 and 17; and
- New Building: 18.

The base model has 17 centroids. The future model replaces the building centroids except building 62 i.e. (centroids 11 to 14) and with centroid 18 thus having 14 centroids. Internal movements such as between the 56 building and the GG expresso café are represented internally in centroid 11.

Compared to 1-dimension road-links in transport modelling, pedestrian modelling operates in a 2-dimensional accessible area allowing cross-lateral flows and congestion. As a result, Legion centroids are area-based instead of points.

2.3 Bus Services

The timetable information was acquired from TfNSW for bus stop 1 (Gresham Street at Bridge Street, Stop ID: 2000150) and bus stop 2 (Pitt Street opposite to Australia Square, Stop ID: 200076).

- During the AM peak, there is a frequency of 6 buses for bus stop 1 and 8 buses for bus stop 2; and
- During the PM peak, there is a frequency of 14 buses for bus stop 1 and 14 buses for bus stop 2.

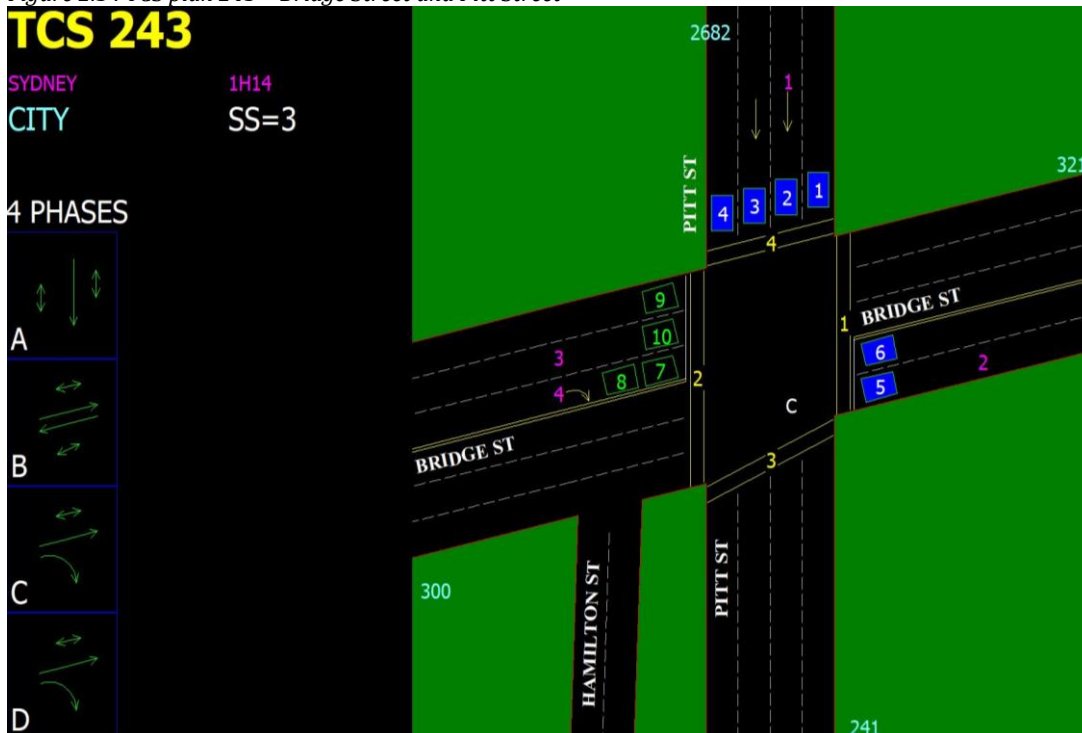
2.4 Pedestrian Crossing time

The intersection at Pitt Street and Bridge Street (TCS 0243) is not a scrambled pedestrian crossing. Bridge Street is an east-west main road and Pitt Street is a low-volume one-way south road. The traffic signal plan is shown **Figure 2.3**.

In the AM peak, the cycle time is 110 seconds with 28 seconds of green time for Bridge Street crossing (A Phase) and 45 seconds of green time for Pitt Street crossing (B Phase).

In the PM peak, the cycle time is 120 seconds with 30 seconds of green time for Bridge Street crossing (A Phase) and 46 seconds of green time for Pitt Street crossing (B Phase).

Figure 2.3 : TCS plan 243 – Bridge Street and Pitt Street



2.5 Mid-block crossing behaviours

2.5.1 Volumes

Mid-block crossing volumes are undetected missing mid-block link counts that are not from the building's generated person-trip in between survey locations. Mid-block crossing favour low traffic and/or low speed sections of road i.e. Pitt Street. The intersection count leading to the Pitt Street approach is located in **Appendix B**. It was observed that majority of Mid-block crossings occur at Bond Street and Pitt Street intersection to and from the Wynyard Train Station.

2.5.2 Patterns

The mid-block crossing 15-minute volume time profiles had to calculated to correspond to the closest main external walkways. E.g. Centroid 7 15-profiles is similar to the centroid 2 as shown in **Table 2.4**.

Additionally, most mid-block crossing occurs across Pitt Street due to the low traffic volume that occur in phase B, C, D. It was observed from the Classified Intersection Count that right turns into Pitt Street are 0. As a result, mid-block crossing occurs majority of the signal time except during the through movement of Phase A and a small volume for Phase B due to the low speed traffic.

2.6 Persons with Restricted Mobility (PRM)

2.6.1 Types

Legion's Best Practice guide by Transport for London has categorised five different class of entities with different speeds and size for modelling purposes. These types are defined in **Table 2.1** below.

Table 2.1 : PRM Types & Route Preference

Entity Type	Description	Example accompanying items	Routing Preference
N	Non-PRM	Handbags, backpacks, umbrella laptop case, pocket dogs, single shopping bags	No particular preference
A	Wheelchair users	Wheelchairs	Always WAG and lifts. Cannot use stairs or escalators
B	Pedestrians with permanent or temporary physical mobility impairments	Walking sticks, guide dogs	Preferably lifts, then escalators & stairs
C	Non-disabled pedestrians with heavy luggage	Rucksacks, sports bag, tennis racket bags, multiple shopping bags, toolbox, wheelie case (flight cabin luggage), fold bikes, fishing rods, golf bag, guitar case, dogs on paws	Use WAG and lift if busy or if they cannot get pass normal gates
D	Non-disabled pedestrians with large luggage	Cello case, all suitcases and large bags (including wheelie cases that are bigger than flight cabin luggage), full-size bikes, flat pack packages	Prefers WAG and lifts. Can use stairs and escalators
E	Adults with young children (including with pushchairs)	Young children, pushchairs	Prefers WAG and lifts. Can use stairs and escalators

2.6.2 Composition

A number of Persons with Restricted Mobility (PRM) were observed entering and exiting the station during the survey. The observed composition of PRMs was considered in the dynamic modelling is provided in **Table 2.2**.

Table 2.2 : PRM composition

PRM Composition	N	PRM A	PRM B	PRM C	PRM D	PRM E
Luggage size	None	Large	Small	Medium	Large	Large
	97.75%	0.00%	0.21%	1.46%	0.54%	0.04%

2.6.3 Speed distribution

The speed distribution considered for each PRM typology in the simulations was based on LU Station modelling with Legion - Best Practice Guide, Issued v2 on 3 July 2009 and is presented in **Table 2.3**. These numbers are significant for areas for burst movements of large groups such as signalled pedestrian crossings where platoons' tails create lower densities. Please note, Entity N's standard deviation may vary based on mobile phone users, age, gender, geographic inclination and other demographics, however the legion default 0.17m/s was adopted for this study.

Table 2.3 : PRM composition

Entity Grouping	Luggage settings	Mean speed	Speed distribution	Standard Deviation
N	No luggage	1.53m/s	normal distribution	0.17m/s
A	Large luggage	0.58m/s	fixed	N/A
B	Small luggage	0.80m/s	fixed	N/A
C	Medium luggage	1.53m/s	normal distribution	0.14m/s
D	Large luggage	1.32m/s	normal distribution	0.14m/s
E	Large luggage	1.37m/s	normal distribution	0.14m/s

Source: LU Station modelling with Legion - Best Practice Guide, Issued v2 on 3 July 2009

2.7 Profiles

The arrival profiles, as shown in **Table 2.4**, for each centroid are proportioned based on the survey counts. The numbers below are percentages of the peak hour flow. This allows internal variations between different centroid dominated by different modes and their distances to the business start and end times as mentioned in **Section 1.3**.

Table 2.4 : 15-minute profiles

Centroid	AM					PM				
	7:45	8:00	8:15	8:30	8:45	16:45	17:00	17:15	17:30	17:45
1	13%	18%	31%	30%	21%	18%	24%	17%	30%	29%
2	15%	17%	26%	25%	31%	22%	26%	27%	27%	21%
3	16%	23%	28%	30%	19%	22%	30%	18%	38%	14%
4	17%	15%	25%	36%	24%	16%	29%	25%	23%	23%

5	18%	19%	27%	24%	31%	19%	24%	23%	27%	25%
6	18%	19%	27%	24%	31%	19%	24%	23%	27%	25%
7	15%	17%	26%	25%	31%	22%	26%	27%	27%	21%
8	17%	15%	25%	36%	24%	16%	29%	25%	23%	23%
9	16%	17%	26%	29%	28%	19%	28%	26%	25%	22%
10	15%	17%	26%	25%	31%	22%	26%	27%	27%	21%
11	24%	17%	19%	29%	34%	31%	25%	24%	33%	18%
12	24%	24%	19%	24%	33%	33%	33%	17%	17%	33%
13	17%	15%	25%	36%	24%	16%	29%	25%	23%	23%
14	18%	19%	27%	24%	31%	19%	24%	23%	27%	25%
15	18%	19%	27%	24%	31%	19%	24%	23%	27%	25%
Average:	17%	18%	26%	28%	28%	21%	27%	23%	27%	23%

The 15-minute peak flow occurs at 8:45am in the AM peak and 5:00pm and 5:30pm in the PM peak.

2.8 Pedestrian Accessibility

The modelled available pedestrian movements area is shown as grey areas in **Figure 2.2**. The modelled area does not include movements inside the buildings.

2.9 Person-Trip Rates

A geographically weighted person-trip rate of the site was determined using the counts entering and leaving 56 Pitt Street main entrance for both AM and PM. 50% of 'Outbound' movements from the building in the AM were people going to the nearby café and as a result a repeated 'Inbound' had to be deducted to prevent double counting the same people and platoons.

The person-trips were compared with office GFA instead of GLFA as this was metric from the RMS supporting document for person-trip conducted by GTA as seen below. 19,637 m² of GFA was compared against 292 IN and 43 OUT in the AM and 43 IN and 246 OUT in the PM. It was concluded that there were:

- AM Peak: 1.7 person-trips per 100m² of GFA (90% IN and 10% OUT)
- PM Peak: 1.45 person-trips per 100m² of GFA (20% IN and 80% OUT)

It was deemed these rates were acceptable as it was in an appropriate range compared to the rates **Table 2.5**. These rates are below average of the 10 locations conducted by GTA. This site is however, higher than the low rated areas such as North Sydney, Parramatta and Newcastle as it is in the Sydney CBD but lower than other major commercial-office CBD. The calculated AM rates remains higher than the PM rates similar to the study below.

Table 2.5 : GFA person-trip rates for office blocks – RMS supported documents

APPENDIX D3 – OFFICE BLOCKS – PERSON-BASED TRIP RATES

	OB1 North Sydney	OB2 Chatswood	OB3 Sydney Olympic Park	OB4 Hurstville	OB5 Macquarie Park	OB6 Parramatta	OB7 Liverpool	OB8 Norwest	OB9 Newcastle	OB10 Wollongong	Average
AM Peak Hour											
Trips	397	249	842	119	142	387	95	34	172	158	260
Trips/100m ² GFA	1.26	2.44	2.47	3.66	2.47	1.43	3.37	2.83	1.41	1.22	2.26
PM Peak Hour											
Trips	338	205	801	77	126	349	65	14	191	128	229
Trips/100m ² GFA	1.08	2.01	2.35	2.37	2.19	1.29	2.31	1.17	1.57	0.99	1.73
Daily											
Trips	2,975	1,691	-	802	1,079	5,114	700	142	2,213	1,074	1754
Trips/100m ² GFA	9.47	16.56	-	24.65	18.77	18.94	24.85	11.83	18.17	8.31	16.84
Road Network AM Peak Hour											
Trips	391	111	-	104	142	266	58	31	172	158	159
Trips/100m ² GFA	1.25	1.09	-	3.20	2.47	0.99	2.06	2.58	1.41	1.22	1.81
Road Network PM Peak Hour											
Trips	338	90	-	67	86	298	48	10	190	128	139
Trips/100m ² GFA	1.08	0.88	-	2.06	1.50	1.10	1.70	0.83	1.56	0.99	1.30

Source: Trip Generation and Parking Generation Surveys (Office Blocks), GTA Consultants for the NSW Roads and Traffic Authority, September 2010, p116

2.10 Person-Trip Generation

The future development will be 176,667m² GBA of office space and 1,679 m² of retail space with the reference in **Table 2.6**. Retail space was not modelled in the future due to the insignificant generation person-trips that would peak outside the model PM time.

Table 2.6 : Person-trip rates for shopping centres – RMS supported documents

APPENDIX F2 – SHOPPING CENTRES – PERSON TRIP RATES

Trips/100m ² GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Thursday										
Daily Person Trips	71.00	105.78	95.73	93.45	95.94	67.41	83.83	91.51	89.96	61.06
Peak Person Trips (per Hour)	6.65	9.96	8.50	8.70	8.29	7.58	8.89	9.81	8.40	5.51
Peak Network Hour Person Trips										
- AM Peak	2.75	3.05	3.97	5.63	4.38	2.13	3.11	5.81	5.92	2.59
- PM Peak	6.22	7.72	7.25	8.40	8.11	6.91	7.60	9.42	7.73	5.17
Friday										
Daily Person Trips	52.96	74.18	66.76	61.95	70.98	43.60	71.96	81.83	69.69	47.91
Peak Person Trips (per Hour)	6.47	9.93	8.94	8.81	9.53	5.72	8.68	10.42	8.78	5.39
Peak Network Hour Person Trips										
- AM Peak	2.58	3.49	3.39	4.50	3.52	2.02	3.25	6.53	3.62	2.35
- PM Peak	4.32	8.27	6.05	7.00	9.26	5.69	6.00	10.28	8.03	5.38
Saturday										
Daily Person Trips	67.75	93.11	77.39	69.01	80.97	69.92	83.35	92.28	86.43	55.01
Peak Person Trips (per Hour)	9.23	12.67	10.80	9.82	10.40	10.04	12.26	14.02	12.92	7.19
Peak Network Hour Person Trips	8.24	8.52	10.42	9.34	10.40	10.04	12.23	12.78	12.66	6.84
Sunday										
Daily Person Trips	54.88	84.27	61.68	48.95	63.71	65.34	67.77	73.86	47.76	46.26
Peak Person Trips (per Hour)	8.60	12.45	9.77	8.03	9.67	10.16	10.99	12.49	7.84	7.11
Peak Network Hour Person Trips	8.52	8.88	9.75	8.02	9.30	8.97	9.53	10.74	7.82	6.27

Source: Trip Generation and Parking Demand of Shopping Centres, Analysis Report, Halcrow for the NSW Roads and Traffic Authority, September 2011, p21

As a result, the person-trip generation for the new proposed development are summarised in **Table 2.7** below. It should be noted that the base scenario includes both retail and commercial users and the future scenario only includes commercial users. It was concluded that the future development has a net increase of over 300% in pedestrian volumes.

Table 2.7 : Person-trip generation for existing and future development

		Base	Future	% increase
AM	IN	666	2,703	306%
	OUT	247	300	21%
PM	IN	247	512	107%
	OUT	477	2,049	330%

2.11 Routing and Distribution

Pedestrian routes were based on the survey data. Unlike the iterative and convergent behaviour for vehicular trip assignment in transport modelling, pedestrians take the shortest path and not necessarily the fastest path.

Pedestrians take more direct routes even with congestion ahead and have very minimal path reassignment due to the high energy cost from larger route distances. This simplifies person-trip distribution and assignment.

Similar routes where the distances from a point A to point B is almost the same for two paths such as from centroid 6 to centroid 3 will be based on percentage distribution of the survey counts.

Additionally, the 2-dimensional accessible space allows cross lateral movements in pedestrian modelling compared to the 1-dimensional accessible link space in transport network modelling. The person-trip assignment and distribution remain unchanged in future for both background and the new proposed development.

2.12 Assumptions and Limitations

The assumptions above have led to several limitations in this model. These limitations are highlighted below:

- The model is dependent on a survey count conducted for 1 day thus a regression model for predicting the future can be mis-represented. This applies to:
 - The background volumes, profiles, distribution and assignments;
 - The building users and distribution; and
 - The proposed building trip generation. Despite the person-trip rates being geographically weighted to the site, it is not temporally weighted for the future and assuming to be the same in the future based on the performance of this current one day.
- Unable to predict bus changes as it is assumed to remain the same in future;

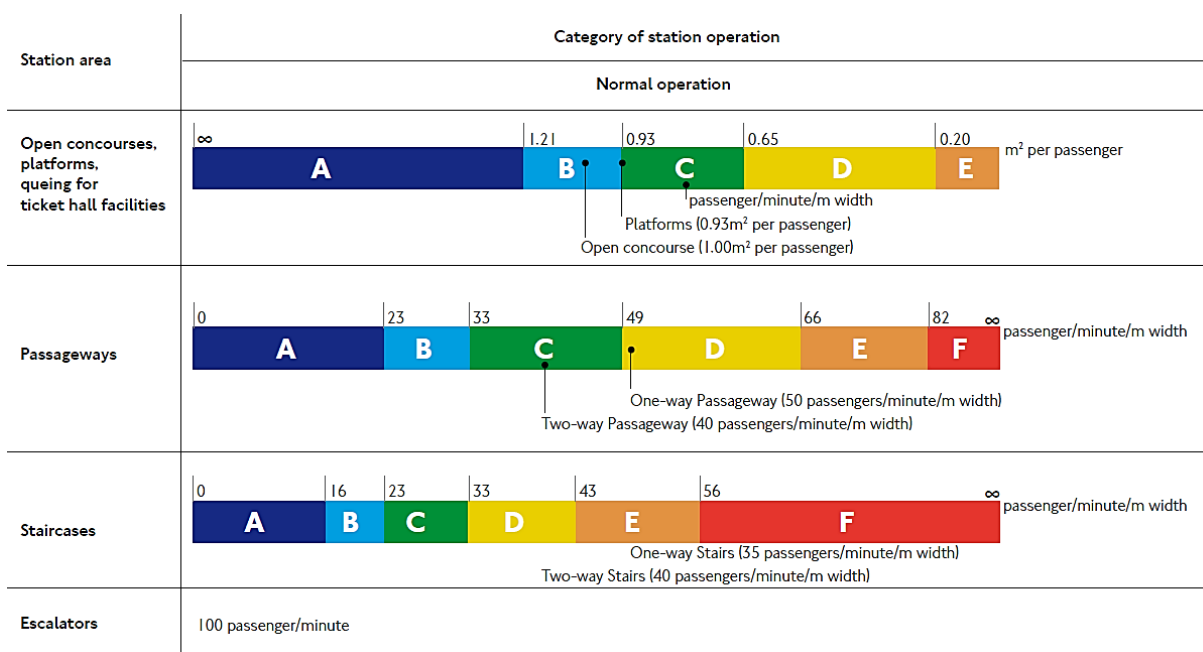
- The effects of the future Sydney Metro's Stations has been estimated based on a +15% growth in background pedestrian traffic;
- It is assumed that there will be minimal signal timing changes and/or new intersection configurations;
- Mid-block crossing volume is an assumption of 'Missing Link Flows' subtracted by the 'Building Person-Trip Generation' between two survey locations. In-reality, a lot can happen in between link counts:
 - People can wait between two survey locations and remain undetected;
 - Car drop-off and pick-ups;
 - Double counting of the same pedestrians due to retail or café stores. A pedestrian may enter the screen-line get a coffee and come back out the same and will be double counting;
 - Unknown passageway from the other side of the block; and
 - There is no-way of knowing unless through an accurate OD tracking. However, current technologies such as Bluetooth for nanoscopic modelling size remains very inaccurate.

3 Pedestrian Modelling Criteria

3.1 Fruin's Level of Service

The static analysis presented in this note is based upon London Underground Station Planning Standards and Guidelines (LU SPSPG), 2012 edition. It adopts the Fruin's pedestrian Level of Service (LoS) definitions detailed in **Figure 3.1** for assessing walkway, waiting area and stair capacity and applied to on-street analysis.

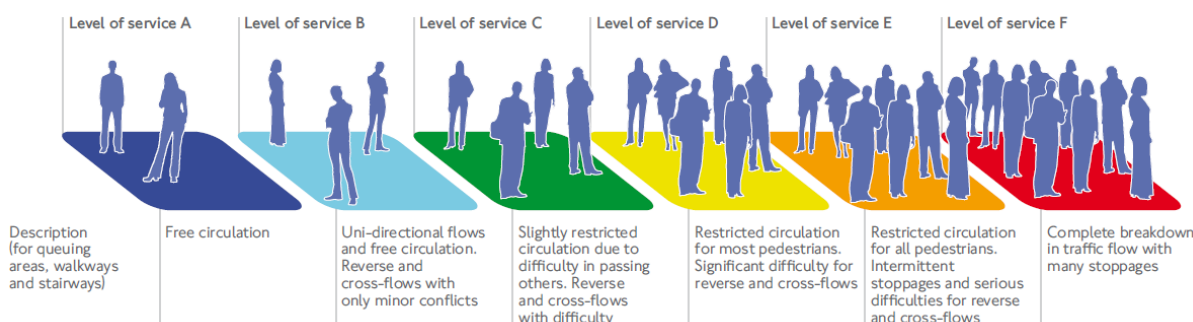
Figure 3.1 : Level of Service guidelines for station areas under normal operations



Source: London Underground Station Planning Standards and Guidelines (2012)

Figure 3.2 provides a brief description of the correlation between LoS and the quality of the pedestrian's space, as provided by London Underground.

Figure 3.2 – Level of Service Criteria



Source: Transport for London, London Underground Station planning standards and guidelines, 2012 p.10

3.2 Conditional Assessment

Table 3.1 shows the Levels of Service (LoS) and associated quantitative measures that LU SPSPG requires to be applied to the following categories of station operation in the station areas and on-street areas:

- Normal operation;
- Guidance for special events up to three days;
- Guidance for special events over three days; and
- Guidance for construction work.

The assessment presented in this note focuses on normal operation, as this is the most conservative scenario and provides the long-term requirements for station element sizing.

Table 3.1 : Planning criteria and Levels of Service (in bold the station areas relevant to this assessment)

Station area	Category of station operation							
	Normal operation		Guidance for special events up to three days		Guidance for special events over three days		Guidance for construction work	
	LoS	Quantitative measure	LoS	Quantitative measure	LoS	Quantitative measure	LoS	Quantitative measure
Open concourses	B	1.0m² per person	D	0.45m ² per person	C	0.8m ² per person	C	0.8m ² per person
Queuing for ticket hall facilities	C	0.8m² per person	E	0.28m ² per person	D	0.45m ² per person	D	0.45m ² per person
Passageways - one-way	D	50 pedestrians /minute/m width	E	80 pedestrians /minute/m width	D	65 pedestrians /minute/m width	D	65 pedestrians /minute/m width
Passageways - two-way	C	40 pedestrians /minute/m width	E	65 pedestrians /minute/m width	D	50 pedestrians /minute/m width	D	50 pedestrians /minute/m width
Stairs- one-way	D	35 pedestrians /minute/m width	E	43 pedestrians /minute/m width	E	43 pedestrians /minute/m width	E	43 pedestrians /minute/m width
Stairs- two-way	C	28 pedestrians /minute/m width	E	43 pedestrians /minute/m width	D	35 pedestrians /minute/m width	D	35 pedestrians /minute/m width
Escalators		100 pedestrians /minute		120 pedestrians /minute		110 pedestrians /minute		110 pedestrians /minute
Platforms	B/C	0.93 m ² per person	E	0.28 m ² per person	D	0.45 m ² per person	D	0.45 m ² per person

Source: London Underground Station Planning Standards and Guidelines (2012)

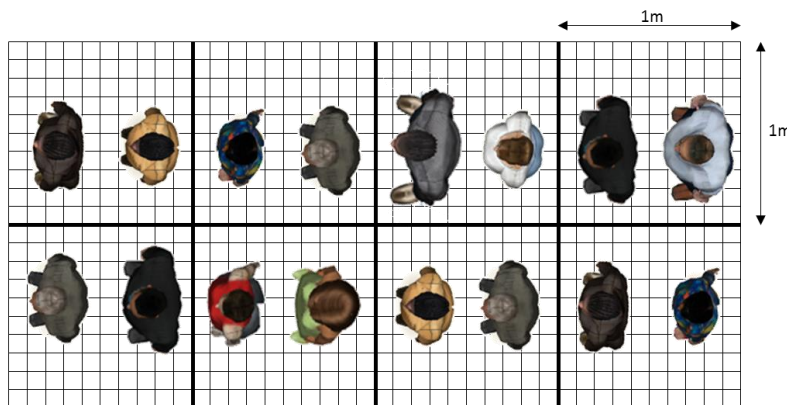
3.2.1 Acceptable Pedestrian Density in Queues

The analysis in this report are based upon normal operation. Pedestrian are able to tolerate a density of 2 people/m² in queue areas such as at pedestrian crossings and bus stops and 1 people/m² in dynamic areas such as pavement walkways.

Figure 3.3 provides a graphical representation of two average sized people standing in 1m². Such density is considered safe for large crowds and events (i.e. by the event safety guide¹ issued by the UK Health and Safety Executive) and is equivalent to Fruin’s Queuing LoS D.

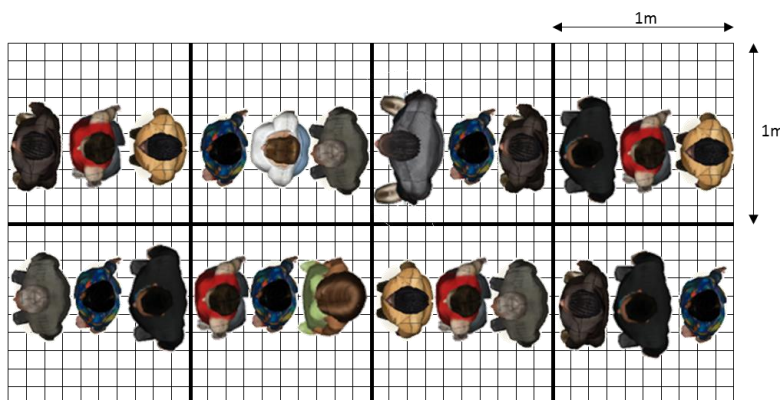
London Underground Station planning standards and guidelines (SPSG - 2012 edition) describes LoS D as a situation in which circulation is restricted for most pedestrians. The planning criteria and levels of service of the SPSG consider Fruin’s Queuing LoS D to be safe when queuing for ticket hall facilities, during construction work or under scheduled public transport.

Figure 3.3: Two people per square metre – graphical representation



In the event of degradation to service frequency, pedestrian densities up to 3 people/m² may be experienced due to accumulation of pedestrians at the bus stop seen in **Figure 3.4**. Densities of up to 3 people/m² or more may be acceptable for short periods, provided that crowd control measures are in place to guarantee the safety of customers and other pedestrians.

Figure 3.4: Three people per square metre – graphical representation



¹ <https://www.worldskillsuk.org/media/2894/event-safety-guide.pdf>

4 Modelling Methodology

Bentley's Legion (Connect v10.01) was used to undertake dynamic pedestrian modelling assessment of the proposed design. The Legion model:

- takes into account a realistic statistical distribution of the pedestrians' characteristics, in terms of size (e.g. taking into account pedestrians with luggage or mobility impairment), average speed and route preferences;
- takes into account furniture and other obstacles;
- simulates the pedestrian movements at signalised crossings and on footways or on the station's precinct;
- measures the densities and Level of Service occurring in the station as well as on the surrounding streets and at pedestrian crossings;
- produces Cumulative Density maps describing the Level of Service (LoS) in each part of the stops during relevant time intervals;
- produces Desire-line maps describing the building-users routing for the modelled time; and
- produces a volume count through the screen-lines for the modelled time.

The Legion model algorithm is an approximation of real-life people's behaviour and the algorithm may occasionally result in some unrealistic behaviours or anomalies. For this reason, the models have been calibrated and verified to ensure that any issue was corrected before the results could be finalised.

4.1 Legion

The methodology for building each Legion model is summarised below:

- The CAD layout presented in
- Figure 1.3 was "cleaned" by removing all non-essential items (i.e. all those which do not represent real obstacle to pedestrian circulation) and imported into Legion;
- A series of assumptions were incorporated in the model as described in detail in Section 2, relating to walking speeds, entity size, delay profiles (e.g. the time needed to pass through a gate);
- An Origin-Destination matrix was produced based upon the observations collected during the pedestrian survey to replicate the movements and circulation on the surrounding streets. This was created through finessing survey counts, and distributing missing link flows between observed/generated person trips from buildings and mid-block crossing volumes;
- A base Legion model was built by incorporating all Legion "Objects" and parameters necessary to simulate pedestrians' movements and behaviour during the simulations;
- Once the model had been built, calibration of the model was carried out to ensure realistic movements were replicated by the models' entities. This was done through optimizing the

GEH statistic (see **Section 5**) of the link flows and the direct routing of pedestrians from Origin to Destinations; and

- Following calibration of the model, simulations covering the peak 1-hour (+15 minutes warmup and cooling period) were completed simulating two additional scenarios and results extracted, as reported in Section 5.

4.2 Scenarios Assessed

Three demand scenarios were tested as follow:

- **Base model** (AM and PM): Existing development + Existing background;
- **Future Scenario 1** (AM and PM): Proposed development + Existing background; and
- **Future Scenario 2** (AM and PM): Proposed development + Existing background + 15%.

4.3 Scenario Demand Development

The modelling demand development for each scenario is described below. The demand matrix can be found in **Appendix C**. Orange represents External Walkways, yellow represents mid-block crossing locations, green represents buildings and blue represents bus-users.

4.3.1 Base Scenario

The base matrix was developed by finessing the survey counts. Each centroid traversed through the model by percentage split at each other survey location. This however was overwritten if the percentage split became illogical such as u-turning back to their locations or non-direct paths to the final centroids.

4.3.2 Future Scenario 1

The building users in the base-scenario (except for 62 Pitt Street) were replaced by the Person-Trip generated from the proposed building summarised in Section 2.11. The replaced old-building numbers (centroids 11a, 11b, 11c, 11d, 12, 13, 14) in the AM peak were 2703 IN and 300 OUT and in the PM peak 512 IN and 2049 OUT for the new centroid 18. The route assignment and percentage distribution to and from other centroids were kept the same as the base model matrix. There were no background movement changes.

4.3.3 Future Scenario 2

The Future Scenario 2 modified the Future Scenario 1 matrix by increasing the background movements by +15%. This included all external walkway movements, mid-block crossing volumes, public transport users that did NOT interact with buildings (Non-green values in **Appendix C**). Additionally, users of the 62 Pitt Street building remain unchanged throughout all scenarios.

4.4 Outputs

The main output from the Legion simulation models are density maps, spatial maps superimposed on the model layout indicating the levels of pedestrian density experienced in the various areas of the station. These maps provide an indication of the status of congestion by using a colour coded scale. The following density maps have been extracted from the modelling output over the peak 15-minute period, to verify the criteria set out in **Table 3.1**. The outputs from these models are:

- Cumulative Mean Density (CMD) maps for the peak 15-minute period. These maps illustrate the density level, for every time step, averaged by location and presented in relation to:
 - Fruin's Walkways Level of Service (LOS) to assess footpaths and open passageways;
 - Fruin's Queuing Level of Service (LOS) used to assess queuing areas and pedestrian crossing reservoir spaces;
- Development's desire-lines for the peak 15-minute period. These maps illustrate the routing of building users (before and after) to assess the efficiency of the new accessibility and how it affects the surrounding background capacity; and
- Pedestrian volumes for the surrounding pavements for the 1-hr period in all scenarios. The volumes are a summary of flow through a screen-line.

5 Calibration and Validation

The following section presents the finding of the calibration process and validation results, including statistics from the model comparing the observed traffic volumes to the modelled traffic volumes.

5.1 Calibration Targets

Traffic modelling GEH statistics is useful for comparing observed pedestrian volumes to modelled pedestrian volumes because it does not emphasise large percentage differences of low volumes and thus does not affect the operation of a footpath but only sensitive to higher differences.

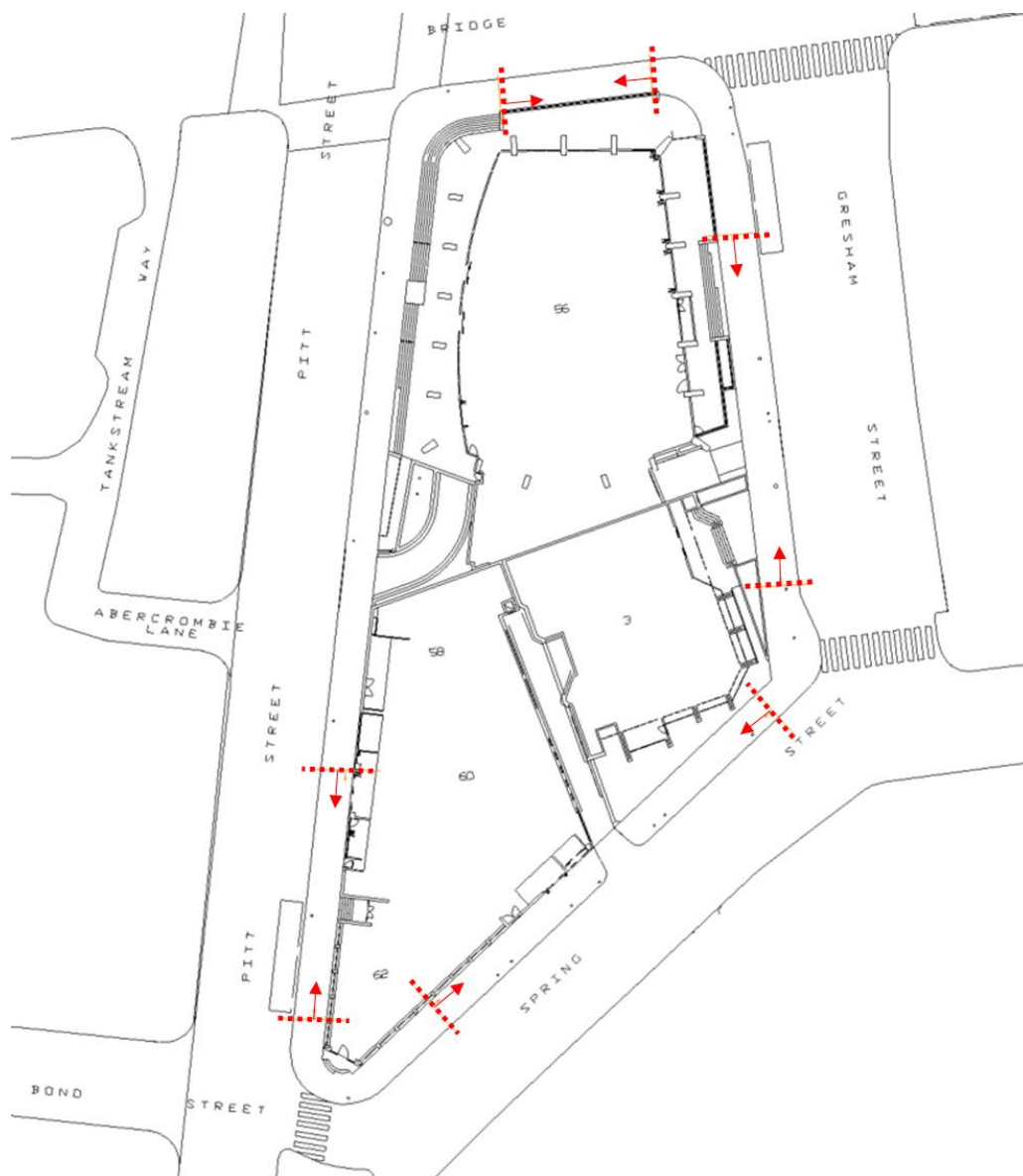
Pedestrian modelling for this site focuses on the capacity assessment of the pavements. As a result, calibration targets comprise of achieving GEH less than 5 for mid-block screen-line flows, in both direction, around the development and modelled OD as shown in **Figure 5.1**. This is usually through controlling the distribution of alternative routes and coding proper geometries.

The GEH statistic is used in the calibration of traffic and pedestrian models to compare the differences between modelled and observed pedestrian flows. The GEH statistic is defined as:

$$GEH = \sqrt{\frac{(V_{observed} - V_{modelled})^2}{(0.5 \times (V_{observed} + V_{modelled}))}}$$

The image below represents the screen-line location and direction used to match the simulated and observed data. The selected location was chosen as they are outside of mid-block crossing areas in which the Legion screen line's direction could miss.

Figure 5.1: Screenline Locations



5.2 Validation Results

Compared to other traffic microsimulation software, turn analysis is harder to track as the modelling space is 2-dimension not 1-dimensional links/road with two direction but rather a 360-degree angle and can be taking shortcuts and direct routes to by-pass intersections or analysis points.

As a result, model has been validated on the basis of screen-lines volumes and direct OD volumes which would result in appropriate turns and directions, as pedestrian only take direct paths, consequently rat-running is minimal.

The GEH of the Origin-Destination for all scenario is below 5 and is in an acceptable range presented in **Table 5.1** with details outcomes located in **Appendix D**. The GEH for the link flow screen-lines is presented below.

Table 5.1 : Screen-line calibration results

Link		AM			PM		
Street Name	Direction	Survey	Modelled	GEH	Survey	Modelled	GEH
Spring Street	EB	800	807	0	187	187	0
	SB	361	358	0	787	744	2
Pitt Street	NB	431	503	3	449	423	1
	SB	424	478	3	624	531	4
Bridge Street	WB	780	691	3	162	224	4
	EB	167	186	1	308	290	1
Gresham Street	NB	293	223	4	61	66	1
	SB	290	311	1	78	44	4

Spring Street validates well for both AM and PM peak periods being under GEH of 5. This is due to the direct path created from the 45-degree angle for direct routing, minimal mid-block crossings and an no main building entrances.

Pitt Street validates well for both AM and PM peak periods being under GEH of 5. However, not as accurate compared to other screen-lines for both directions and both periods as this area has the most main entrances for the buildings and preferred street for mid-block crossing.

Bridge Street validates well for both AM and PM peak periods being under GEH of 5. However, westbound movements towards the signalised intersection and building can vary as this is an alternative path for east centroid to south centroid users.

Gresham Street validates well for both AM and PM peak periods being under GEH of 5. However, northbound and southbound movements (depending on peak period flow) can vary as this is an alternate path for east to west user.

6 Legion modelling Results

This section provides results of the Legion modelling assessment terms of Cumulative Mean Density (CMD) maps providing the Level of Service (LoS), desire-lines of buildings and screen-line volumes.

6.1 Fruin's Level of Service - Cumulative Mean Density Maps

The CMD map extracted for the peak 15-minutes for the existing and the two future scenarios are presented below. Fruin's LoS Walkway is measured on the pavements, roads and the crosswalk. The Fruin's LoS Queueing is measured on the north-west corner at the Pitt Street and Bridge Street signalised pedestrian crossing as this is a queue storage area.

6.1.1 Base Model – Current Development + Existing Background

The LoS maps in **Figure 6.1** and **Figure 6.2** show the pavements surrounding the block is performing acceptably LoS A with some minor localised LoS C at the centre of the signalised crossing due to the counterflow from platoons in opposite directions.

Figure 6.1 : Cumulative Mean Density Maps – Base AM Peak (08:45 – 09:00)

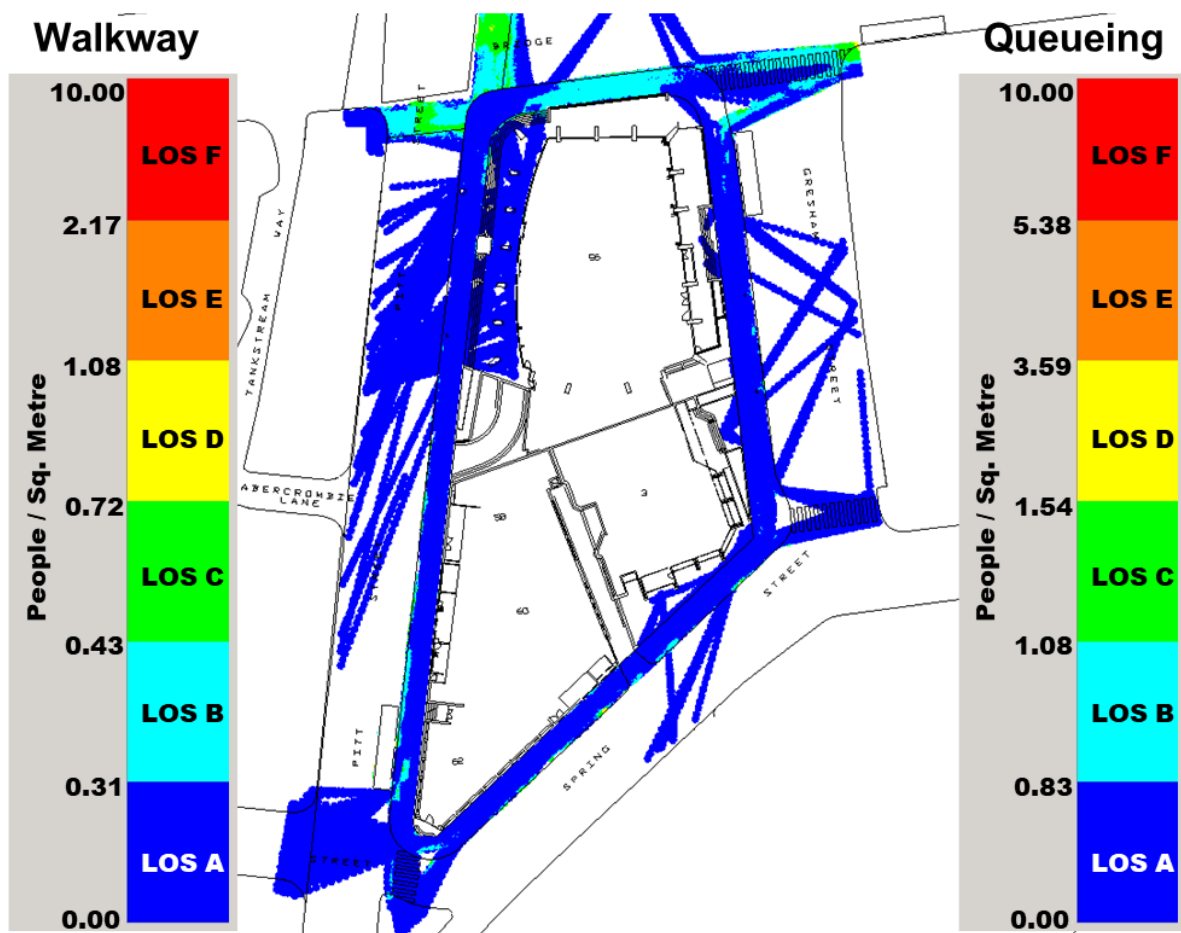
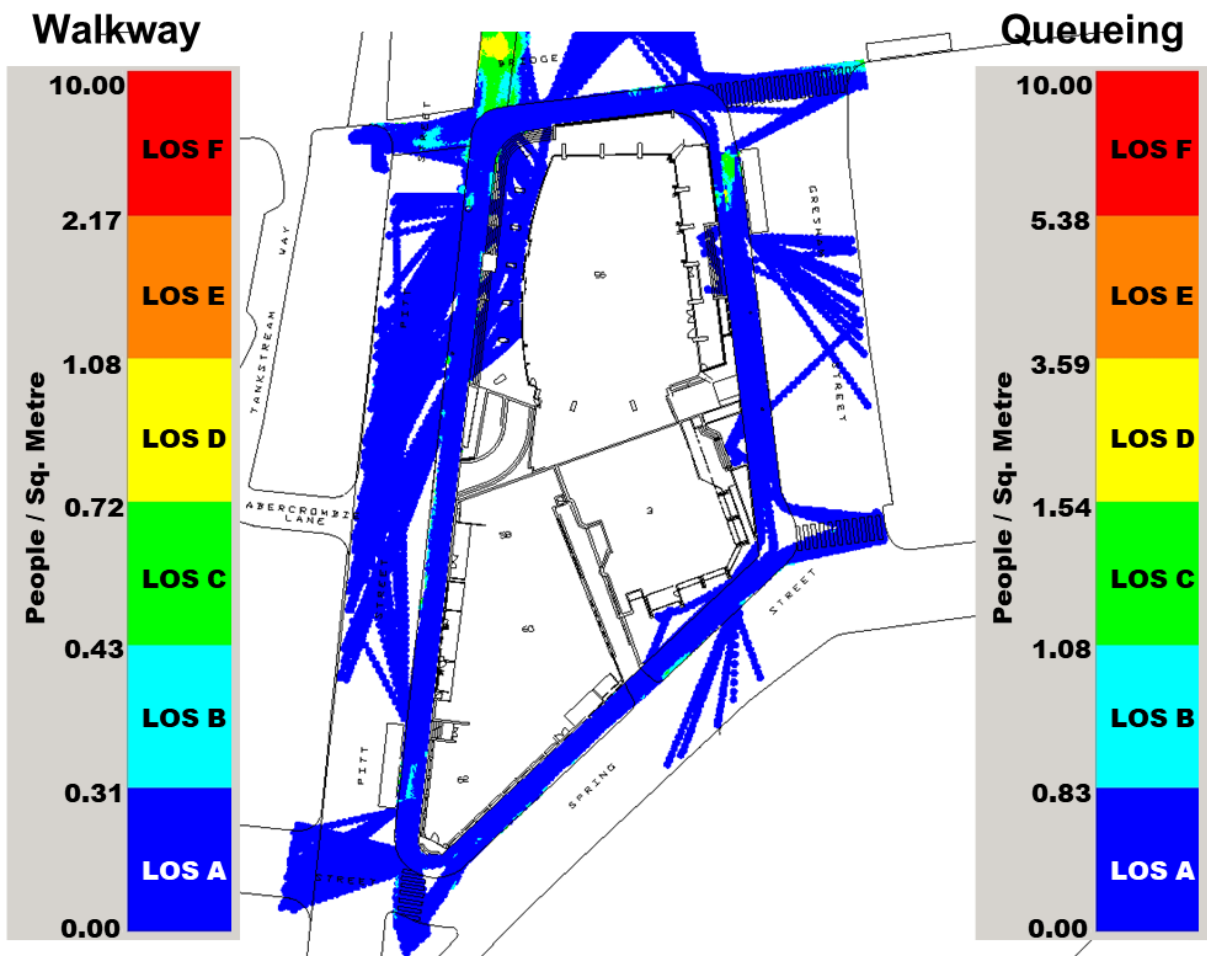


Figure 6.2 : Cumulative Mean Density Maps – Base PM Peak (17:30 – 17:45)



6.1.2 Future Scenario 1 – Proposed Development + Existing Background

The LoS maps in **Figure 6.3** and **Figure 6.4** show the pavements surrounding the block is performing acceptably at no worse than LoS C except some minor localised LoS D at the centre of the signalised crossing due to the counterflow from platoons in opposite directions.

The future scenario is slightly worse (but still acceptable) compared to the base due to the large person-trips generated from the proposed development. The AM has one major 15-minute peak prior 9:00AM whilst the PM has two 15-minute peaks at 5:00AM and 5:30AM resulting in the AM performing poorer than the PM peak.

Figure 6.3 : Cumulative Mean Density Maps – Future Scenario 1 AM Peak (08:45 – 09:00)

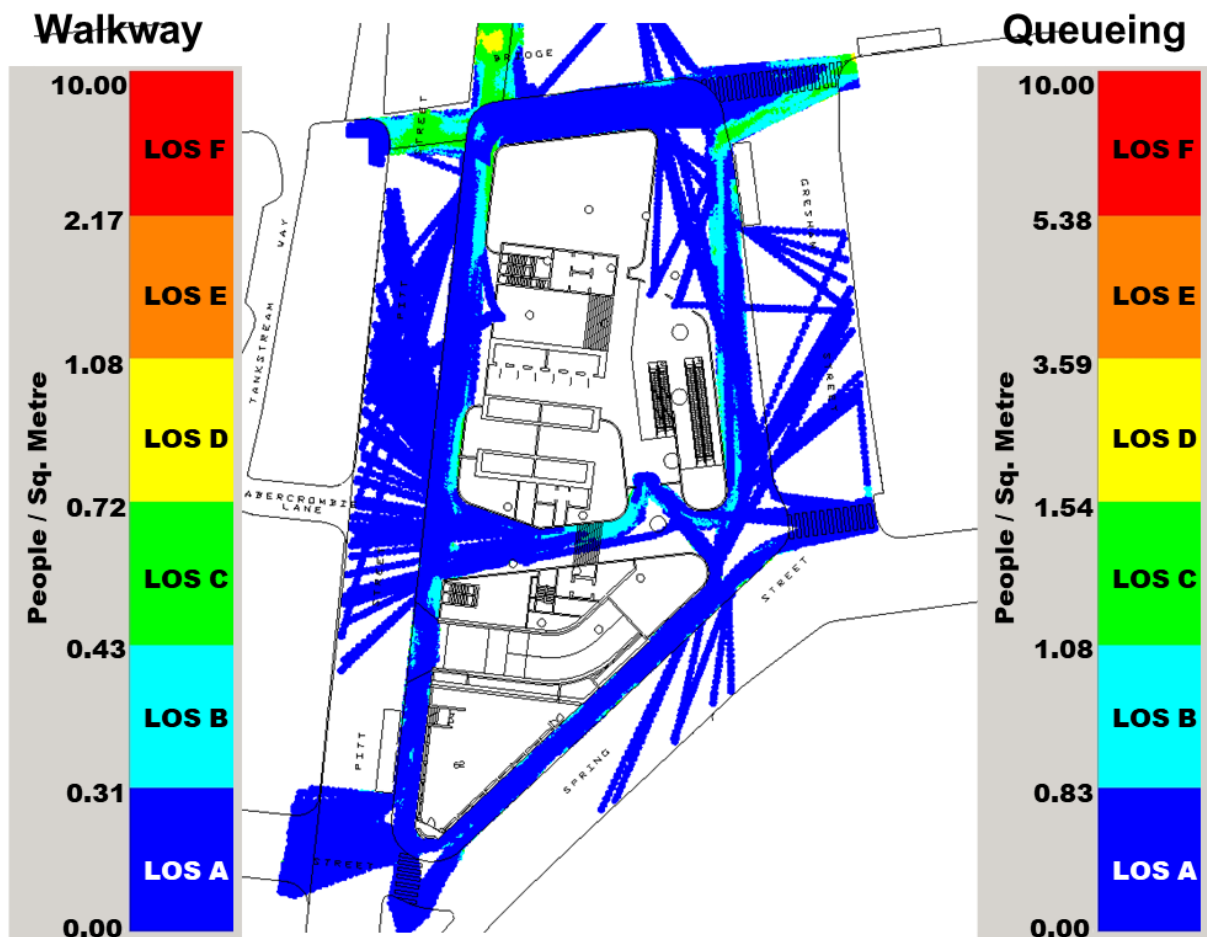
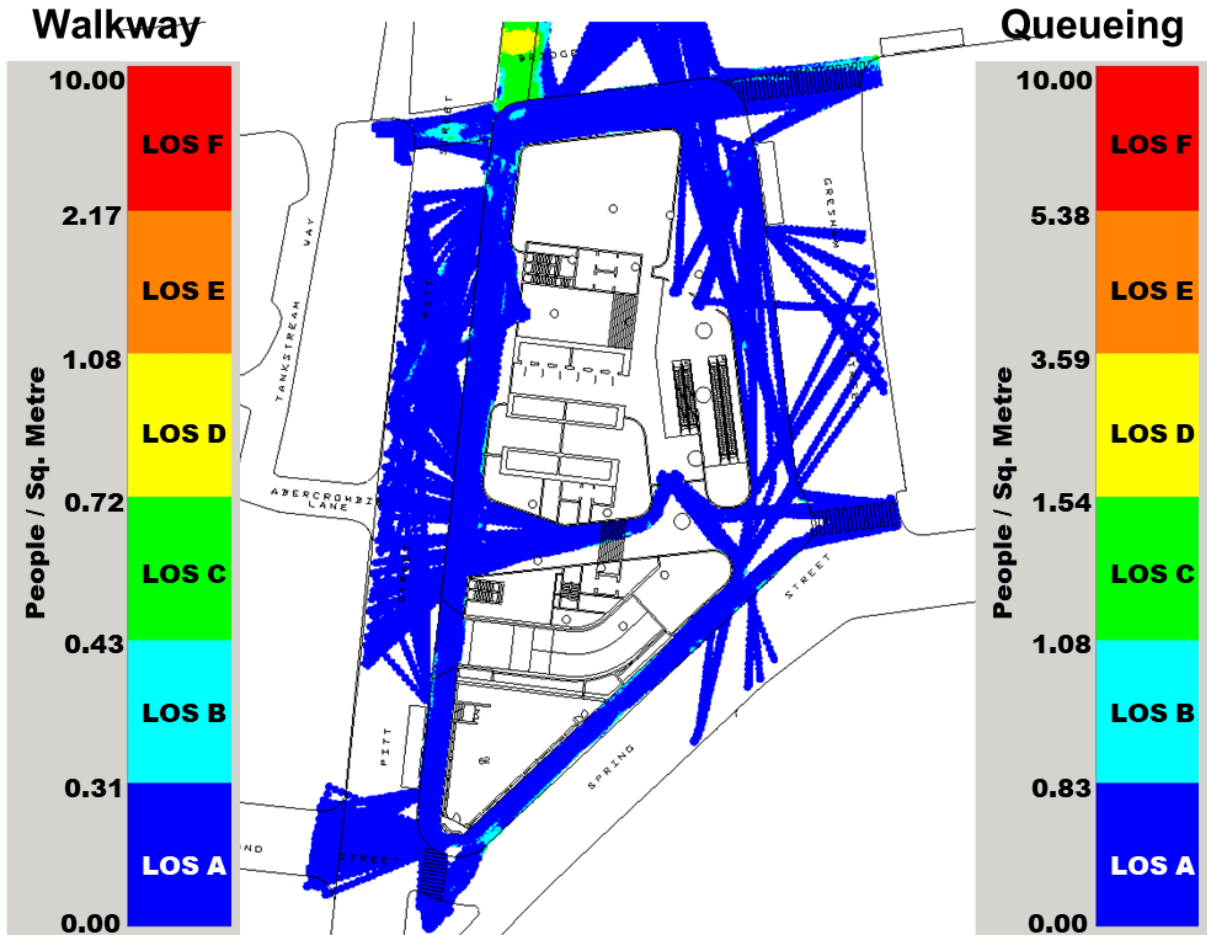


Figure 6.4 : Cumulative Mean Density Maps – Future Scenario 1 PM Peak (17:30 – 17:45)



6.1.3 Future Scenario 2 – Proposed Development + Background Factored (+15%)

The LoS maps in **Figure 6.5** and **Figure 6.6** show the pavements surrounding the block is performing acceptably at no worse than LoS C except some minor localised LoS D at the centre of the signalised crossing due to the north-south counterflow from platoons in opposite directions.

The future scenario is slightly worse (but still acceptable) compared to the base due to the large person-trips generated from the proposed development. The AM has one major 15-minute peak prior 9:00AM whilst the PM has two 15-minute peaks at 5:00AM and 5:30AM resulting in the AM performing poorer than the PM peak.

Figure 6.5 : Cumulative Mean Density Maps – Future Scenario 2 AM Peak (08:45 – 09:00)

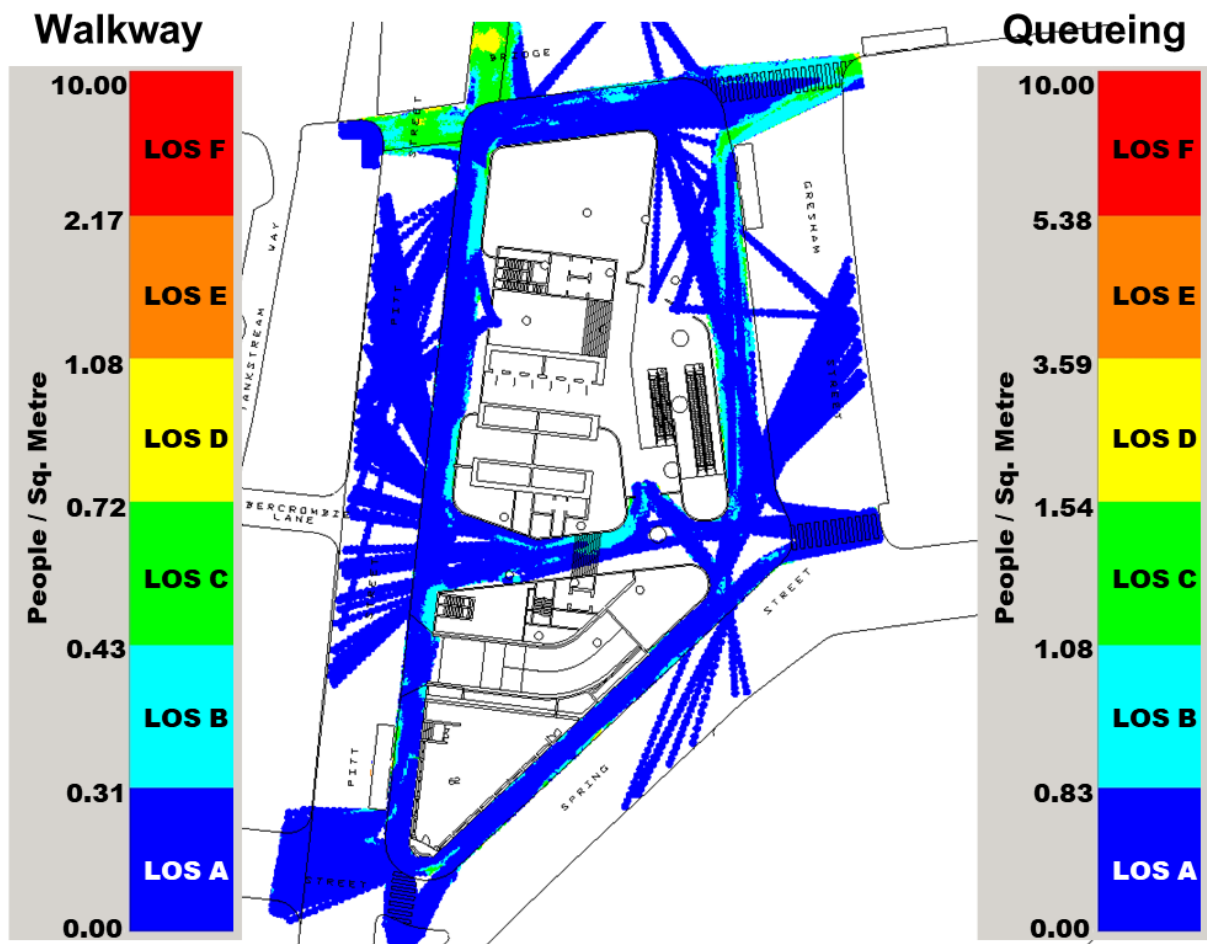
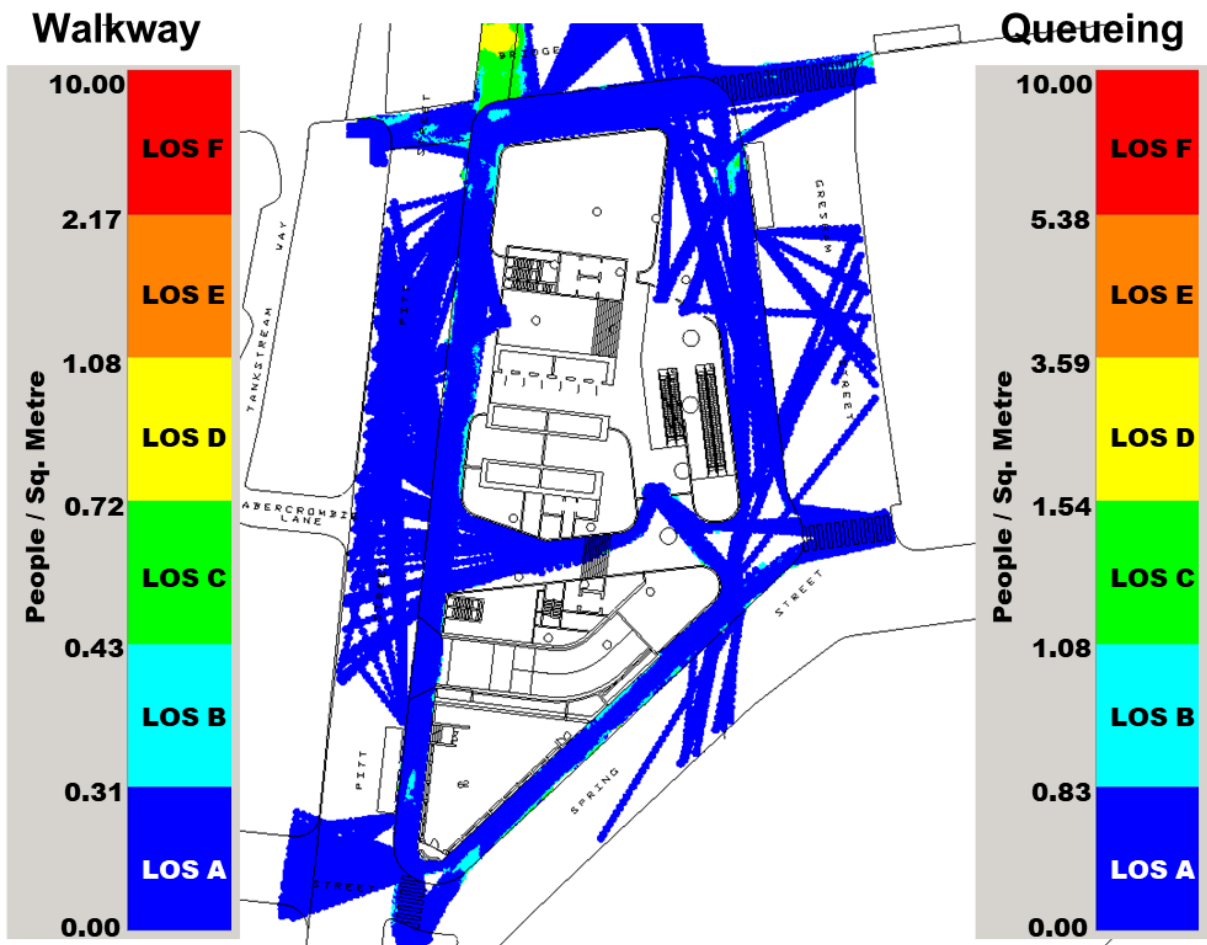


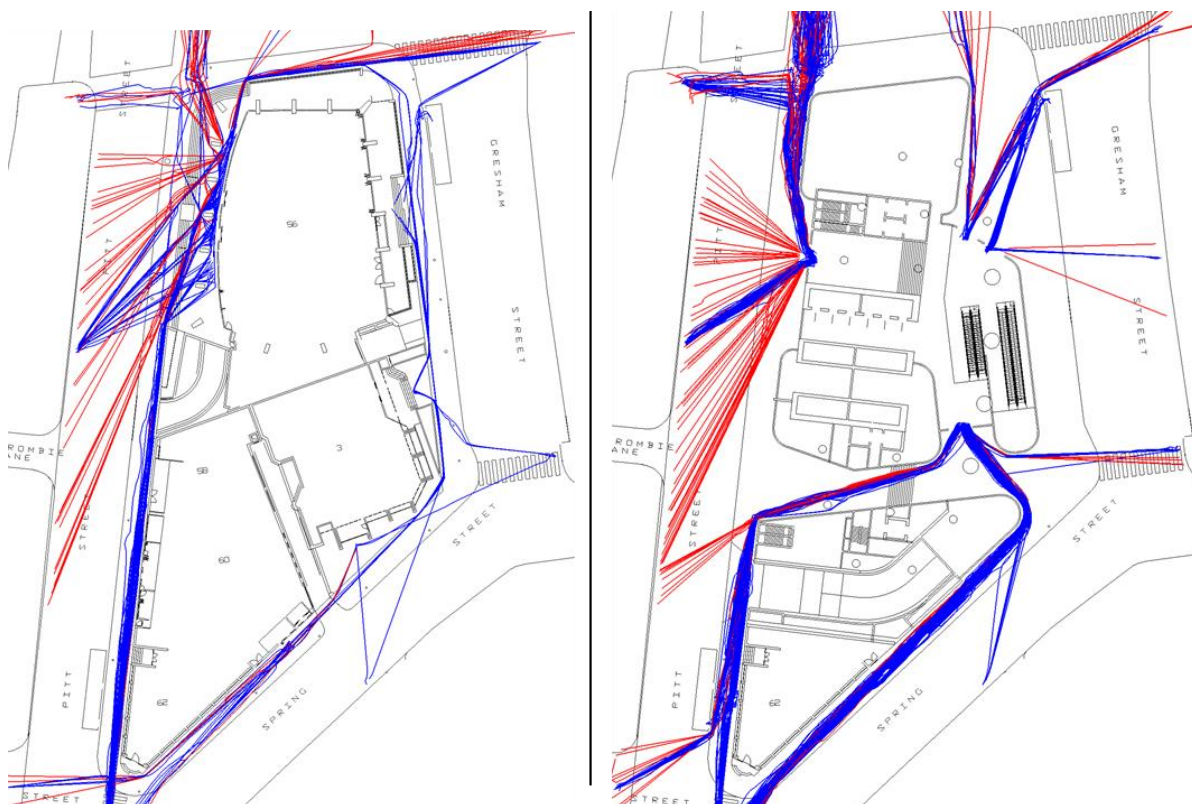
Figure 6.6 : Cumulative Mean Density Maps – Future Scenario 2 PM Peak (17:30 – 17:45)



6.2 Desire-Line – Existing Building vs. Future Development Flow

The image in **Figure 6.7** presents the desired paths of the building users (excluding background movements) before and after the development in the PM peak. Red represents IN and blue represents OUT trips of the building.

Figure 6.7: Desire-Line – Users of Existing Building (left) vs Proposed Development (right) - PM Peak (17:30 – 17:45)



Despite a large generation of person-trips from the future proposed development, it can be seen from the image above that the future scenario allows a more direct route to the public transport systems external of the model. This is due to the entrances being exposed in all orientations around the future building. Furthermore, the new passageway reduces pedestrian travel time by preventing them walking around the Pitt Street and Spring Street corner to reach the building’s entrance.

As a result of the entrance orientations and the passageways, the surrounding pavement area remain free of capacity as the building users route do not take out the pathing area as seen in the large gaps between the desire-lines in the future scenario. Thus, allowing the remaining pavement capacity for background movements. Due to the limitations and assumptions of this model for the future route assignment and distribution of the Sydney Metro’s Station, there will be slightly less mid-block crossings across Pitt Street as most train-users will be redistributed from the south-west to the east. This would result in a safer access as there will be less mid-block crossings on the Pitt Street to Wynyard Station and more on the pedestrian crossings at Spring Street and Gresham Street for the Metro Stations.

6.3 Screen-line flows

An analysis for of the pavement capacity was carried out with the screen line locations remaining unchanged.

Table 6.1 summarises the screen line volumes for the different scenarios. **Red** represents an **increase** and **green** represents a **decrease**.

Table 6.1 : Screen-line volumes scenario comparison

Street Name	Direction	Existing AM	w/ Development	w/ +15% Background
Spring Street	EB	807	953	1037
	SB	358	350	401
Pitt Street	NB	503	888	947
	SB	478	472	516
Bridge Street	WB	691	667	755
	EB	186	102	121
Gresham Street	NB	223	136	143
	SB	311	696	700

Street Name	Direction	Existing PM	w/ Development	w/ +15% Background
Spring Street	EB	187	166	210
	SB	744	1622	1785
Pitt Street	NB	423	446	490
	SB	531	596	641
Bridge Street	WB	224	221	261
	EB	290	180	187
Gresham Street	NB	66	47	81
	SB	187	166	210

In both the AM and PM peak periods, the future development reduces pedestrian volumes in alternative routes and corner movements such as Bridge Street however increases significantly for direct path to and from the proposed development depending on the peak periods.

There is a major increase for Spring Street southbound during the PM peak due to its direct and shortest route to the centroid 5 (south traffic island) to get to Wynyard station. This is due to the local behaviours of reaching the centroid 5 destination the shortest however the new passageway may/may-not redistributed the flow to Pitt Street Southbound as the ‘true’ shortest destination is Wynyard Station not the modelled centroid 5 destination.

As a result, the southern half of Pitt Street’s walkway will be the most affected in both directions for all peak periods.

7 Conclusion

The results of the pedestrian modelling assessment were reviewed to analyse the predicted passengers and level of service for the surrounding pavements to the new development. **Table 7.1** summarises the performances of the pavements in different scenarios and peak periods.

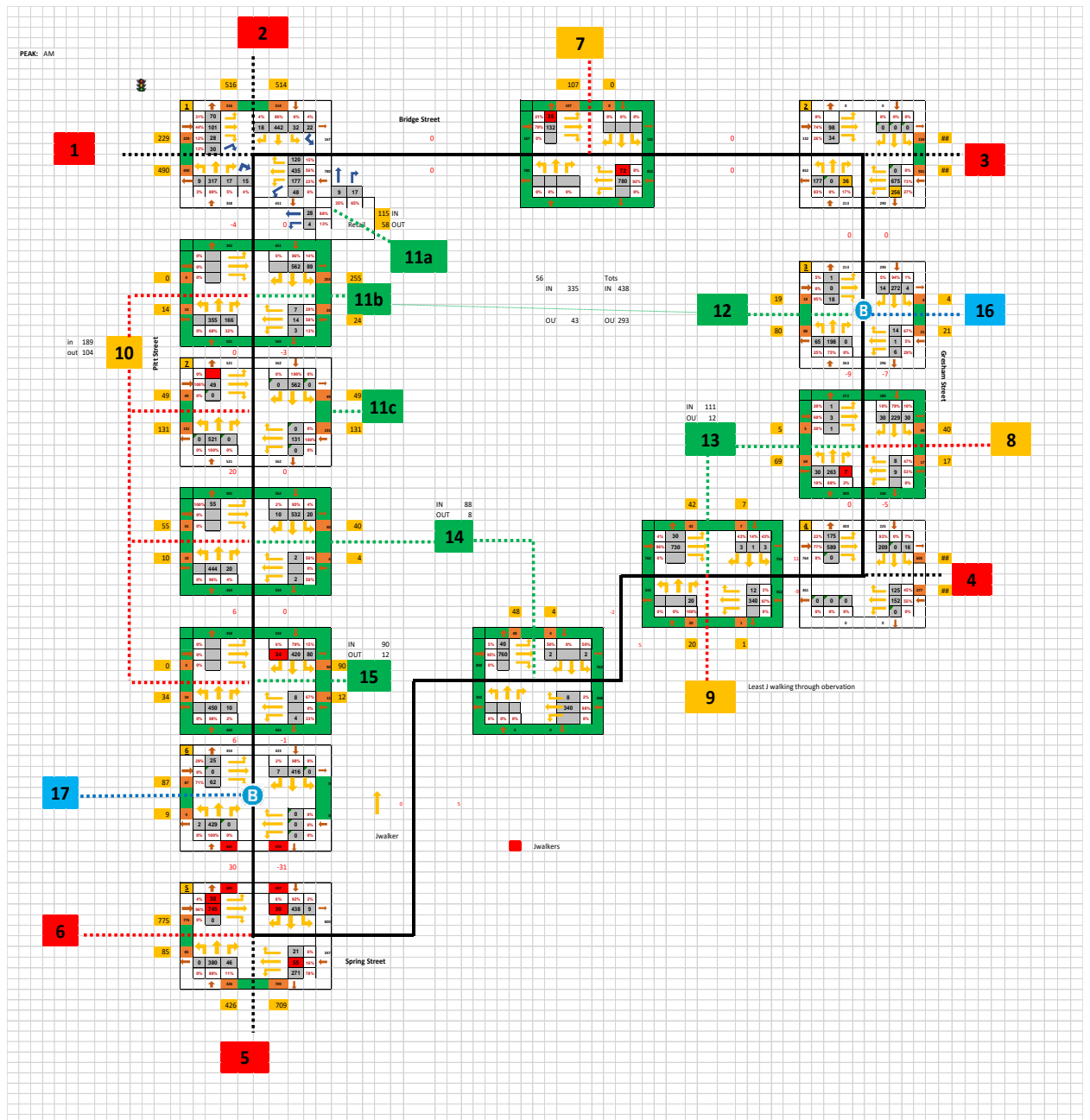
Table 7.1 : LoS Result Summary

Pavement		Base Scenario	Future Scenario 1	Future Scenario 2
Pitt Street	AM	A	B	B
	PM	A	A	A
Bridge Street	AM	B	B	B
	PM	A	A	A
Gresham Street	AM	A	B	B
	PM	A	A	A
Spring Street	AM	A	A	B
	PM	A	A	A
New Passageway	AM	-	B	B
	PM	-	A	A

It can be concluded from the table above that the surrounding pavements are performing acceptably, and the future person-trip generated from the new development will have minimal impact on the pavement's capacity.

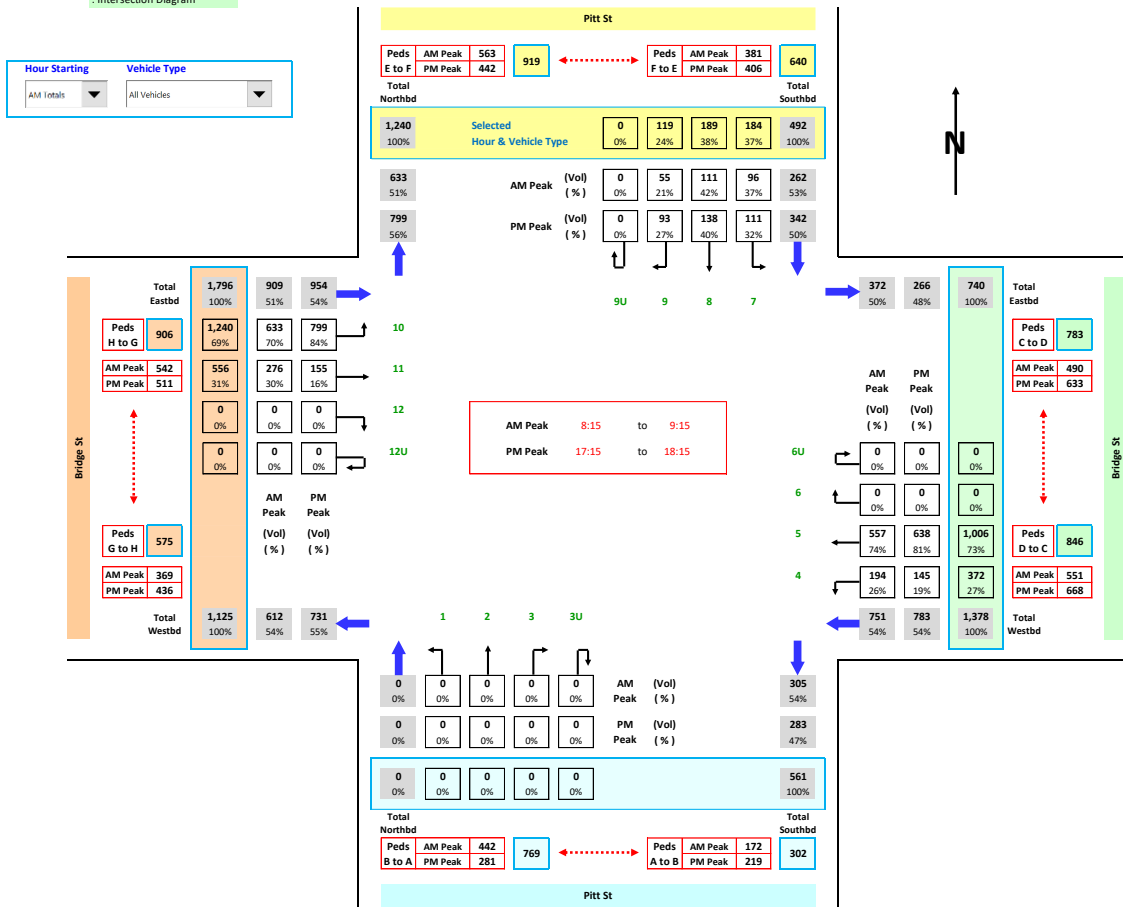
Appendix A – Balanced Pedestrian Flows

AM Peak



Appendix B – Classified Intersection Count

Job No. : N5572
 Client : Ason
 Suburb : Pitt St
 Location : 1. Pitt St / Bridge St
 Day/Date : Wed, 5th February 2020
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram



Appendix C – Origin-Destination Matrices

Base AM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	11a	11b	11c	12	13	14	15	16	17
1	0	70	59	15	16	1	21	2	0	2	30	4	0	0	2	1	3	0	0
2	18	0	22	4	257	22	0	1	0	30	22	60	0	0	1	14	54	0	5
3	345	95	0	0	240	51	57	0	0	9	38	19	0	12	32	9	17	4	1
4	45	35	0	0	112	31	7	3	0	0	5	0	0	27	18	3	0	0	0
5	0	220	0	32	0	0	11	6	0	0	10	113	0	2	3	18	8	0	2
6	66	29	18	524	0	0	7	4	0	0	1	9	0	34	44	39	1	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	5	1	0	0	0	0	0	0	0	0	0	0	2	9	0	0	0	0
9	0	0	3	15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10	0	33	2	0	0	0	1	0	0	0	2	18	49	0	0	0	0	0	0
11a	25	10	15	0	2	0	4	0	0	0							0	0	0
11b	0	6	0	0	2	0	0	0	0	14							0	0	0
11c	0	0	0	0	0	0	0	0	0	131							0	0	0
12	0	0	1	13	0	0	0	2	0	0							0	0	0
13	0	0	1	4	2	1	0	3	1	0							0	0	0
14	0	1	0	2	3	1	0	0	0	0							0	0	0
15	0	5	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0
16	6	2	2	0	0	0	1	6	0	0	1	2	0	1	1	0	0	0	0
17	0	15	0	0	46	0	0	16	0	0	0	7	0	0	0	2	1	0	0

Base PM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	11a	11b	11c	12	13	14	15	16	17
1	0	55	89	14	10	0	81	0	0	6	1	1	0	0	1	0	0	10	0
2	50	0	48	7	340	0	0	0	0	199	14	29	0	0	1	3	3	5	7
3	108	26	0	0	17	6	1	0	0	5	11	1	0	0	1	0	0	9	0
4	5	2	7	0	433	261	0	0	0	0	1	0	0	2	5	3	0	6	0
5	0	347	2	13	0	0	23	0	0	0	7	0	0	0	1	4	4	1	20
6	1	25	19	121	0	0	1	0	0	0	1	0	0	2	8	4	0	7	0
7	149	35	43	6	12	0	0	0	0	7	15	1	0	0	0	0	0	5	0
8	7	2	14	0	6	4	0	0	0	0	1	0	0	3	1	0	0	11	0
9	0	0	2	16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
10	0	70	3	0	29	0	3	0	0	0	1	0	125	0	0	0	0	0	1
11a	7	28	12	0	8	0	7	0	0	5							0	0	0
11b	1	13	0	0	138	0	0	0	0	46							1	0	3
11c	0	0	0	0	0	0	0	0	0	27							0	0	0
12	0	0	10	6	14	8	0	1	0	0							0	1	0
13	10	1	9	8	24	14	0	1	10	0							0	7	0
14	0	9	0	2	39	5	0	0	0	2							0	0	0
15	0	9	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1	15	0	0	11	3	3	0	0	0	0	0	0	0	0	0	0	0	0

Future 1 AM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	B	15	16	17
1	0	70	59	15	16	1	21	2	0	2	149	3	0	0
2	18	0	22	4	257	22	0	1	0	30	393	54	0	5
3	345	95	0	0	240	51	57	0	0	9	450	17	4	1
4	45	35	0	0	112	31	7	3	0	0	214	0	0	0
5	0	220	0	32	0	0	11	6	0	0	592	8	0	2
6	66	29	18	524	0	0	7	4	0	0	509	1	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	5	1	0	0	0	0	0	0	0	46	0	0	0
9	0	0	3	15	0	0	0	0	0	0	6	0	0	0
10	0	33	2	0	0	0	1	0	0	0	276	0	0	0
B	31	21	21	24	11	3	5	6	1	177		1	0	0
15	0	5	0	0	4	0	0	0	0	0	11	0	0	0
16	6	2	2	0	0	0	1	6	0	0	17	0	0	0
17	0	15	0	0	46	0	0	16	0	0	39	1	0	0

Future 1 PM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	B	15	16	17
1	0	55	89	14	10	0	81	0	0	6	7	0	10	0
2	50	0	48	7	340	0	0	0	0	199	96	3	5	7
3	108	26	0	0	17	6	1	0	0	5	27	0	9	0
4	5	2	7	0	433	261	0	0	0	0	20	0	6	0
5	0	347	2	13	0	0	23	0	0	0	24	4	1	20
6	1	25	19	121	0	0	1	0	0	0	29	0	7	0
7	149	35	43	6	12	0	0	0	0	7	35	0	5	0
8	7	2	14	0	6	4	0	0	0	0	11	0	11	0
9	0	0	2	16	0	0	0	0	0	0	1	0	1	0
10	0	70	3	0	29	0	3	0	0	0	263	0	0	1
B	77	221	131	69	960	118	30	8	43	338		6	35	13
15	0	9	0	0	48	0	0	0	0	0	0	0	0	1
16	3	0	3	0	0	0	0	0	0	0	0	0	0	0
17	1	15	0	0	11	3	3	0	0	0	0	0	0	0

Future 2 AM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	B	15	16	17
1	0	80.5	68.2	17.5	18.7	1.28	24.3	2.3	0	2.17	149	3.43	0	0.34
2	21	0	25	5	295	25	0	1	0	34	393	54	0	5
3	396	109	0	0	276	58	66	0	0	11	450	17	4	2
4	52	40	0	0	129	35	8	3	0	0	214	0	0	0
5	0	253	0	37	0	0	13	7	0	0	592	8	0	2
6	76	33	21	603	0	0	8	4	0	0	509	1	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	6	1	0	0	0	0	0	0	0	46	0	0	0
9	0	0	3	18	0	0	0	0	0	0	6	0	0	0
10	0	38	2	0	0	0	1	0	0	0	276	0	0	0
B	31	21	21	24	11	3	5	6	1	177		1	0	0
15	0	5	0	0	4	0	0	0	0	0	11	0	0	0
16	7	2	3	0	0	0	1	7	0	0	17	0	0	0
17	0	17	0	0	52	0	0	18	0	0	39	1	0	0

Future 2 PM Matrix

Centroids	1	2	3	4	5	6	7	8	9	10	B	15	16	17
1	0	63	103	17	11	0	93	0	0	7	7	0	12	0
2	58	0	55	8	391	0	0	0	0	229	96	3	6	8
3	124	29	0	0	19	7	1	0	0	6	27	0	11	0
4	6	2	8	0	497	300	0	0	0	0	20	0	7	0
5	0	399	2	15	0	0	27	0	0	0	24	4	1	23
6	1	28	22	139	0	0	1	1	0	0	29	0	8	0
7	171	40	49	7	13	0	0	0	0	8	35	0	6	0
8	8	3	16	0	7	4	0	0	0	0	11	0	13	0
9	0	0	3	19	0	0	0	0	0	0	1	0	1	0
10	0	80	4	0	33	0	3	0	0	0	263	0	0	1
B	77	221	131	69	960	118	30	8	43	338		6	35	13
15	0	9	0	0	48	0	0	0	0	0	0	0	0	1
16	4	1	3	0	0	0	0	0	0	0	0	0	0	0
17	1	17	0	0	13	3	4	0	0	0	0	0	0	0

Appendix D – Origin-Destination Model GEH

Base AM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_56_Pitt_West	Ex_Building_56_Pitt_East	Ex_Building_3_Spring	Ex_Building_58_60	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	0.61	0.26	0.25	0.49	1.41	1.03	0.82	0	2	0.89	0	0.82	1.41	2.13	0	0
En_North_Signal_Crossing	1.00	0.00	0.66	0.00	0.25	0.66	0	1.41	0	1.21	0.86	0	1.41	0.52	0.14	0	1.6
En_Bridge_Gresham_Street	0.27	0.31	0.00	0.00	0.06	0.87	0.77	0	0	0	0.82	0	0.54	0.32	0.76	0.53	1.41
En_East_Bent_Street	0.15	1.63	0.00	0.00	0.29	0.35	1.62	0.53	0	0	0.47	0.56	0.49	1	0	0	0
En_South_Island	0	0.27	0	0.18	0	0	1.6	0	0	0	0.46	0.82	1.41	0.24	0	0	2
En_J_Walk_Bond_Street	0.84	1.6	0	0.04	0	0	1.03	0	0	0	1.03	0.17	0.46	0.32	1.41	0	0
En_J_Walk_Bridge_Street																	
En_J_Walk_Gresham_Street	0	0.47	0	0	0	0	0	0	0	0	0	2	0.63	0	0	0	0
En_J_Walk_Spring_Street	0	0	0.63	0	0	0	0	0	0	0	0	1.41	0	0	0	0	0
En_J_Walk_Pitt_Street	0	0	0.82	0	0	0	1.41	0	0	0	0.37	0	0	0	0	0	0
En_Building_56_Pitt_West	1.03	0.79	1.41	0	0.47	0	0.53	0	0	0.17	1.41	0	0	0	1.41	0	0
En_Building_56_Pitt_East	0	0	1.41	0.28	0	0	0	0	0	0	0	0	0.63	0	0	0	0
En_Building_3_Spring	0	0	1.41	0	2	1.41	0	1.41	0	0	0	0	0	0	0	0	0
En_Building_58_60	0	0	0	2	0.53	0	0	0	0	0	1.41	0	0	0	0	0	0
En_Building_62	0	0	0	0	1.15	0	0	0	0	0	0	0	0	0	0	0	0
En_Bus_1	0.76	1.6	2	0	0	0	0.82	0	0	0	1.41	1.41	0	0	0	0	0
En_Bus_2	0	0.53	0	0	1.53	0	0	0.79	0	0	0.37	0	0	0	0.82	0	0

Base PM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_56_Pitt_West	Ex_Building_56_Pitt_East	Ex_Building_3_Spring	Ex_Building_58_60	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	2.13	1.32	2.16	0.6	0	0.11	0	0	0.89	0	0	0.82	0	0	0	0
En_North_Signal_Crossing	0.14	0.00	0.29	0.00	0.91	0	0	0	0	0.36	0.15	0	0.82	0	1.41	2.31	1.79
En_Bridge_Gresham_Street	0.10	0.20	0.00	0.00	0.47	1.41	0	0	0	0	0.29	0	0	0	0	0.71	0
En_East_Bent_Street	2.67	1.15	0.82	0.00	0.24	0.12	0	0	0	0	1.41	0	0.43	1.41	0	0.76	0
En_South_Island	0	0.21	2	0.79	0	0	0.21	0	0	0	0	0	0	0.89	0.53	1.41	1.46
En_J_Walk_Bond_Street	0	0.62	1.08	0.18	0	0	0	0	0	0	0	0	1.18	0	0	0.82	0
En_J_Walk_Bridge_Street	0.88	0.52	0.6	2	0.93	0	0	0	0	0.82	0.79	0	0	0	0	0.43	0
En_J_Walk_Gresham_Street	0.39	2	0.76	0	0.43	0.89	0	0	0	0	0	0.63	0	0	0	1.33	0
En_J_Walk_Spring_Street	0	0	0.63	0.79	0	0	0	0	0	0	0	0	0	0	0	0	0
En_J_Walk_Pitt_Street	0	0.59	0.53	0	0.89	0	0	0	0	0	1.1	0	0	0	0	0	0
En_Building_56_Pitt_West	1.63	1.32	0.28	0	0.65	0	1.9	0	0	0.46	0	0	0	0	0.82	0	0
En_Building_56_Pitt_East	0	0	0.6	1.41	0.52	0.34	0	1.41	0	0	0	0	0.82	0	0	0	0
En_Building_3_Spring	0	1.41	0.63	0.97	0.42	0.27	0	1.41	1.03	0	1.41	2	0	0	0	0	0
En_Building_58_60	0	0.34	0	2	0.49	1.51	0	0	0	0	0	0	0	0	0	0	0
En_Building_62	0	0.93	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	1.41
En_Bus_1	1.41	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
En_Bus_2	1.41	0.74	0	0	0.63	0	0	0	0	0	0	0	0	0	0	0	0

Future 1 AM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_New	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	0.36	0.13	0.25	0.79	1.41	1.41	0	0	0.82	0	2.45	0	0
En_North_Signal_Crossing	1.00	0.00	0.66	0.53	0.92	0.82	0	1.41	0	0.56	1.86	1.05	0	1
En_Bridge_Gresham_Street	0.32	0.80	0.00	0.00	2.14	0.55	1.75	0	0	1.1	0.82	2.55	0	0
En_East_Bent_Street	0.73	0.33	0.00	0.00	0.77	0.55	0.39	0.63	0	0	1.83	0	0	0
En_South_Island	0	0.89	0	0.35	0	0	0.31	0.89	0	0	1.23	0.76	0	0
En_J_Walk_Bond_Street	0.96	0	0.24	0.57	0	0	0.39	0	0	0	1.15	0.82	0	0
En_J_Walk_Bridge_Street														
En_J_Walk_Gresham_Street	0	1	0	0	0	0	0	0	0	0	0	0	0	0
En_J_Walk_Spring_Street	0	0	1.79	1.73	0	0	0	0	0	0	0	0	0	0
En_J_Walk_Pitt_Street	0	1.47	2	0	0	0	1.41	0	0	0	1	0	0	0
En_Building_New	0.61	0.25	0	0	0.53	0	0	0	0	0.08	1.41	1.41	0	0
En_Building_62	0	0.43	0	0	0.53	0	0	0	0	0	2	0	0	0
En_Bus_1	0.43	0	0.82	0	0	0	1.41	1.41	0	0	0	0	0	0
En_Bus_2	0	0.26	0	0	0.72	0	0	0.94	0	0	1.03	1.41	0	0

Future 1 PM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_New	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	0.14	0.11	0.00	0.667	0	0.564	0	0	1.414	0.365	0	0.309	0
En_North_Signal_Crossing	1.33	0.00	0.74	0.39	0.538	0	0	0	0	0.7	2.043	1.414	0.471	0
En_Bridge_Gresham_Street	1.29	0.19	0.00	0.00	1.132	0	0.816	0	0	0.426	0	0	0.343	0
En_East_Bent_Street	0.82	1.15	0.71	0.00	0.923	0.499	0	0	0	0	2.353	0	2	0
En_South_Island	0	0.486	0.816	0.577	0	0	1.342	0	0	0	0.206	1.633	1.414	0.226
En_J_Walk_Bond_Street	0	0.202	1.231	0.183	0	0	0	0	0	0	0.718	0	0.816	0
En_J_Walk_Bridge_Street	0.245	0	1.45	0.392	1.622	0	0	0	0	1.789	1.728	0	1.604	0
En_J_Walk_Gresham_Street	0.365	2	0.516	0	0.426	0.471	0	0	0	0	0.632	0	0.632	0
En_J_Walk_Spring_Street	0	0	0.816	0.516	0	0	0	0	0	0	0	0	1.414	0
En_J_Walk_Pitt_Street	0	1.37	0	0	0.77	0	2.132	0	0	0	0.246	0	0	1.414
En_Building_New	0.579	0.533	1.025	1.715	1.206	0.278	0.756	0.365	0.152	0.493	0	0.392	0.497	0.283
En_Building_62	0	1.095	0	0	0	0	0	0	0	0	0	0	0	1.414
En_Bus_1	0.535	0	0	0	0	0	0	0	0	0	0	0	0	0
En_Bus_2	1.414	0.263	0	0	1.361	1.414	0.632	0	0	0	0	0	0	0

Future 2 AM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_New	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	0.45	0.24	0.50	1	1.4	1.5	0.8	0	2	1	1	0	0
En_North_Signal_Crossing	2.22	0.00	0.58	1.60	0.6	0.4	0	0	0	0.7	0.2	0.4	0	1.6
En_Bridge_Gresham_Street	1.24	0.10	0.00	0.00	1	0.3	1.7	0	0	0.3	1.1	2.2	1.2	0.8
En_East_Bent_Street	2.25	0.65	0.00	0.00	0.1	0	0.4	1	0	0	0.9	0	0	0
En_South_Island	0	1.3	0	0.5	0	0	0.5	0.8	0	0	0.2	0.7	0	1.2
En_J_Walk_Bond_Street	0.6	0.8	2	0.2	0	0	0.4	1.2	0	0	1.6	0	0	0
En_J_Walk_Bridge_Street														
En_J_Walk_Gresham_Street	0	2	0	0	0	0	0	0	0	0	0.3	0	0	0
En_J_Walk_Spring_Street	0	0	0.5	0.7	0	0	0	0	0	0	0.4	0	0	0
En_J_Walk_Pitt_Street	0	0.7	0	0	0	0	0	0	0	0	0.2	0	0	0
En_Building_New	0	0.2	0	0.4	0.3	0.6	1	0	1.4	0.3	0	0	0	0
En_Building_62	0	0.5	0	0	0.5	0	0	0	0	0	1	0	0	0
En_Bus_1	0.7	1.2	1	0	0	0	1.4	1.8	0	0	0	0	0	0
En_Bus_2	0	0.5	0	0	0.1	0	0	0.5	0	0	0.8	0.8	0	0

Future 2 PM Matrix

GEH	Ex_West_Signal_Crossing	Ex_North_Signal_Crossing	Ex_Bridge_Gresham_Street	Ex_East_Bent_Street	Ex_South_Island	Ex_J_Walk_Bond_Street	Ex_J_Walk_Bridge_Street	Ex_J_Walk_Gresham_Street	Ex_J_Walk_Spring_Street	Ex_J_Walk_Pitt_Street	Ex_Building_New	Ex_Building_62	Ex_Bus_1	Ex_Bus_2
En_West_Signal_Crossing	0.00	0.74	1.64	0.76	0.29	0	0.61	0	0	1.79	1.33	0	2.4	0
En_North_Signal_Crossing	0.89	0.00	0.83	0.37	0.46	0	0	0	0	1.49	1	0	0.43	0.37
En_Bridge_Gresham_Street	0.36	0.19	0.00	0.00	0.23	2.36	0	0	0	0.76	0.59	0	1.6	0
En_East_Bent_Street	0.43	0.82	1.26	0.00	0.91	0.23	0	0	0	0	1.25	0	0	0
En_South_Island	0	0.76	0.63	1.73	0	0	0.39	0	0	0	0.59	0.89	0	0.87
En_J_Walk_Bond_Street	0	1.2	2.1	0.86	0	0	0.82	0.82	0	0	1.18	0	0.34	0
En_J_Walk_Bridge_Street	0.08	0.48	0	0	1.54	0	0	0	0	0.67	0	0	0	0
En_J_Walk_Gresham_Street	0	0.53	0.79	0	0.71	0	0	0	0	0	0.31	0	0.88	0
En_J_Walk_Spring_Street	0	0	1.41	1.5	0	0	0	0	0	0	0	0	0.82	0
En_J_Walk_Pitt_Street	0	0.11	0.47	0	0.34	0	0.53	0	0	0	0.75	0	0	1.41
En_Building_New	0.82	0.96	0.09	0.49	0.26	0.18	1.04	0.97	0.31	0.11	0	0.43	2.23	0
En_Building_62	0	0.34	0	0	0	0	0	0	0	0	0	0	0	0
En_Bus_1	0.47	0	1.41	0	0	0	0	0	0	0	0	0	0	0
En_Bus_2	1.41	0.5	0	0	0.28	1	0.89	0	0	0	0	0	0	0

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