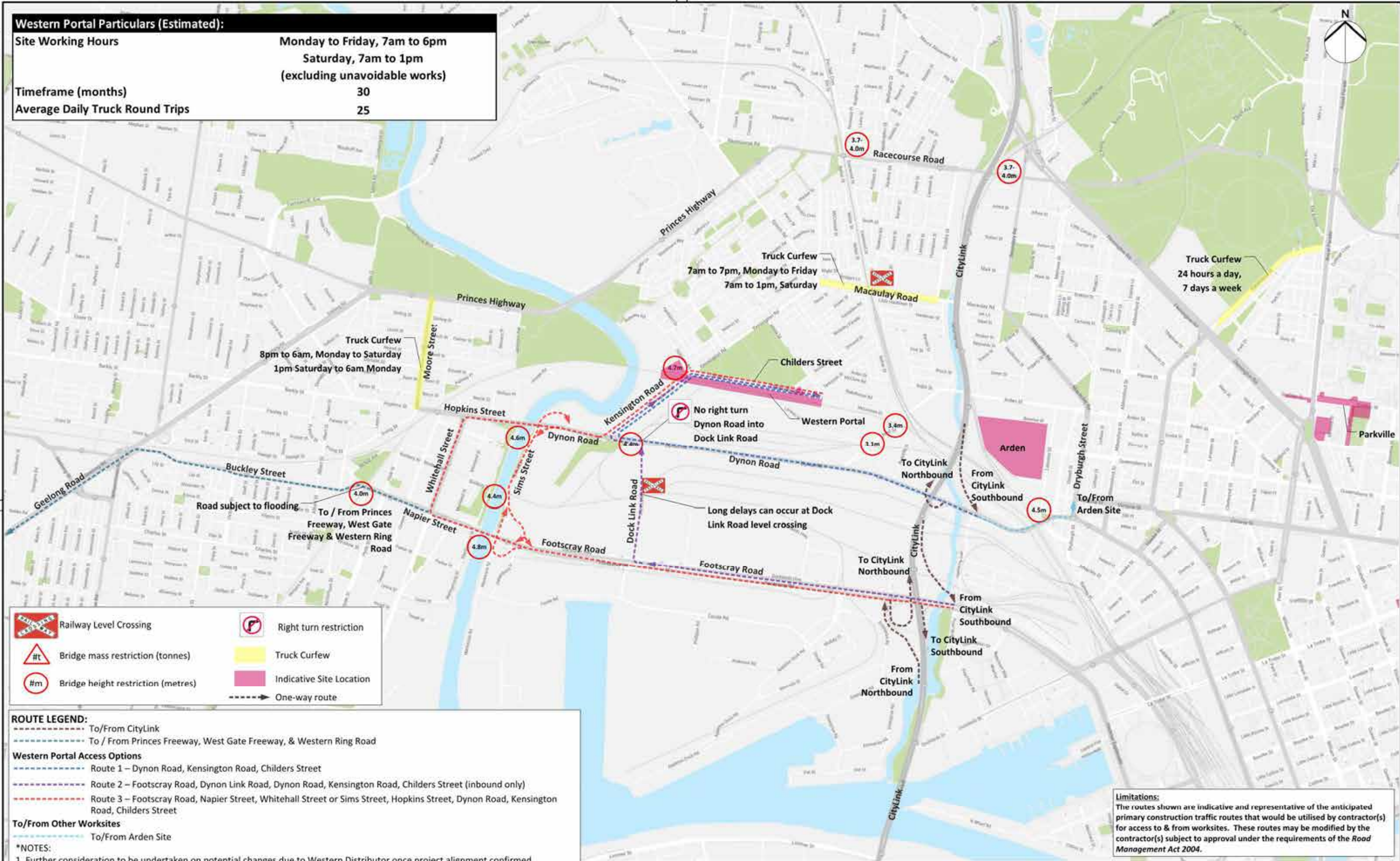
Appendix C

Construction Traffic Routes

Western Portal Particulars (Estimated):

Site Working Hours	Monday to Friday, 7am to 6pm Saturday, 7am to 1pm (excluding unavoidable works)
Timeframe (months)	30
Average Daily Truck Round Trips	25



ROUTE LEGEND:

- To/From CityLink
- To / From Princes Freeway, West Gate Freeway, & Western Ring Road

Western Portal Access Options

- Route 1 – Dynon Road, Kensington Road, Childers Street
- Route 2 – Footscray Road, Dynon Link Road, Dynon Road, Kensington Road, Childers Street (inbound only)
- Route 3 – Footscray Road, Napier Street, Whitehall Street or Sims Street, Hopkins Street, Dynon Road, Kensington Road, Childers Street

To/From Other Worksites

- To/From Arden Site

*NOTES:

1. Further consideration to be undertaken on potential changes due to Western Distributor once project alignment confirmed.

Limitations:

The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

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ADVISIAN		1.3	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.2	21/03/16	SITE LOCATION UPDATE	KK	SB		
ADVISIAN		1.1	05/03/16	MINOR ROUTE AMENDMENT	SB	JW		

Consultant

Advisian

MELBOURNE METRO RAIL AUTHORITY

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MELBOURNE METRO
WESTERN PORTAL CONSTRUCTION
VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East.	East.	
North.	North.	
ID#	ID#	

MMR_ADV_PL_0002-SK002

VicTrack ACCESS

File Name	Drawn By SB	Designed By SB
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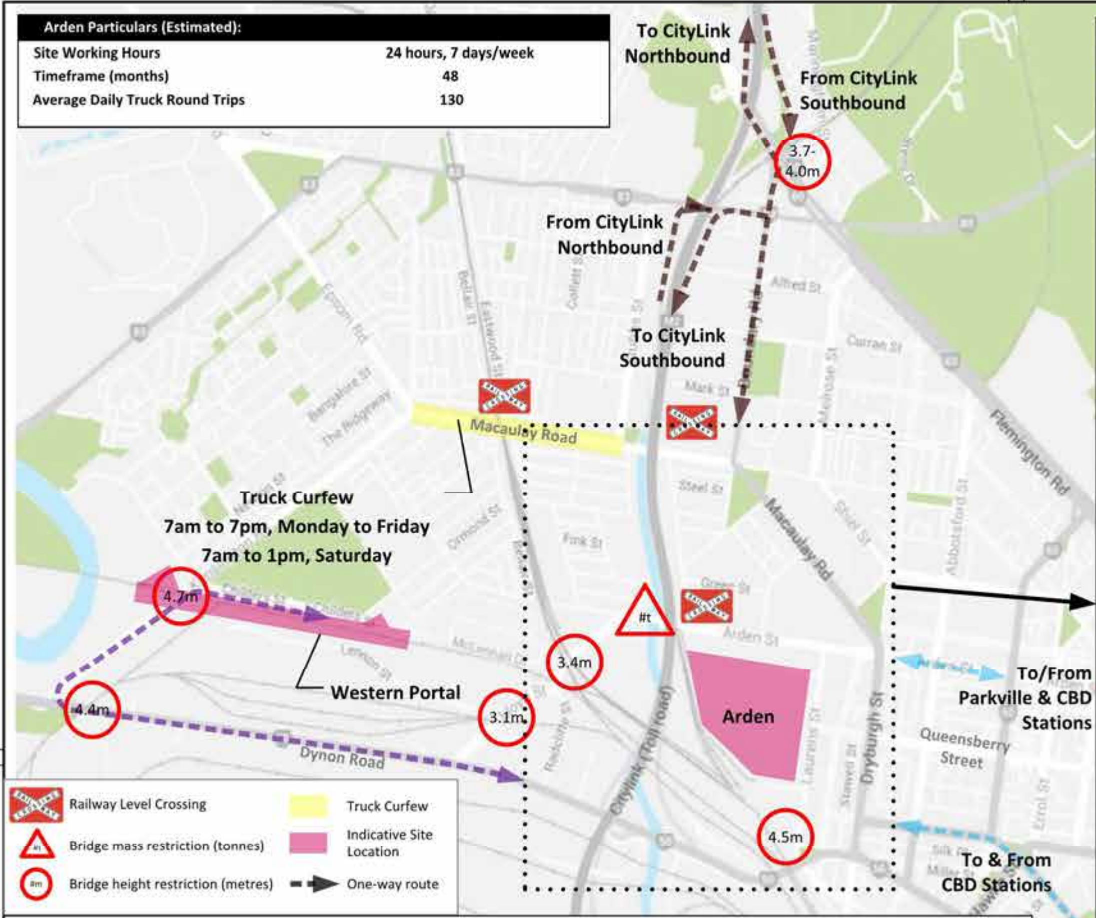
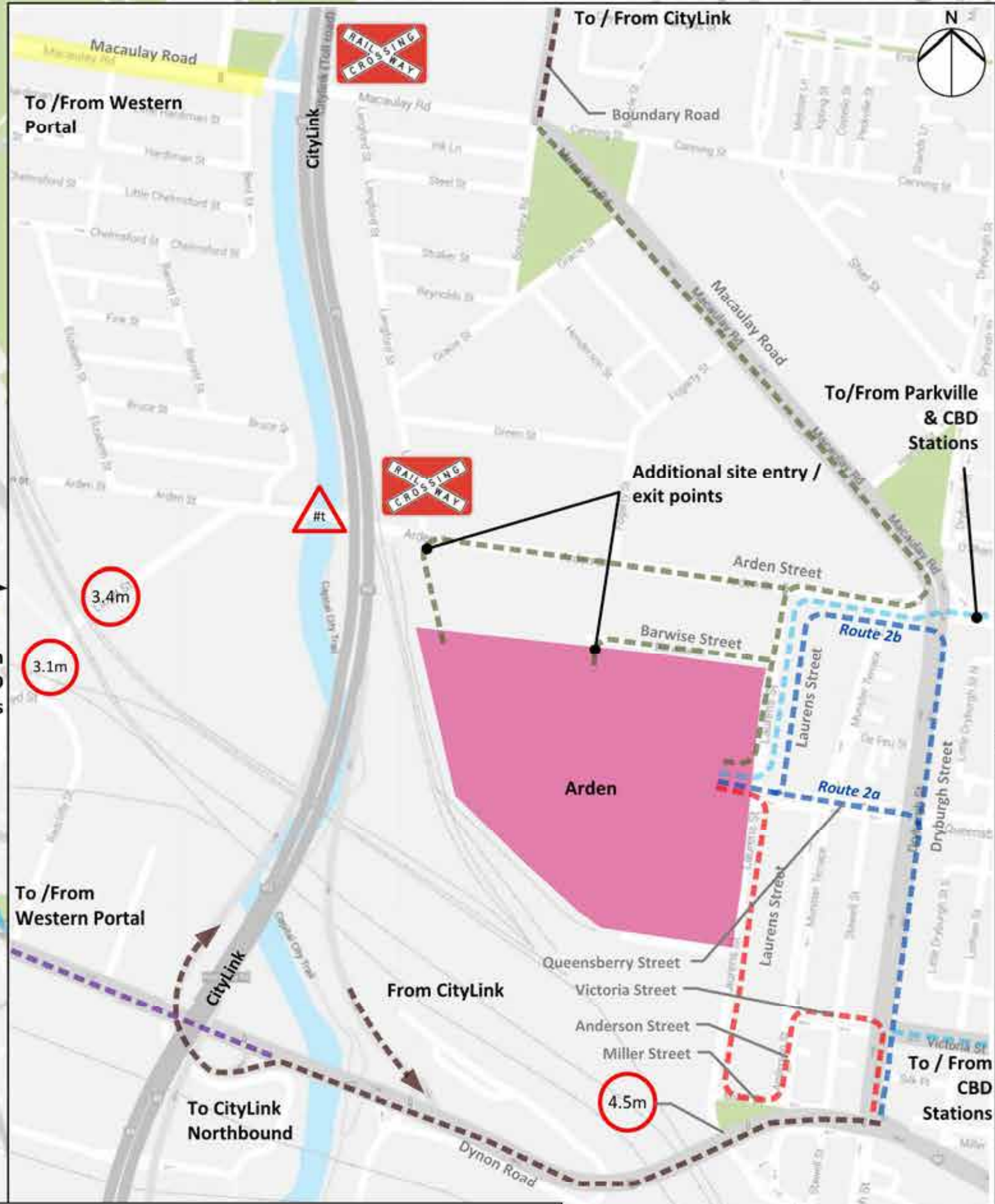
Arden Particulars (Estimated):	
Site Working Hours	24 hours, 7 days/week
Timeframe (months)	48
Average Daily Truck Round Trips	130





ROUTE LEGEND:

To/From CityLink

Arden Vehicle Southern Route Options:

Route 1 – Laurens Street, Miller Street, Anderson Street, Victoria Street, Dryburgh Street, Dynon Road

Route 2a – Queensberry Street, Dryburgh Street, Dynon Road

Route 2b – Laurens Street, Arden Street, Dryburgh Street, Dynon Road

Arden Vehicle Northern Route Options:

Laurens Street, Arden Street, Macaulay Road, Boundary Road

Arden to Other Worksites

Western Portal via Dynon Road – Route 1, 2, 3a or 3b, Dynon Road, Kensington Road, Childers Street

To/From Parkville / CBD Stations

*NOTES:

1. Further consideration to be undertaken on potential changes due to Western Distributor once project alignment confirmed.

Limitations:

The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

Project Drawing Number MMR_ADV_PL_0002-SK001

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
ADVISIAN	1.3		14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN	1.2		21/03/16	SITE LOCATION UPDATE	KK	SB		
ADVISIAN	1.1		05/03/16	ADDED NOTATION REGARDING WESTERN DISTRIBUTOR PROJECT	SB	JW		

Consultant: Advisian; Melbourne Metro Rail Authority

MELBOURNE METRO
ARDEN SITE VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	

VicTrack ACCESS

File Name

Sheet No. 01 of 01

In Serv.

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Drawn By SB	Designed By SB
Checked By VG	Ind. Review
Approved	Approval Date
Drawing Number	Revision 1.3

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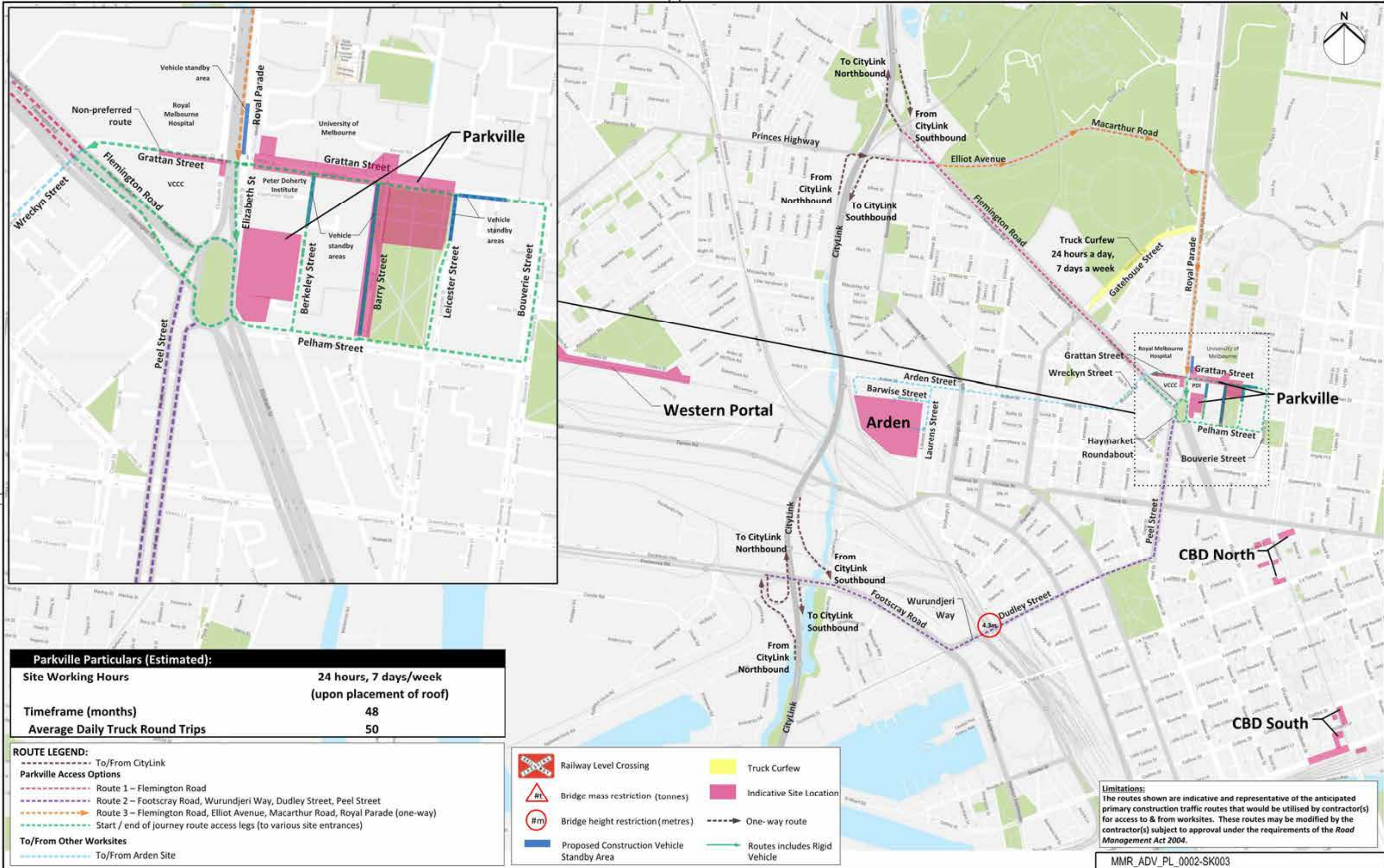

Parkville Particulars (Estimated):	
Site Working Hours	24 hours, 7 days/week (upon placement of roof)
Timeframe (months)	48
Average Daily Truck Round Trips	50

ROUTE LEGEND:

- To/From CityLink

Parkville Access Options

- Route 1 – Flemington Road
- Route 2 – Footscray Road, Wurundjeri Way, Dudley Street, Peel Street
- Route 3 – Flemington Road, Elliot Avenue, Macarthur Road, Royal Parade (one-way)
- Start / end of journey route access legs (to various site entrances)

To/From Other Worksites

- To/From Arden Site

- Railway Level Crossing
- Bridge mass restriction (tonnes)
- Bridge height restriction (metres)
- Proposed Construction Vehicle Standby Area
- Truck Curfew
- Indicative Site Location
- One- way route
- Routes includes Rigid Vehicle

Limitations:
The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

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ADVISIAN		1.3	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.2	21/03/16	SITE LOCATION UPDATE	KK	SB		
ADVISIAN		1.1	25/11/15	PROPOSED CONSTRUCTION VEHICLE STANDBY AREAS ADDITION	SB	JW		

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MELBOURNE METRO
PARKVILLE CONSTRUCTION VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East.	East.	
North.	North.	
ID#	ID#	

VicTrack ACCESS

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Approved	Approval Date
File Name	
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In Serv.	Drawing Number
Scale NTS	Sheet Size A3
Revision	1.3

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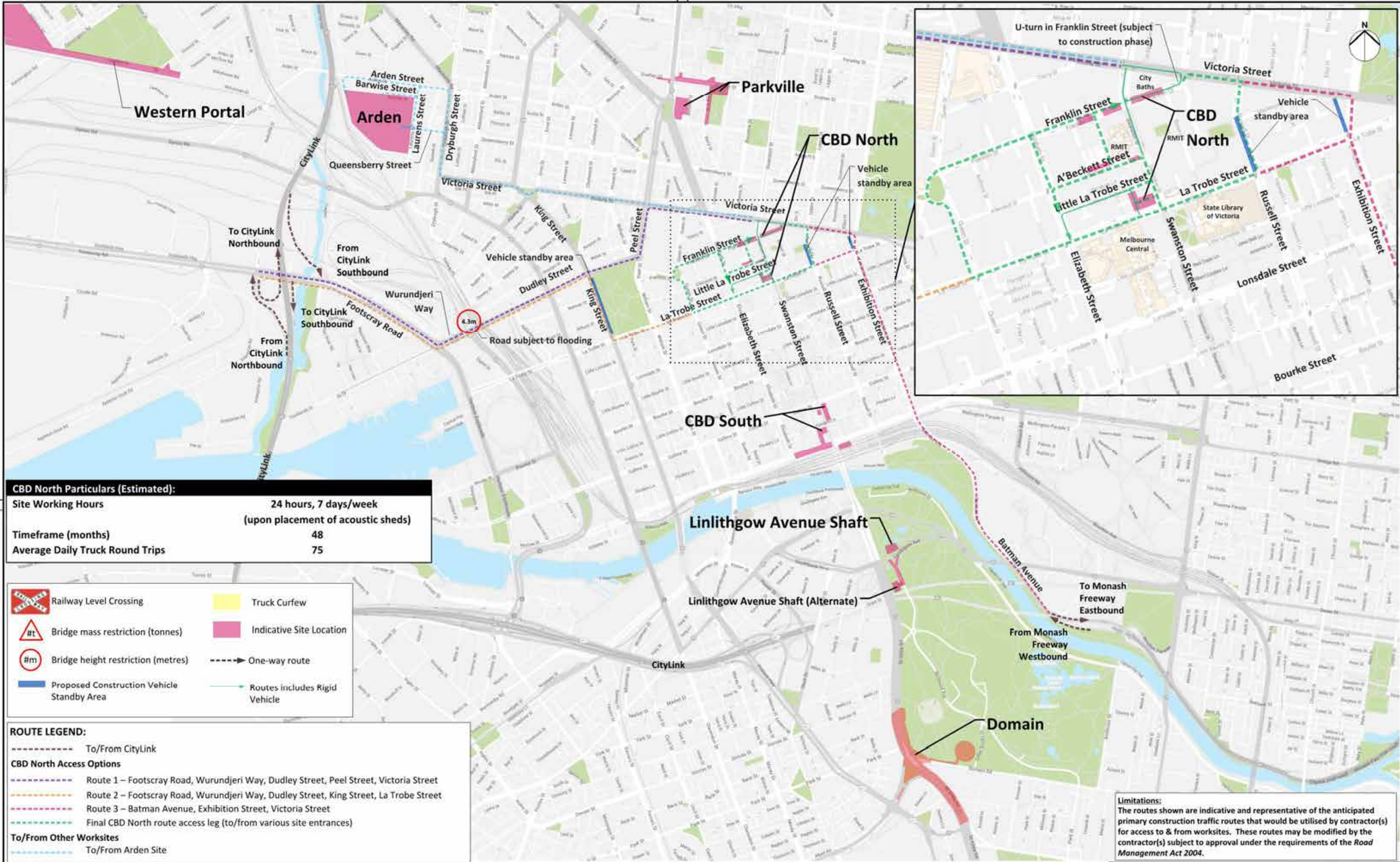

CBD North Particulars (Estimated):

Site Working Hours	24 hours, 7 days/week (upon placement of acoustic sheds)
Timeframe (months)	48
Average Daily Truck Round Trips	75

- Railway Level Crossing
- Truck Curfew
- Bridge mass restriction (tonnes)
- Indicative Site Location
- Bridge height restriction (metres)
- One-way route
- Proposed Construction Vehicle Standby Area
- Routes includes Rigid Vehicle

ROUTE LEGEND:

- To/From CityLink

CBD North Access Options

- Route 1 – Footscray Road, Wurundjeri Way, Dudley Street, Peel Street, Victoria Street
- Route 2 – Footscray Road, Wurundjeri Way, Dudley Street, King Street, La Trobe Street
- Route 3 – Batman Avenue, Exhibition Street, Victoria Street
- Final CBD North route access leg (to/from various site entrances)

To/From Other Worksites

- To/From Arden Site

Limitations:
The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

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Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
ADVISIAN		1.6	16/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.5	21/03/16	SITE LOCATION UPDATE	KK	SB		
ADVISIAN		1.4	16/02/16	REMOVAL OF PROPOSED QUEEN STREET VEHICLE STANDBY AREA	VG	JW		
ADVISIAN		1.3	08/01/16	MINOR AMENDEMENTS	VG	JW		
ADVISIAN		1.2	07/01/16	AMENDED VEHICLE STANDBY AREAS	SB	JW		
ADVISIAN		1.1	21/11/15	PROPOSED CONSTRUCTION VEHICLE STANDBY AREAS ADDITION	SB	JW		

Consultant: Advisian; Melbourne Metro Rail Authority

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MELBOURNE METRO
CBD NORTH CONSTRUCTION VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	

VicTrack ACCESS

File Name	
Sheet No.	01 of 01
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Scale NTS	Sheet Size A3
Drawn By SB	Designed By SB
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Approved	Approval Date
Drawing Number	Revision 1.6

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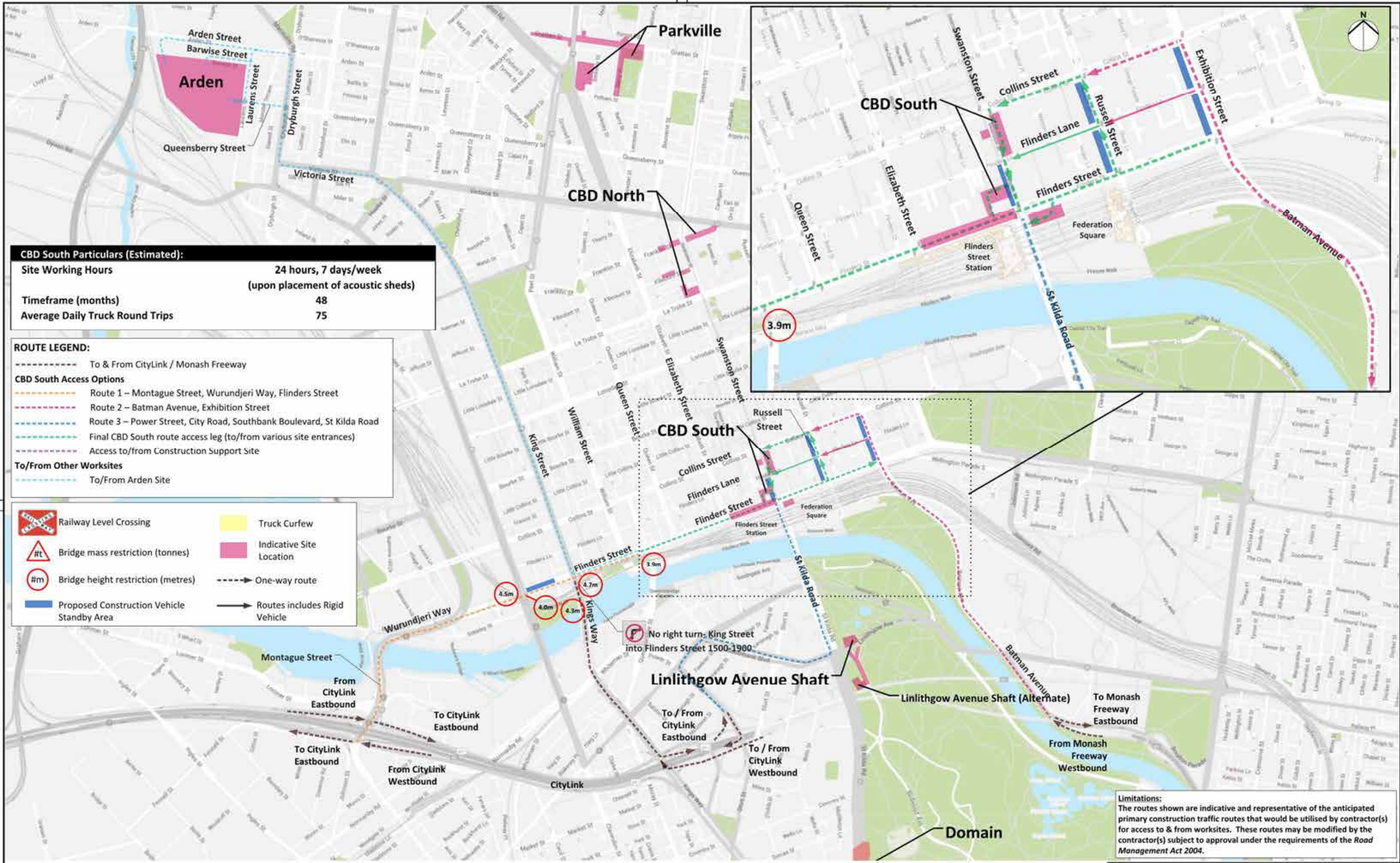

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MMR_ADV_PL_0002-SK005

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ADVISIAN		1.5	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.4	21/03/16	SITE LOCATION AMENDMENT	KK	SB		
ADVISIAN		1.3	08/01/16	MINOR AMENDMENTS – PARKING AND MINOR ROUTE CHANGES	SB	JW		
ADVISIAN		1.2	07/01/16	OUTBOUND ST KILDA ROAD ADDED. AMEND STANDBY ROUTES	SB	JW		
ADVISIAN		1.1	24/11/15	PROPOSED CONSTRUCTION VEHICLE STANDBY AREAS ADDITION	SB	JW		

Consultant

Advisian

MELBOURNE METRO RAIL AUTHORITY

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MELBOURNE METRO
CBD SOUTH CONSTRUCTION VEHICLE ACCESS ROUTES

Up Location East. North. ID#

Down Location East. North. ID#

Datum

VicTrack ACCESS

File Name

Sheet No. 01 of 01

In Serv.

Scale NTS | Sheet Size A3

Drawn By SB | Designed By SB

Checked By JW | Ind. Review

Approved | Approval Date

Drawing Number | Revision 1.5

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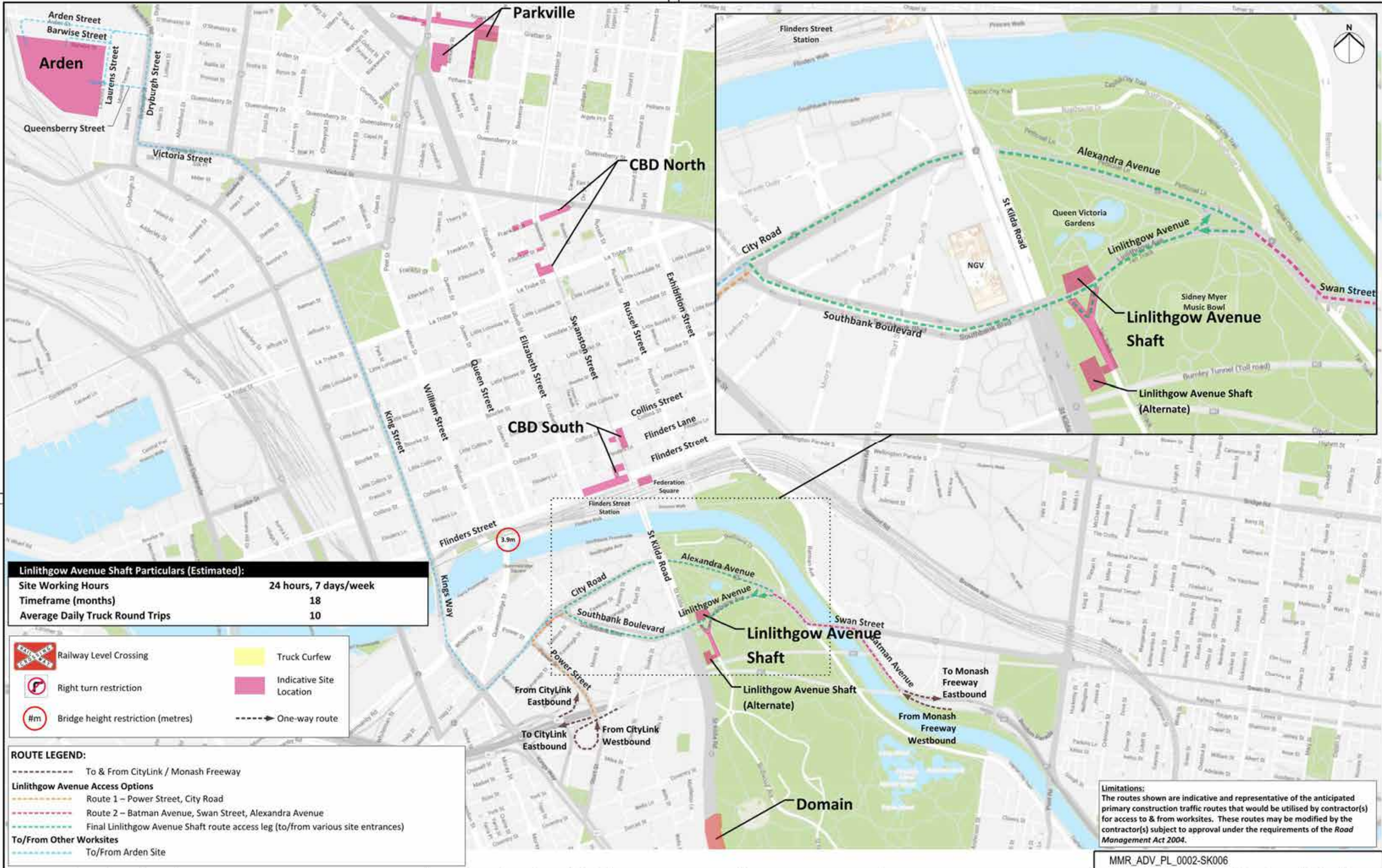

Linlithgow Avenue Shaft Particulars (Estimated):	
Site Working Hours	24 hours, 7 days/week
Timeframe (months)	18
Average Daily Truck Round Trips	10

ROUTE LEGEND:

- To & From CityLink / Monash Freeway

Linlithgow Avenue Access Options

- Route 1 – Power Street, City Road
- Route 2 – Batman Avenue, Swan Street, Alexandra Avenue
- Final Linlithgow Avenue Shaft route access leg (to/from various site entrances)

To/From Other Worksites

- To/From Arden Site

Limitations:
The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

MMR_ADV_PL_0002-SK006

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
ADVISIAN		1.2	16/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.1	21/03/16	SITE LOCATION UPDATE	KK	SB		

Consultant: Advisian — Melbourne Metro Rail Authority

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MELBOURNE METRO
LINLITHGOW AVENUE CONSTRUCTION
VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East.	East.	
North.	North.	
ID#	ID#	

VicTrack ACCESS

File Name
Sheet No. 01 of 01
In Serv.
Scale NTS | Sheet Size A3

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Checked By JW | Ind. Review
Approved | Approval Date
Drawing Number | Revision 1.2

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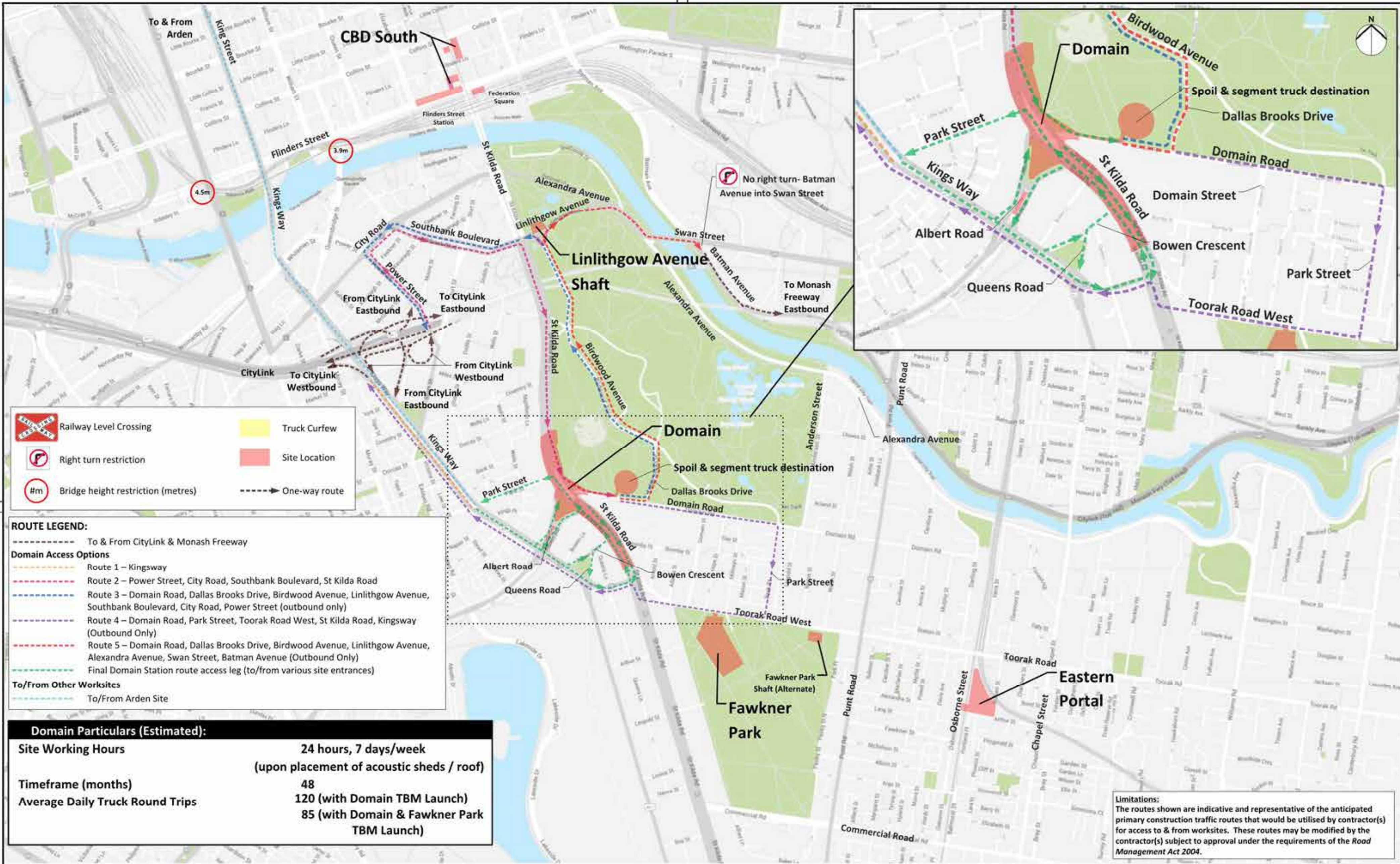

Domain Particulars (Estimated):

Site Working Hours	24 hours, 7 days/week (upon placement of acoustic sheds / roof)
Timeframe (months)	48
Average Daily Truck Round Trips	120 (with Domain TBM Launch) 85 (with Domain & Fawkner Park TBM Launch)

Limitations:
The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

MMR_ADV_PL_0002-SK007

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ADVISIAN		1.4	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.3	12/04/16	MINOR CORRECTION TO ROUTE LEGEND	MH	SB		
ADVISIAN		1.2	17/03/16	UPDATE AS SHARED TBM LAUNCH SITE	MH	SB	JW	
ADVISIAN		1.1	05/03/16	ADDED ALBERT ROAD INBOUND SITE ROUTE	SB	JW		

Consultant: Advisian — MELBOURNE METRO RAIL AUTHORITY

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MELBOURNE METRO
DOMAIN CONSTRUCTION VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	

VicTrack ACCESS

File Name	
Sheet No.	01 of 01
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Scale NTS	Sheet Size A3
Drawn By SB	Designed By SB
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Approved	Approval Date
Drawing Number	Revision 1.4

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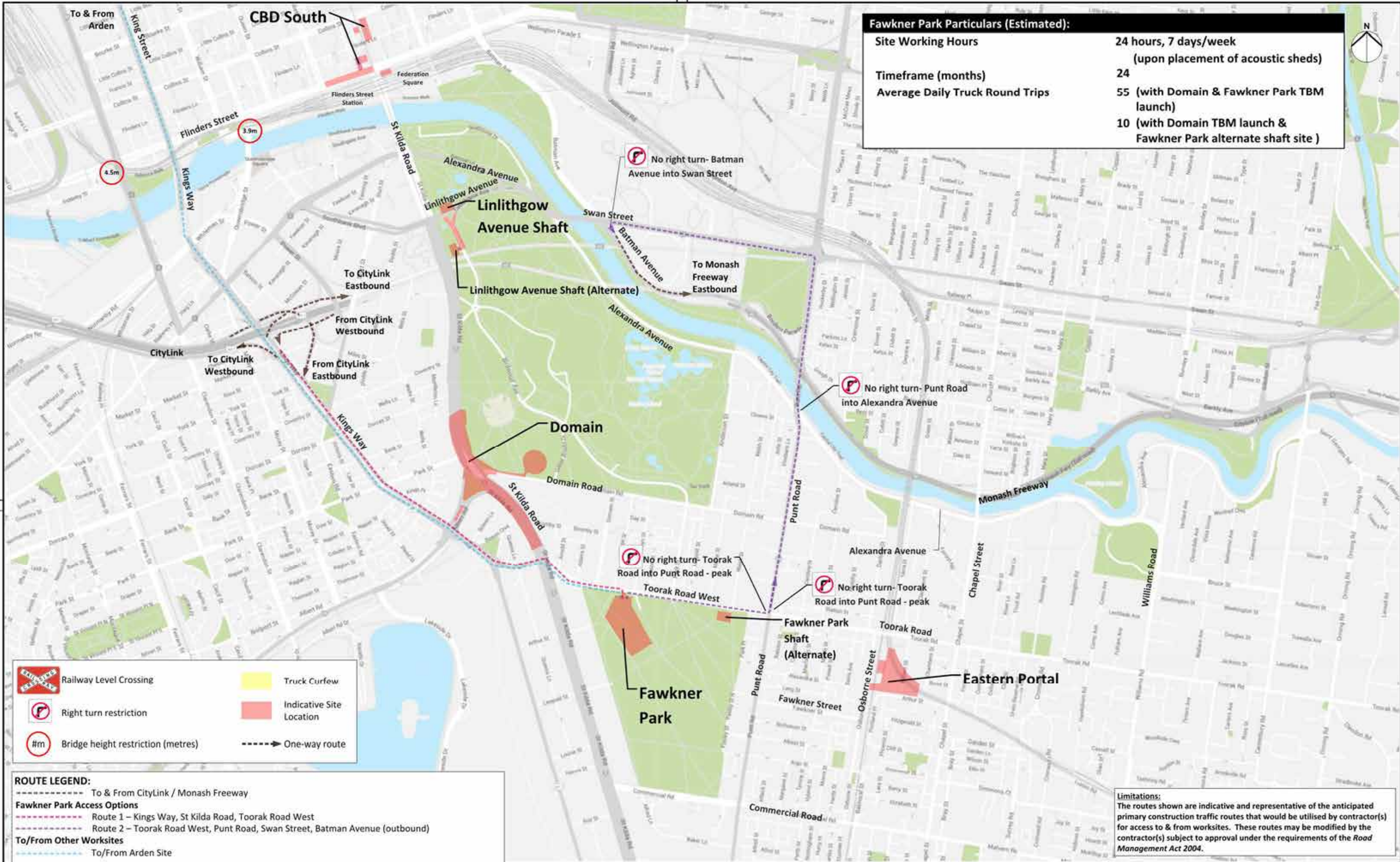

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Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
ADVISIAN		1.3	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.2	21/03/16	SITE LOCATION UPDATE	KK	SB		
ADVISIAN		1.1	17/03/16	UPDATE AS TBM LAUNCH SITE	MH	SB		

Consultant: Advisian — Melbourne Metro Rail Authority

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MELBOURNE METRO
FAWKNER PARK CONSTRUCTION VEHICLE ACCESS ROUTES

VicTrack ACCESS

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Designed By	SB
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Approval Date	
File Name	
Sheet No.	01 of 01
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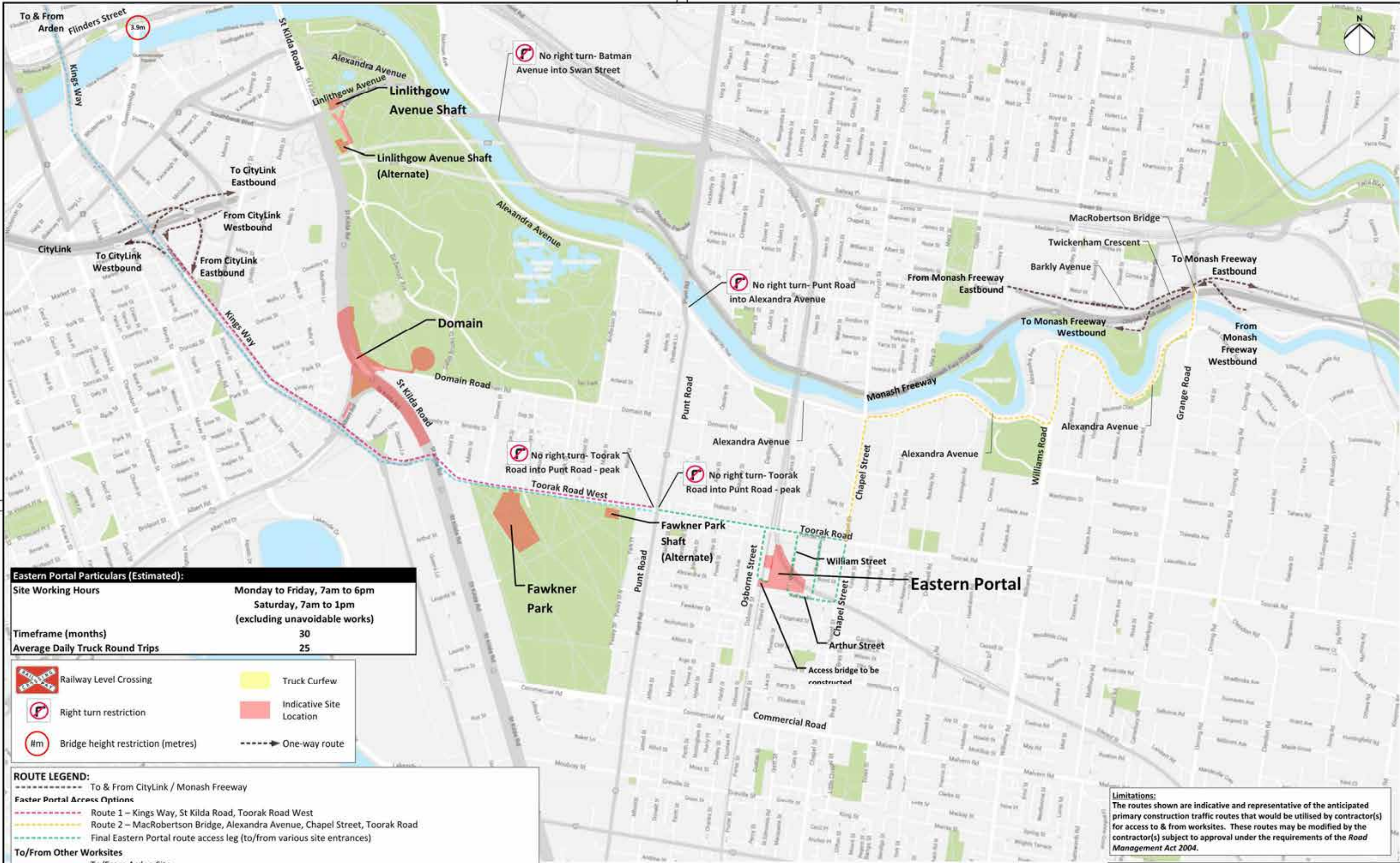

Eastern Portal Particulars (Estimated):

Site Working Hours	Monday to Friday, 7am to 6pm Saturday, 7am to 1pm (excluding unavoidable works)
Timeframe (months)	30
Average Daily Truck Round Trips	25

Railway Level Crossing
Truck Curfew
Right turn restriction
Indicative Site Location
#m Bridge height restriction (metres)
One-way route

ROUTE LEGEND:

To & From CityLink / Monash Freeway

Easter Portal Access Options

Route 1 – Kings Way, St Kilda Road, Toorak Road West
Route 2 – MacRobertson Bridge, Alexandra Avenue, Chapel Street, Toorak Road
Final Eastern Portal route access leg (to/from various site entrances)

To/From Other Worksites

To/From Arden Site

Limitations:
The routes shown are indicative and representative of the anticipated primary construction traffic routes that would be utilised by contractor(s) for access to & from worksites. These routes may be modified by the contractor(s) subject to approval under the requirements of the *Road Management Act 2004*.

MMR_ADV_PL_0002-SK009

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
ADVISIAN		1.3	14/04/16	ENVIRONMENTAL EFFECTS STATEMENT ISSUE	MH	SB		
ADVISIAN		1.2	21/03/16	SITE LOCATION UPDATES	KK	SB		
ADVISIAN		1.1	24/02/16	ROUTE UPDATES	SB	JW		

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MELBOURNE METRO RAIL AUTHORITY

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MELBOURNE METRO
EASTERN PORTAL CONSTRUCTION VEHICLE ACCESS ROUTES

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	

VicTrack ACCESS

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File Name		Approved	Approval Date
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In Serv.		Drawing Number	Revision 1.3
Scale NTS	Sheet Size A3		

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Appendix D

Transport Modelling Summary

Melbourne Metro Rail Project

MMR-AJM-WNAA-RP-KR-001323

Transport Modelling Summary Report

Melbourne Metro Rail Authority

20 April 2016

Revision: C1

Reference: CMS332569

Aurecon Jacobs Mott MacDonald
in association with Grimshaw

AJM Joint Venture

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Report title		Transport Modelling Summary Report				
Document ID		MMR-AJM-WNAA-RP-KR-001323			**Contract No.**	CMS332569
File path						
Client		Melbourne Metro Rail Authority		**Client contact**	Daniel Cullen	
Rev	**Date**	**Revision details/status**	**Prepared by**	**Author**	**Verifier**	**Approver**
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Appendices

Appendix A

Outline of Modelling Tools

Appendix B

Traffic Signal Timing Changes

Glossary and Abbreviations

Term	Definition
Aimsun V8.1	Industry standard traffic simulation transport modelling software, developed by TSS - Transport Simulation Systems
AJM-JV	Aurecon Jacobs Mott McDonald Joint Venture
CBD	Central Business District
ClicSim	City Link Inner Core Simulation - Rail simulation modelling software
DDA	Disability Discrimination Act
DELWP	Department of Environment, Land, Water and Planning
DoS	Degree of Saturation, a measurement of vehicle demand to capacity
EE Act	Environment Effects Act 1978
EES	Environment Effects Statement
IDM	Traffic signal operation statistics
LGA	Local Government Authority
Melbourne Metro	Melbourne Metro Rail Project
MTPF Act	Major Transport Project Facilitation Act 2009
MURL	Melbourne Underground Rail Loop
OD	Origin-destination
PBN	Principal Bicycle Network
PT	Public transport
PTV	Public Transport Victoria
RM Act	Road Management Act 2004
SCATS®	SCATS® (Sydney Coordinated Adaptive Traffic System) is an adaptive urban traffic management system that synchronises traffic signals to optimise traffic flow across a whole city, region or corridor.
Sidra Intersection V6.0	Industry standard software package to model intersections and network capacity
SPPF	State Planning Policy Framework
TBM	Tunnel Boring Machine
VCCC	Victorian Comprehensive Cancer Centre
VISSIM V5.4	Microsimulation model developed by PTV Planung Transport Verkehr AG
VITM	Victorian Integrated Transport Model

1 Introduction

1.1 Project Description

The proposed Melbourne Metro Rail Project (Melbourne Metro) comprises two nine-kilometre long rail tunnels from Kensington to South Yarra, travelling underneath Swanston Street in the CBD, as part of a new Sunbury to Cranbourne/Pakenham line.

The infrastructure proposed to be constructed as part of Melbourne Metro broadly comprises:

- Two nine-kilometre rail tunnels from Kensington to South Yarra, travelling underneath Swanston Street in Melbourne’s Central Business District (CBD), connecting the Sunbury and Cranbourne/Pakenham railway lines. The tunnels would be used by electric trains.
- New underground stations at Arden, Parkville, CBD North, CBD South and Domain. CBD North and CBD South will feature direct interchange with the existing Melbourne Central and Flinders Street stations respectively
- Train/tram interchanges at Parkville and Domain stations
- Rail tunnel entrances at Kensington and South Yarra.

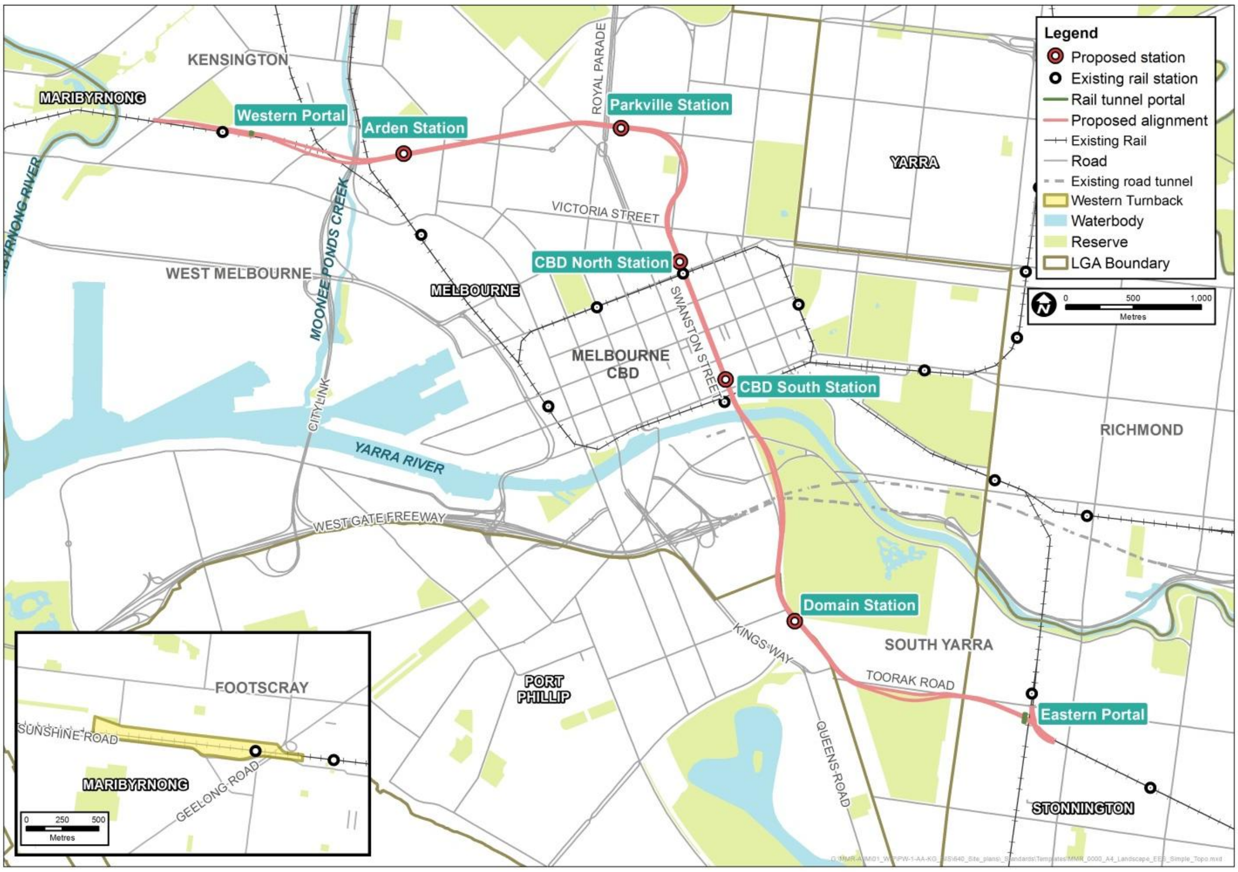


Figure 1-1 Map of the proposed Melbourne Metro Rail Project alignment and five proposed underground stations

Construction methods would involve bored and mined tunnels, top down construction of the station boxes, and portals. The project will require planning, environmental and land tenure related approvals to proceed.

1.2 Project Summary

Table 1-1 below provides a summary of the components of the Concept Design and where present alternative design option to the Concept Design. The components are shown on the plans contained in Map Book A.

Table 1-1 Summary of EES Concept Design and Alternative Design Options

Components		Concept design	**Alternative design option**
Tunnels	Vertical Alignment	Project Vertical Alignment	-
	Yarra River Crossing	Tunnel boring machine (TBM) under the river	-
	CityLink tunnels crossing*	Above CityLink tunnels	Below CityLink tunnels
	TBM southern launch site	Fawkner Park open space and tennis courts Domain Launch site	-
	Emergency access shafts	Fawkner Park north east location (Option 5)	Option 2 – Using the location of the preferred Fawkner Park TBM launch site
		Linlithgow Avenue: located in Queen Victoria Gardens (option 1)	Located in Tom's Block (Option 3)
Portals	Western Portal (Kensington)	50 Lloyd Street Business Estate – TBM Retrieval box and a shorter decline structure (Option 1)	-
	Eastern Portal (South Yarra)	TBM shaft in the rail reserve between Osborne Street and the existing Sandringham line (Option 1)	-
Underground Stations	Arden	Aligned between Arden and Queensberry Streets, contained in VicTrack land (Option D4) – Box construction	-
	Parkville	Located under Grattan Street road reserve, to the east of Royal Parade (Option 3) Cut and cover construction proposed, with top-down method	Bottom up cut and cover construction
	CBD North	Located under Swanston Street, between Franklin and La Trobe Streets Entrances on the east side of Franklin Street and on the corner of Swanston and La Trobe Streets, with underground connection to Melbourne Central station (Option 2), excluding 393 Swanston Street Plant room located under Franklin Street, between Swanston and Bowen Streets Cavern method of station tunnel construction	-
	CBD South	Located under Swanston Street, between Collins and Flinders Streets Collins Street entrance at City Square (*potential to include 65 and 67 Swanston Street)	-

Components		Concept design	Alternative design option
		Flinders Street entrance including Port Phillip Arcade with underground connection to Flinders Street station (Option 2) Underground entrance connection to Federation Square Cavern method of station tunnel construction	
	Domain	Located under St Kilda Road, adjacent to Albert Road Cut and cover construction proposed, with a mixture of both top down and bottom up	-
Turnback	Western Turnback	West Footscray - a third platform and track at West Footscray station, with modifications to existing concourse	-

* could be subject to change

1.3 Project Precincts

For assessment purposes, the proposed project boundary has been divided into precincts as outlined below. The precincts have been defined based on the location of project components and required construction works, the potential impacts on local areas and the character of surrounding communities.

The proposed precincts are:

- Precinct 1: Tunnels (outside other precincts)
- Precinct 2: Western Portal (Kensington)
- Precinct 3: Arden Station
- Precinct 4: Parkville Station
- Precinct 5: CBD North Station
- Precinct 6: CBD South Station
- Precinct 7: Domain Station
- Precinct 8: Eastern Portal (South Yarra)
- Precinct 9: Western turnback (West Footscray).

The transport modelling addressed in this report also considers the operation of the transport network in light of potential wider network enhancements to the metropolitan passenger rail network. The objective of these enhancements is to take advantage of the capacity uplift created by Melbourne Metro.

The proposed tunnel alignment and the various station precincts are shown in Figure 1-2:

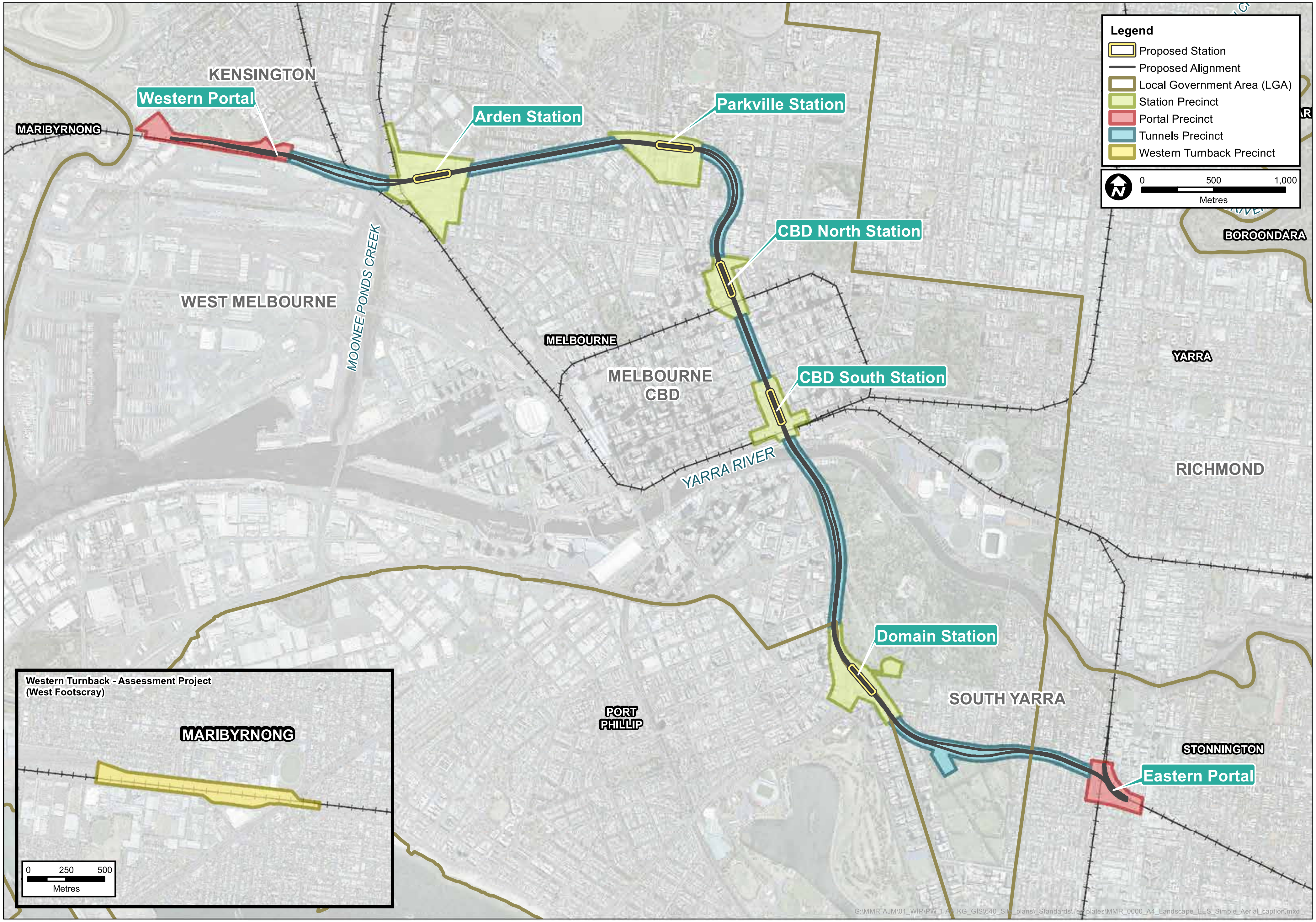


Figure 1-2 Melbourne Metro precincts

2 Methodology

2.1 Overview of Modelling Approach

The complexity of Melbourne Metro and the breadth of the network has meant that a number of different modelling packages have been used to test and understand the issues at each precinct.

Different modelling tools have been applied at different precinct locations depending on the precinct complexity and the type of issues to be addressed (further details are included in Appendix A):

- ***Victorian Integrated Transport Model (VITM)*** is the State Government's strategic transport model. VITM has been used by Public Transport Victoria for the development of the broad patronage forecasts and the demands across the network for each forecast year
- ***ClicSim*** is a passenger simulation model of the Melbourne rail system originally developed to assess the capacity of the City Loop and Inner Core (CLIC) stations; it has been used for the development of pedestrian flows at each station portal and to generate pedestrian flows around key inner city precincts
- ***Aimsun*** is a mesoscopic/micro-simulation hybrid model, which can model different areas as either micro-simulation or mesoscopic areas within the same model and has been used to assess the Parkville Station Precinct in greater detail due to the complexity of issues around that precinct
- ***VISSIM*** is a micro-simulation traffic model that models individual vehicles through a small/medium network and has been used to assess the Domain station precinct in greater detail due to the complexity of issues around that precinct
- ***Sidra*** is an industry standard traffic model used to assess the performance of individual intersections or small networks. The model is a micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive models. Selected intersections have been modelled in the CBD North and CBD South precincts.

For the purposes of the transport impact assessment report (for the EES) the models have been tailored to evaluate issues around each precinct on a case-by-case basis as indicated. The transport impact assessment is required to consider and evaluate the impacts of the changes at each precinct for the following scenarios:

- Base year models to reflect the ***existing conditions*** – 2011 is the Base Year for VITM, 2012 is the Base Year for ClicSim and 2015 is the Base Year for Aimsun, VISSIM and Sidra models
- Future conditions models to reflect the 2021 and 2031 No Project Case – to understand the differences between the existing conditions and the 2021 and 2031 conditions if Melbourne Metro was ***not built***
- Future conditions models to reflect the 2021 Melbourne Metro Construction – to understand the differences between the 2021 conditions if Melbourne Metro was ***not built*** and the 2021 conditions ***with Melbourne Metro being constructed.***
- Future conditions models to reflect Melbourne Metro – to understand the differences between the 2031 conditions if Melbourne Metro was ***not built*** and the 2031 conditions ***with Melbourne Metro complete.***

Modelling has been undertaken to analyse road network conditions and pedestrian conditions for each of these model years. Analysis of public transport operations and bicycle operating conditions has been assessed separately by the transport team.

2.2 Overall Approach

The role of transport modelling is to undertake quantitative analysis and assessment to support achievement of the Technical, Planning and Stakeholder services. It is an intrinsic part of project development.

Figure 2-1 below shows the development of the overall strategy for Melbourne Metro. AJM-JV appreciates that in order to meet the objectives and requirements of the project a range of transport modelling analytical tools is required. Any understanding of station operations, traffic and transport activities needs to consider all modes of transport including walking and cycling. This is consistent with the requirements of the *Transport Integration Act 2010*. Therefore, tools have been used that analyse not only cars, or traffic, but also pedestrians, trams, buses, etc. Consideration has also been given to interchange between modes.

In addition, these tools need to provide understanding at different levels of detail depending on the stage of the design and time in project development. Consequently at an early stage more strategic high level tools have been used more detailed tools have been used later. The principal software packages/models used are:

- VITM; strategic model
- ClicSim; pedestrian model including station demands
- Aimsun; hybrid mesoscopic and microsimulation traffic model
- VISSIM; microsimulation traffic and transport model
- Sidra; for local intersection analysis
- Bicycle Model; City of Melbourne bicycle model.

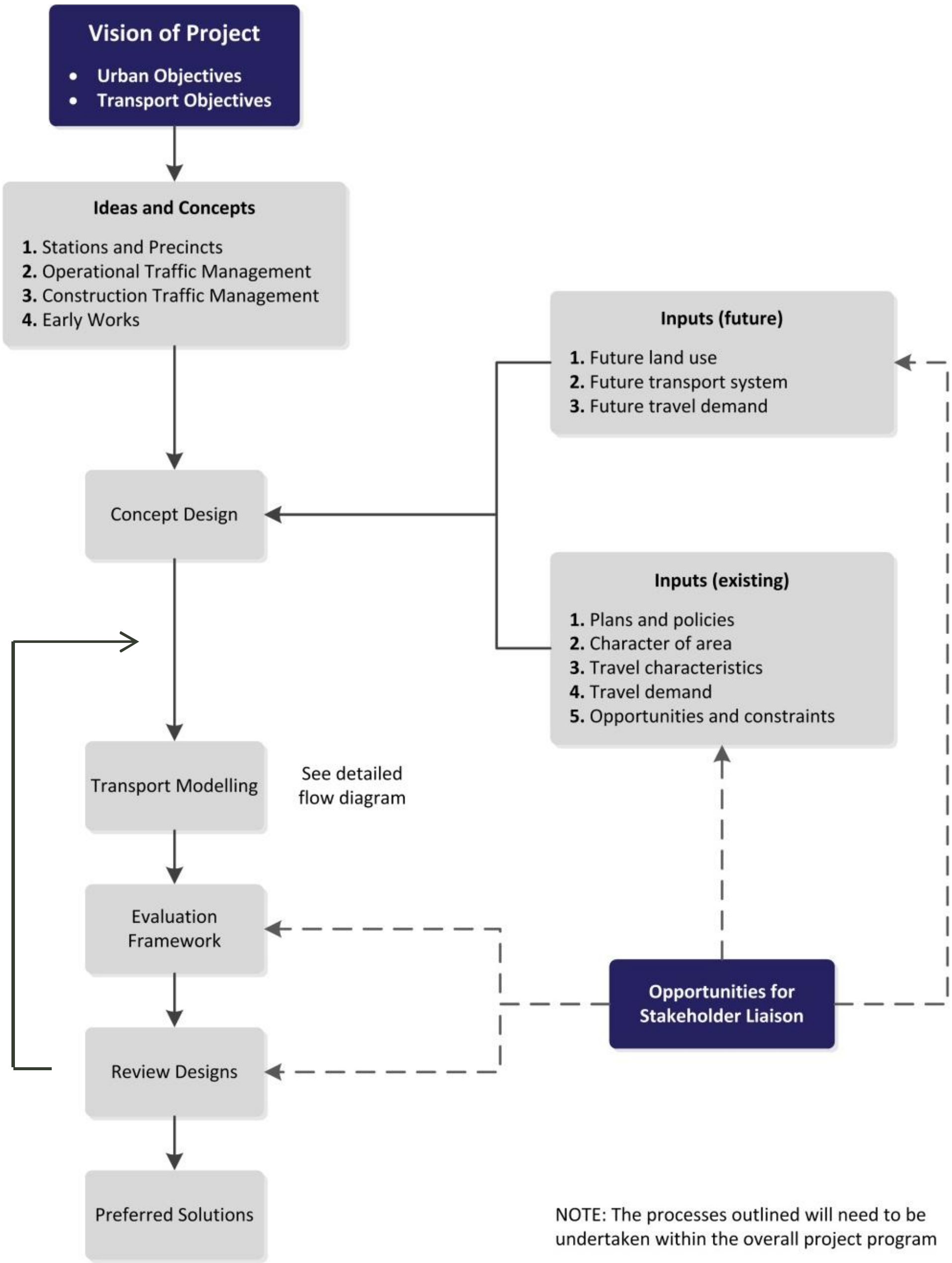


Figure 2-1 Transport modelling strategy

Public Transport Victoria will be providing inputs via other models that they manage and operate.

Public Transport Victoria's role in Melbourne Metro is to develop forecasts that would be used for:

- Development of public transport (train, tram and bus) service plans by Public Transport Victoria
- Determination of benefits to inform the economic evaluation of the project by Public Transport Victoria
- Underpin the development of requirements that specify scope and the design of new heavy rail infrastructure including stations to MMRA
- Provide a starting point for MMRA to develop more detailed localised project related forecasts.

The VITM model, which is maintained by DEDJTR and provided to Public Transport Victoria, has been the primary source of data. Public Transport Victoria has made enhancements for public transport in the VITM model to support Melbourne Metro, as well as developing CLICSIM station forecasts and passenger dwell times.

Melbourne Metro VITM enhanced model has been provided to AJM-JV. The forecasts have been developed in context of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR)'s demand modelling framework.

Figure 2-2 shows more detail in the approach to applying pedestrian and traffic modelling to inform design development (and the key aspects of the design that are dependent on this analysis and understanding of impacts.

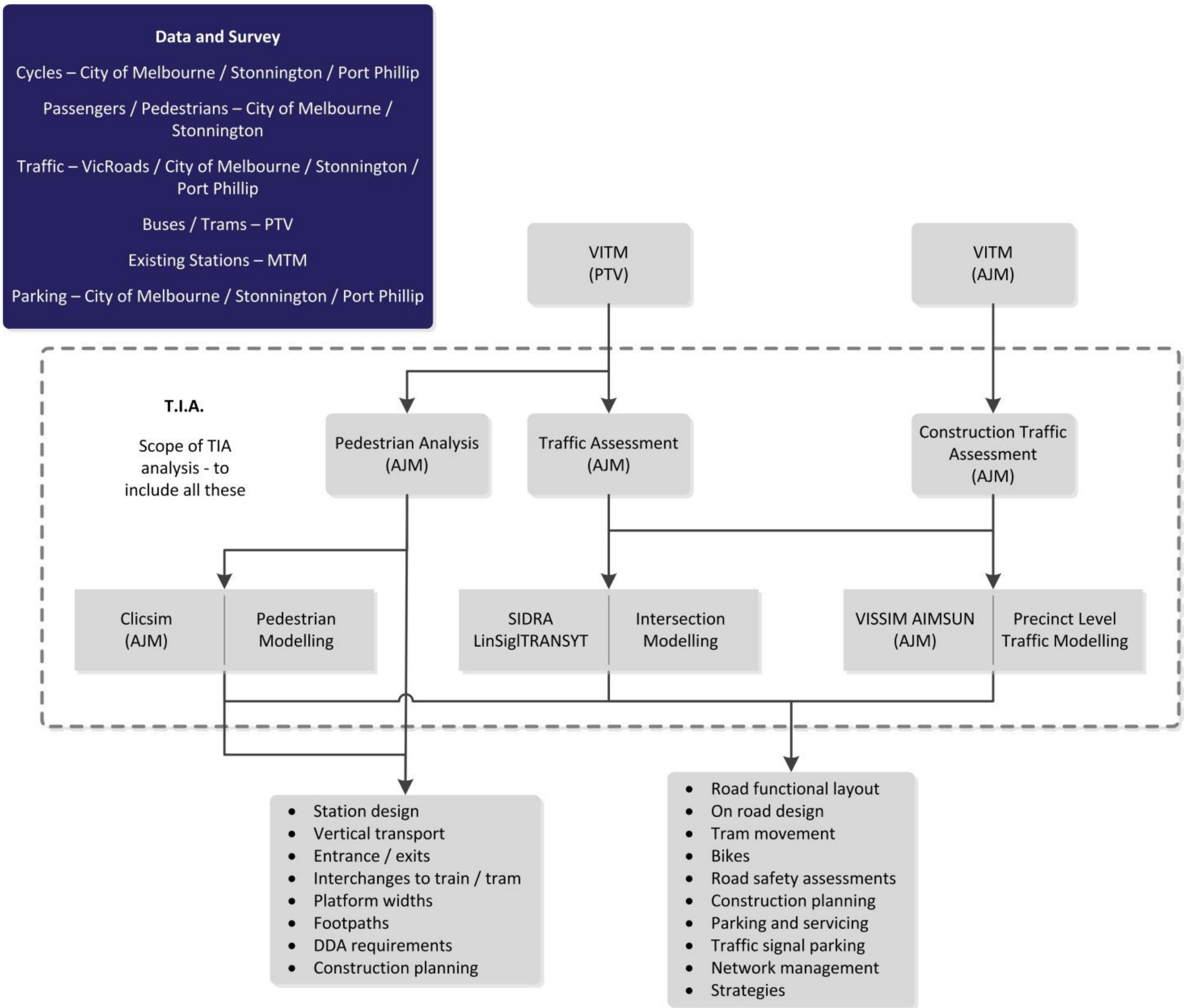


Figure 2-2 Modelling strategy process

2.3 Modelling Tools

2.3.1 Background

A range of transport models have been used to support design development, undertake the assessment and analysis ranging from the strategic level through to the micro and considering all modes of transport. The principal software packages/models used are outlined below.

2.3.2 VITM

VITM is the State's in-house strategic demand model which is managed and maintained by DEDJTR. It is a multi-modal analytical tool which forecasts travel and can be used to look at alternate travel by private vehicles and public transport in response to various transport infrastructure and land use planning scenarios.

Public Transport Victoria is using VITM for Melbourne Metro to forecast public transport and road system usage including MTM patronage for a number of scenarios. This would be used to inform Melbourne Metro passenger demand and traffic volumes (at a strategic level) used in the various pedestrian and traffic modelling described below e.g. through station entry and exit patronage forecasts. Public Transport Victoria has made enhancements to the original VITM model for this purpose.

For pedestrian modelling, VITM is being used to inform passenger distribution from the stations to the surrounding areas and interchange with other public transport. For traffic modelling, VITM is being used to inform the wider traffic impacts of key phases of construction (for example closure of a road) and operational impacts of the project. In particular, VITM is used to compare the incremental change in traffic flow and distribution between the base case and scenarios, rather than provide absolute traffic volumes.

2.3.3 ClicSim

ClicSim is a passenger simulation model of the Melbourne rail system originally developed to assess the capacity of the City Loop and Inner Core (CLIC) stations. The model was used for work on Melbourne Metro in 2010 to assess capacity requirements at CBD North and CBD South stations. The model was subsequently recalibrated in 2014 as part of the former Melbourne Rail Link (MRL) project, and has now been updated to include all of the proposed Melbourne Metro stations.

The ClicSim model is a dynamic passenger simulation that models the location of trains and passengers on a second-by-second basis across the entire metropolitan rail network.

The inputs to the model are:

- A representation of the rail network and walking networks in each station
- Station-to-station origin-destination matrices of passenger demand at a particular time period (AM and PM peaks)
- The proposed train timetable.

The primary outputs from the model are:

- Pedestrian volumes in each part of the modelled stations (e.g. gate lines, platforms, concourses, vertical transport)
- Pedestrian levels of service (based upon Fruin) in each station on a minute-by-minute basis
- Train loads
- Boarding, alighting and transfer volumes.

The main application of the model is in providing forecasts of future passenger volumes to assist in the design of each station element and providing level of service evaluations for each station.

2.3.4 Aimsun

Aimsun is a mesoscopic/micro-simulation hybrid traffic modelling tool, which can model different areas as either micro-simulation or mesoscopic areas within the same model. Aimsun can be used to simulate SCATS signal operation at individual sites or across a network; and has a SCATSIM capability. The model incorporates all road based vehicles e.g. cars, trucks, trams, etc.

For the project Aimsun would be applied as mesoscopic/micro-simulation hybrid where understanding of both local and network operations due to construction or operations are expected to be significant and potentially lead to some redistribution of traffic. The models would be used to inform local network design and area assessment. The VITM model would be used to provide inputs on wider strategic impacts and origin and destinations information.

2.3.5 VISSIM

VISSIM is a traffic micro-simulation traffic model that models individual vehicles through a small/medium network. VISSIM can be used to simulate SCATS signal operation at individual sites or across a network. The model can be used to identify traffic impacts and inform local network design and area assessment. VITM would provide inputs on potential changes in wider traffic patterns. All road vehicles, bicycles and pedestrians can be modelled.

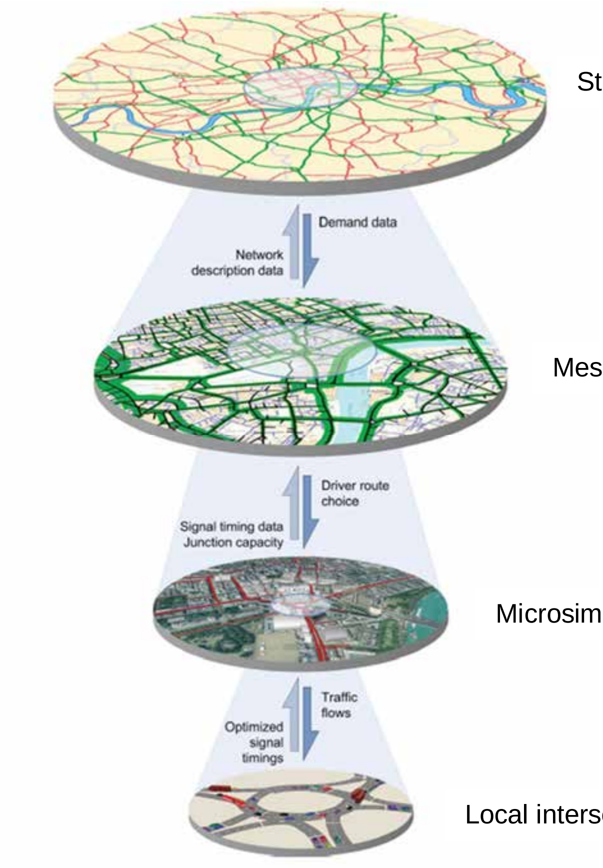
2.3.6 Sidra

Sidra is an Australian industry standard traffic model used to assess the performance of individual intersections or small networks. The model is a micro-analytical traffic evaluation tool that employs lane –by-lane and vehicle drive models. It can be used to compare alternative treatments of individual intersections or small networks. Sidra allows modelling of separate modes (light vehicles, trucks, buses, cycles, trams etc.) which can be allocated to different lanes, lane segments and signal phases. Sidra is a relatively cost effective model to assess local impacts of transport projects.

Other software, namely LinSig, may be used for the review and assessment of design improvements along corridors to which they are more suited.

2.3.7 Traffic Modelling Hierarchy

Figure 2-3 below shows the general recognised hierarchy of traffic and transport models.



Strategic Transport Model

Mesoscopic Model

Microsimulation / Network signal model

Local intersection Model

Source: Transport for London (2010)

Figure 2-3 Transport modelling hierarchy

The hierarchy of models to be applied is presented in Table 2-1 below.

Table 2-1 Transport modelling hierarchy

Type of analysis	Traffic and transport model	Rail model	Pedestrian model
Strategic	• VITM • Bicycle Model	• VITM	• ClicSim
Mesoscopic	• Aimsun	• ClicSim	• ClicSim
Network	• Vissim • Aimsun • LinSig		• ClicSim
Local	• Sidra • Vissim • Aimsun		

2.3.8 Modal Coverage

As identified it is important that the modelling considers the benefits and impacts across all modes in the design development and impact assessment planning in accordance with the *Transport Integration Act 2010* and the VicRoads SmartRoads approach to scheme assessment. Table 2-2 below identifies which modes are covered by which models.

Table 2-2 Overview of Melbourne Metro surface transport modelling

Mode	VITM	CLIMSIM	AIMSUN (Mesoscopic)	Bicycle model	AIMSUN (Microsimulation)	VISSIM	LinSig/	SIDRA
Trains	X	x						
Cars/trucks, etc.	X		X		x	x	x	x
Buses	X		X		x	x	x	x
Trams	X	Indirect	X		x	x	x	x
Bicycles				x		x		
Pedestrians		x			Limited	Limited	x	

2.4 Data Inputs

2.4.1 Inputs

A range of inputs are required for the transport modelling. These are identified in Table 2-3:

Table 2-3 Data Inputs into transport models

Input	Provider
Road geometry, layouts and street furniture	VicRoads City of Melbourne City of Port Phillip City of Stonnington
Station geometry of each station would be obtained from architectural drawings and models	AJM-JV
Construction staging and network changes	Constructability advisor AJM-JV
VITM Models for: • 2011 • 2021 • 2031 • 2046	Public Transport Victoria
Origin-destination matrices of passenger demand during the AM and PM peaks from VITM forecasts	Public Transport Victoria
Proposed future train timetables would be supplied by Public Transport Victoria from its RailSys model	Public Transport Victoria
Tram timetables	Public Transport Victoria
ClicSim to provide pedestrian demand and origins-destinations	Public Transport Victoria/AJM-JV
Various data from VITM for: traffic volumes along links and sub-area OD matrices for use in Traffic modelling	Via Public Transport Victoria supplied model
SCATS, IDM and other signal data for intersections	VicRoads
Existing traffic and pedestrian flow data – provided by stakeholders	VicRoads City of Melbourne City of Port Phillip City of Stonnington
Bicycle Model	City of Melbourne
Tram boarding and alighting data	Public Transport Victoria
New traffic and pedestrian survey data	AJM-JV to collect

2.4.2 Model Years

The design and assessment of the Project has to take account of a number of time horizons that consider construction, business case and design capacities. This has been influenced by the availability of VITM strategic models that are provided starting with 2011, and then 2021, 2031 and 2046. The following time scenarios have been considered:

- **2011 – Current Year**: based on VITM model to establish current travel patterns and behaviours
- **2015 – Survey Year**: various traffic surveys were undertaken in 2015 to support the collection of base data and provide greater detail on our understanding of the various transport networks
- **2021 – Construction Year**: the 2021 VITM model provides a suitable time horizon for this work to start and has been used to assess construction impacts

- **2031 – Opening Year:** the nearest approximation to the year Melbourne Metro would open. Initially identified as the Day 1 assessment year.

2.5 Pedestrian Modelling

The purpose of the pedestrian modelling is to provide pedestrian forecasts for Melbourne Metro stations and precincts to enable designers and planners to provide for anticipated future pedestrian volumes. The modelling also provides an understanding of the level of service of the different layouts for pedestrians, allowing both design refinement and scheme assessment.

The modelling draws on demand forecasts for Melbourne Metro from VITM. The VITM forecasts are based on land use and network assumptions that reflect current government policy.

New station layouts have been coded with the ClicSim passenger demand simulation model for each station (including a refresh of Flinders Street and Melbourne Central stations).

Outputs include the station levels of service, forecast pedestrian volumes, boardings and alightings and train loads.

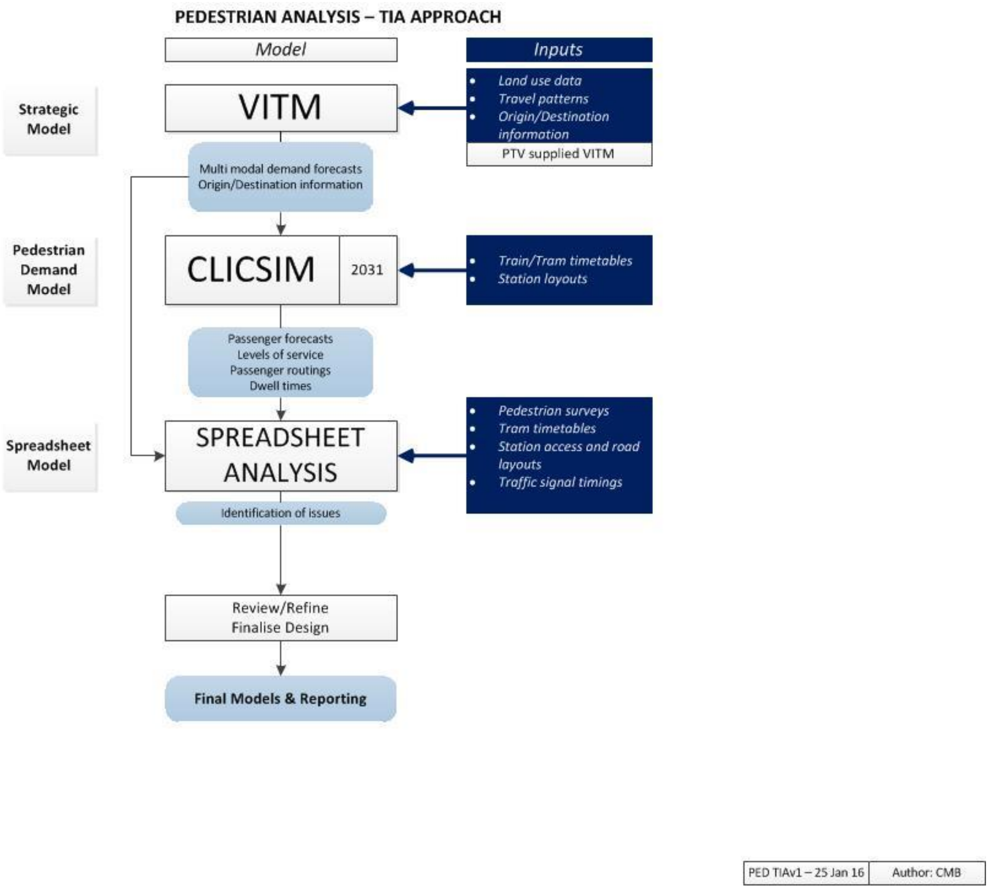


Figure 2-4 Pedestrian modelling approach

ClicSim has been supplemented with spreadsheet analysis, mainly at the precinct level, to assist in understanding the distribution of passengers from station exits to nearby tram stops and walking destinations.

The transport impact assessment uses volumes extracted from the ClicSim results which align with strict time windows around the peak periods. These were 07:00-09:00 in the AM model runs, and 16:30-18:30 for the PM model runs. Only entries, exits, and transfers that occur during these time windows are included in the totals.

Figure 2-5 shows how passenger transfers between station platforms were calculated. Transfers occur within stations between platforms as well as between stations where there is a pedestrian connection between two stations such as Flinders Street Station and CBD South station.

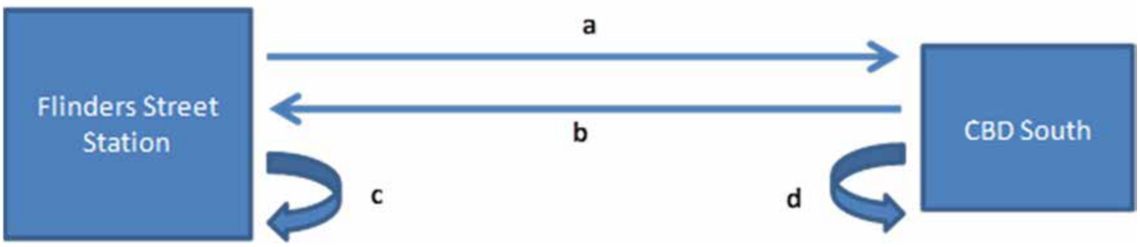


Figure 2-5: Transfer types

2.6 Traffic Modelling

The modelling of the highway network has been undertaken at various levels of modelling detail across the project lifecycle. This section outlines the different approaches, and modelling tools used, for the different stages of the Project covering, in order of discussion:

- Main construction
- Operational state.

2.6.1 Main Construction

The main construction activities relate to works around the stations boxes, ventilation shafts and TBM launch sites. Consideration is required of individual site activities, as well as the combined concurrent activities based on all worksites being in operation simultaneously. Figure 2-6 illustrates the approach identifying the transport models used, the inputs and potential outputs and deliverables. Optioneering and scenario testing has been an ongoing part of this work and a number of model runs have been undertaken.

The design year of 2021 has been applied with analysis of the morning and evening peaks only. Comparison with the 2011 VITM has been undertaken at a strategic level with consideration of current 2015 flows for aspects of the other work.

The VITM 2021 strategic model, supplied by Public Transport Victoria, has been used to understand potential impacts at a Melbourne wide level. This model has been updated to include agreed network changes, and changes to tram and bus operations and tram diversion works. The model has then been used to test different construction traffic management scenarios which are discussed with MMRA and others.

The outputs from the VITM models have been used two ways.

- To provide an initial indication of the potential scale of change, including diversion routes and flow changes
- Using agreed scenarios the data outputs such as flow changes, new origin and destination patterns have been analysed and used to produce amended matrices for the different worksite models at the operational level.

There are some issues with directly using VITM, or any strategic model outputs, at an operational level due to the strategic nature of the models. AJM-JV would document how these results are used in the operational models.

Each worksite is being modelled at an operational model using more detailed tools ranging from mesoscopic and microsimulation models through to individual intersection models in SIDRA. Initial testing and option development may use single site SIDRA models to understand potential impacts of different options before the more comprehensive modelling takes place.

2.6.2 Legacy State

The traffic modelling for the station precincts follows a similar approach to the construction activity modelling. It is intended that the same models are generally used to test both states. The design year of 2031 has been applied with analysis of the morning and evening peaks only. Comparison with 'No Project' scenarios has been undertaken to provide greater context to the benefits and impacts of the project and support the transport impact work for the EES.

Inputs to the models come from a range sources with the intention to develop and refine, including:

- Tram schedules and timetables
- Tram stop layouts
- Road layouts
- Traffic signal timings and methods of control including pedestrian timings.

The approach is outlined in Figure 2-6 below.

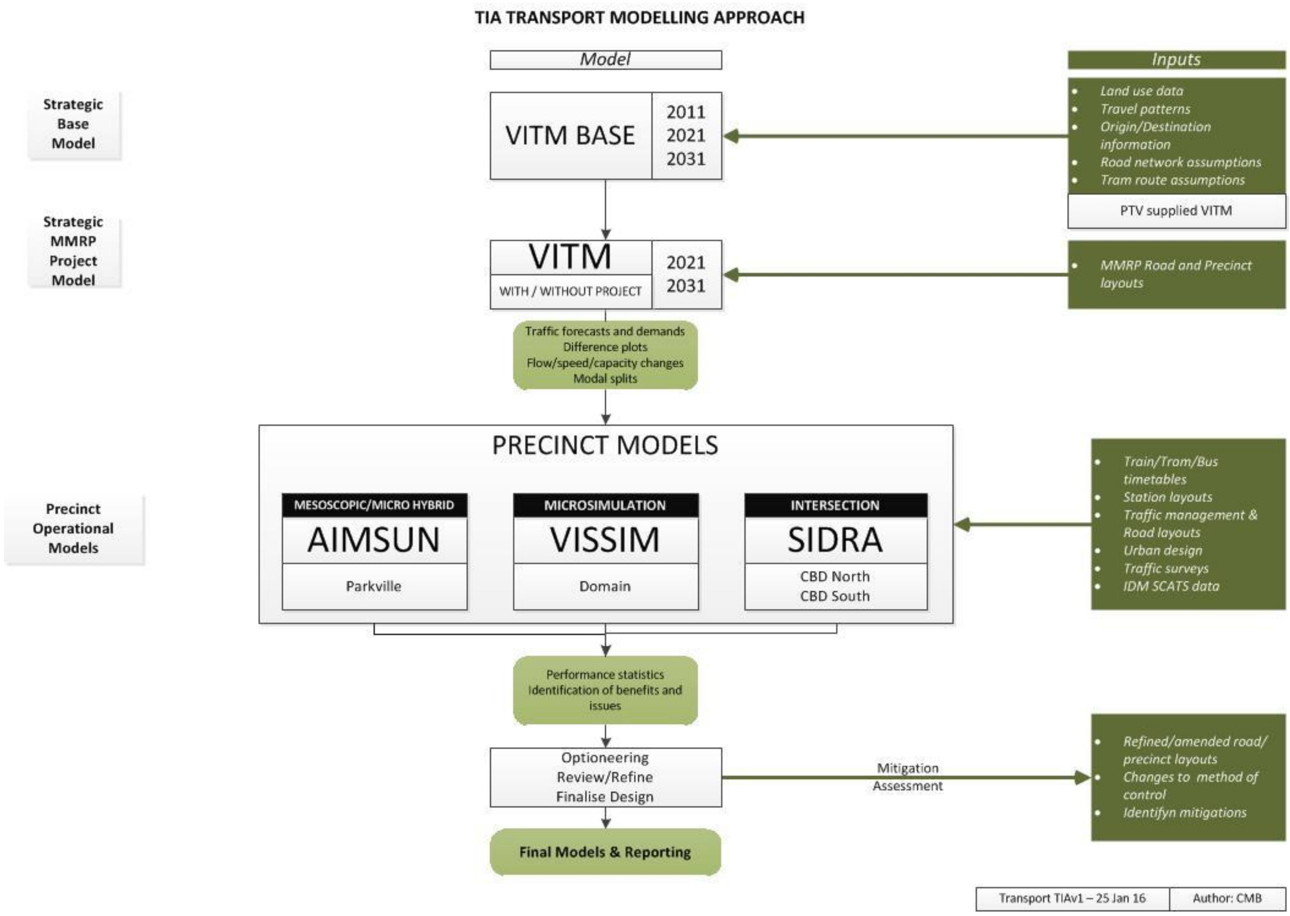


Figure 2-6 Stations design development and assessment modelling

2.6.3 Historical Traffic Growth

A review of historical traffic data undertaken by AJM-JV indicates that traffic volumes within the CBD, Parkville and Domain have remained static or actually fallen over the last 10 years, as shown in Figure 2-6 and Figure 2-7. This is due to increased public transport capacity as well as key routes through and around these precincts being at or near capacity during peak periods. Given this, it seems unlikely that there would be significant traffic growth over the next decade or so. With this in mind, unless outputs from VITM show significant growth which can be explained, our approach has been to use actual traffic volumes from the latest available surveys.

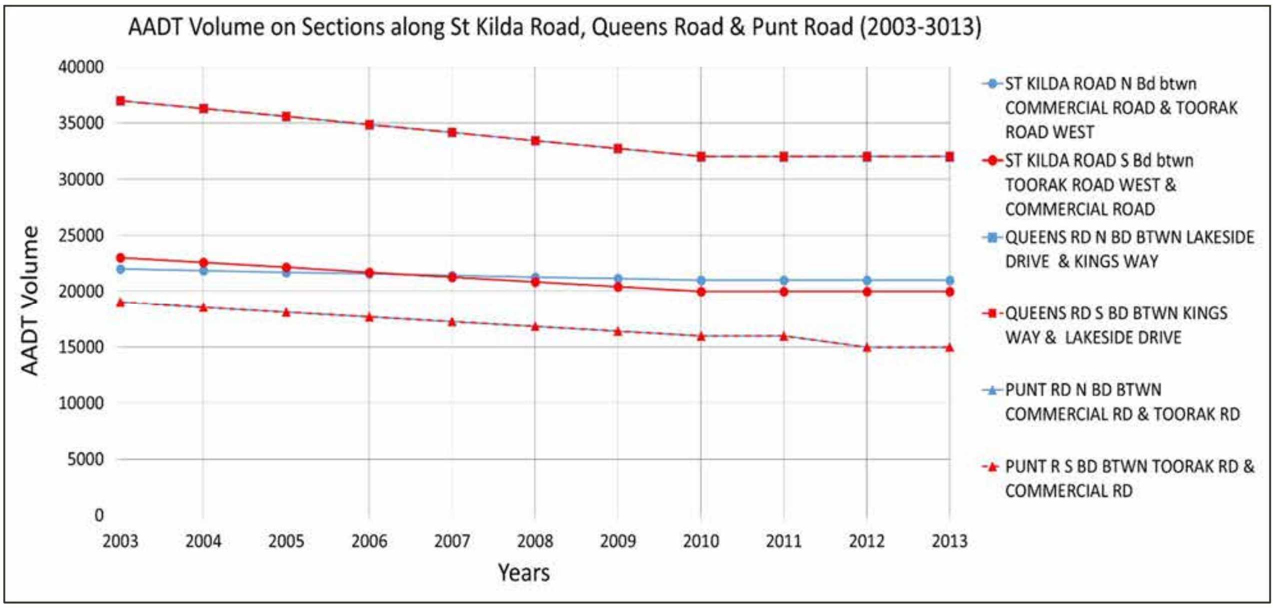


Figure 2-7 Domain Precinct Screen Line AADT Volume 2003-2013

Source: VicRoads

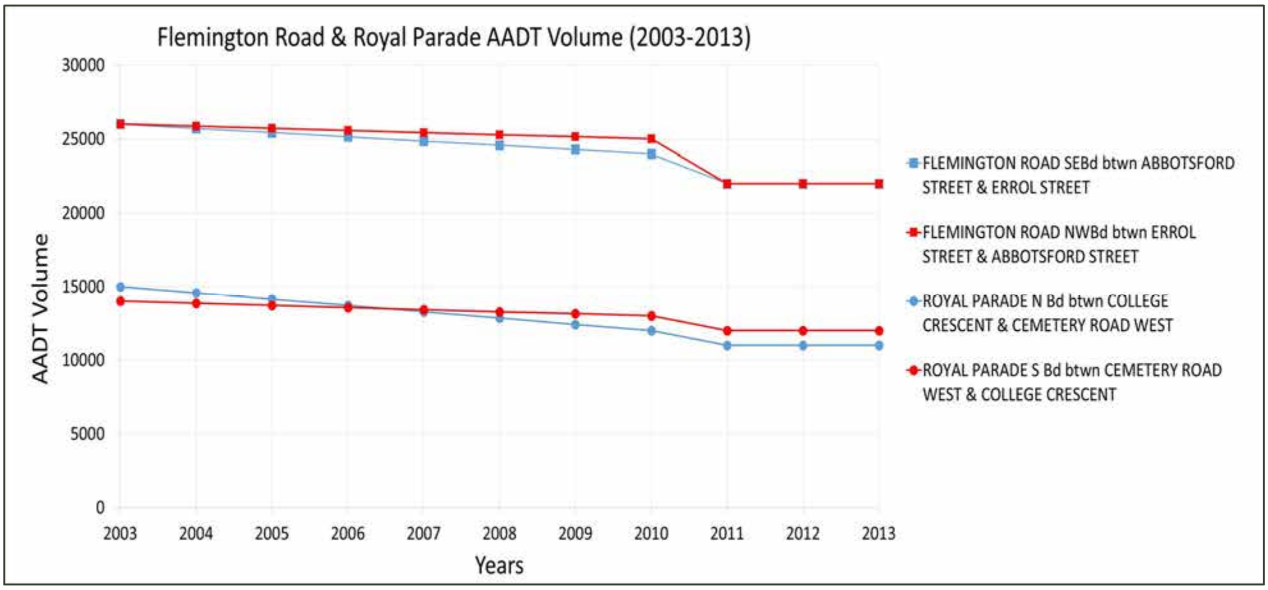


Figure 2-8 Flemington Road & Royal parade AADT Volumes 2003-2013

Source: VicRoads

2.6.4 Traffic Growth within the CBD

Within the CBD, intersections are closely spaced and controlled to ensure maximum throughput through linked signals. Key routes through the CBD are at or near capacity during peak periods, and the signals operate to ensure that upstream signals are kept clear from queuing traffic as far as possible. As a result, several intersections operate within their theoretical reserve capacity. Notwithstanding this the CBD network is close to capacity during peak periods. This is reflected in the analysis of historical data, which indicates that traffic volumes entering the CBD have not increased over the last 10 – 15 years.

AJM-JV has undertaken a review of a cordon screenline around the CBD to compare traffic entering and exiting the CBD during peak periods predicted by VITM for the various 2011 and 2031 Base and Concept Design models. The key finding is that the growth predicted by the various models ranges from 0 per cent to 5 per cent in the AM Peak and 0 per cent to 7 per cent in the PM peak. This is within daily variations of traffic flow,

Given this, it was determined that 2015 traffic turn volumes were appropriate for the 2031 Base models. However, to test sensitivity of this assumption, a scenario has also been modelled based on a 10 per cent growth of traffic for all movements. Given the VITM outputs, this is a conservative assumption. Results from both the base models for 2031, and the sensitivity test, are provided in this summary report for the CBD North and CBD South precinct analyses.

2.6.5 Wider Network Changes

The current proposals for utility and service diversions would require some lane closures and limited full closures. Further work would be undertaken by the Early Works Managing Agent to be appointed by MMRA. At this stage the impact of these works is seen to be limited and SIDRA localised intersection modelling has been used to test potential options.

To enable construction of Melbourne Metro there would be a series of transport management changes affecting the transport network. Mitigation measures are being developed as part of the design and assessment process.

2.7 Technical Modelling Issues

2.7.1 Standards and Guidelines

A range of standards and guidelines have been used for all modelling. These are as follows:

- *London Underground Limited (2012), Station Planning Standards and Guidelines*
- *NZTA Transport Model Development Guidelines*
- *AUSTROADS Guide to Traffic Management Part 3: Traffic Studies and Analysis*
- *RMS Traffic Modelling Guidelines (2013)*
- *Transport for London (2010) Traffic Modelling Guidelines, TfL Traffic Manager and Network Performance Best Practice, Version 3.0, September 2010*
- *Austroads (2006) The Use and Application of Microsimulation Models*
- *Transport Modelling Guidelines - Volume 2: Strategic Modelling, Version 3, April 2012.*

2.7.2 Calibration and Validation

Calibration and validation is an important process to ensure base models reflect current network performance and operating conditions.

Calibration describes the process of placing verifiable data into a traffic model to replicate observed street conditions. All input data for calibration should be auditable, such as signal timings and on-street measurements (e.g. lane distance, cruise times, saturation flows). For Melbourne Metro, this information has been collected from a combination of on-street surveys, site observations and data from stakeholders, principally VicRoads and Public Transport Victoria. To synthesise the observed behaviour, it is usual for calibration to require adjustment of model parameters, and this is the case for Melbourne Metro models described in this summary report. For this reason, the calibration process has been applied to each period being modelled.

Validation is the process of comparing model output against independently measured data that was not used during the calibration process. The purpose of validation is to verify that a model has been correctly calibrated and is therefore capable of producing valid predictions for proposed scenarios.

All transport modelling undertaken for Melbourne Metro has undergone a rigorous calibration and validation process, and independently reviewed to ensure they are fit for purpose to test future year scenarios. Reports of this calibration/validation process and results for the strategic and local network modelling are detailed in the following reports:

- Public Transport Victoria (2016), '*Melbourne Metro Public Transport Demand Forecasts'*
- AIMSUN – *Parkville Base Traffic Model Calibration/Validation Report, MMR-AJM-PEPV-RP-KR-000159, P4*, 21 October 2015.
- VISSIM - *Calibration/Validation Report- Domain Station Base Model, MMR-AJM-PWDM-RP-KR-000160, P3*, 30 October 2015.

2.7.3 Verification

All transport and traffic models produced by AJM-JV have been subject to verification independently of the team undertaking the modelling.

2.7.4 Peer Review Processes

All models produced by AJM-JV have been passed onto key stakeholders for comment and approval. VicRoads has undertaken reviews of the road based transport models, including the VISSIM, Aimsun and Sidra models. The ClicSim modelling has been reviewed by Public Transport Victoria and both VITM and ClicSim have been independently peer reviewed for Public Transport Victoria.

In addition, MMRA has appointed independent peer reviewers to review all the transport modelling.

3 Road Network Analysis by Precinct

3.1 Broader Network Impacts

3.1.1 Assessment of the Broader Network Impacts

The VITM Project Models, developed by Public Transport Victoria, have been used to assess the wider impacts of Melbourne Metro at a strategic level. The following sections summarise outputs from the various models. As VITM is a strategic application and does not model traffic in detail, impacts on the wider network have been confined to changes greater than 10 per cent (plus or minus).

The following sections discuss difference plots comparing traffic volumes on links of the network for the various models, where RED indicates increases in volumes and BLUE decreases. It is noted that the numbers relate to 2-hour volume changes.

3.1.2 Future Conditions – 2031 No Project Case

The 2031 VITM Base (No Project) model includes updates to the rail, tram and bus networks (and services) as advised by Public Transport Victoria. Also included in the 2031 Base model are numerous highway projects, such as the City-Tullamarine upgrade – expected to be implemented across Victoria by 2031 and designed to improve capacity of the highway network as well as improvements to the public transport networks.

The 2031 VITM Base model for the project was provided to AJM-JV by Public Transport Victoria. A number of minor changes have been made to the model to provide a more robust highway network around Melbourne Metro station locations. These are shown in Table 3-1.

Table 3-1 Updates Included in 2031 Base (No Project) model

Location	Changes Included in 2031 base model
Network wide	Legacy tram and bus network assumptions
CBD	Speed limit reduced to 40km/h (from 50km/h).
Princes Bridge	Reduced to one lane northbound (approaching CBD).
Swanston Street, north of the CBD	Reduced to one lane in each direction.

Comparison of the 2011 and 2031 traffic volumes, for both AM and PM peaks, indicate significant increases in traffic flow along the CityLink-Tullamarine and Monash freeways.

Elsewhere, changes in traffic flow are much less in scale. Increases in traffic flow tend to be in the contra-peak direction, rather than the peak direction. Following discussion with MMRA, DEDJTR and Public Transport Victoria the changes can be explained by the following differences within the 2011 and 2031 Base models:

- For counter peak traffic flows, there is more road capacity available in the 2011 model for growth – therefore, as demand increases, contra-peak routes are more attractive to facilitate additional trips
- The 2031 model includes increased parking costs in the CBD – higher than CPI growth – therefore car trips to the CBD are reduced, particularly in the AM commuter peak period
- The 2031 model includes significant increased public transport capacity (in addition to Melbourne Metro), particularly for trips to the CBD, that would attract more travel to PT modes, rather than car travel

- In combination these two factors produce a greater demand for PT compared to car in the peak direction – thereby reducing the peak period car travel in the peak direction
- The 2031 VITM demand model includes a significant increase in the population in the CBD – in combination with the above factors this increases the counter peak car travel demand in VITM
- Fuel prices are assumed to increase in the future.

In particular, it is noted that increases around Parkville and the CBD are limited, while those around Domain are again generally in the contra-peak direction.

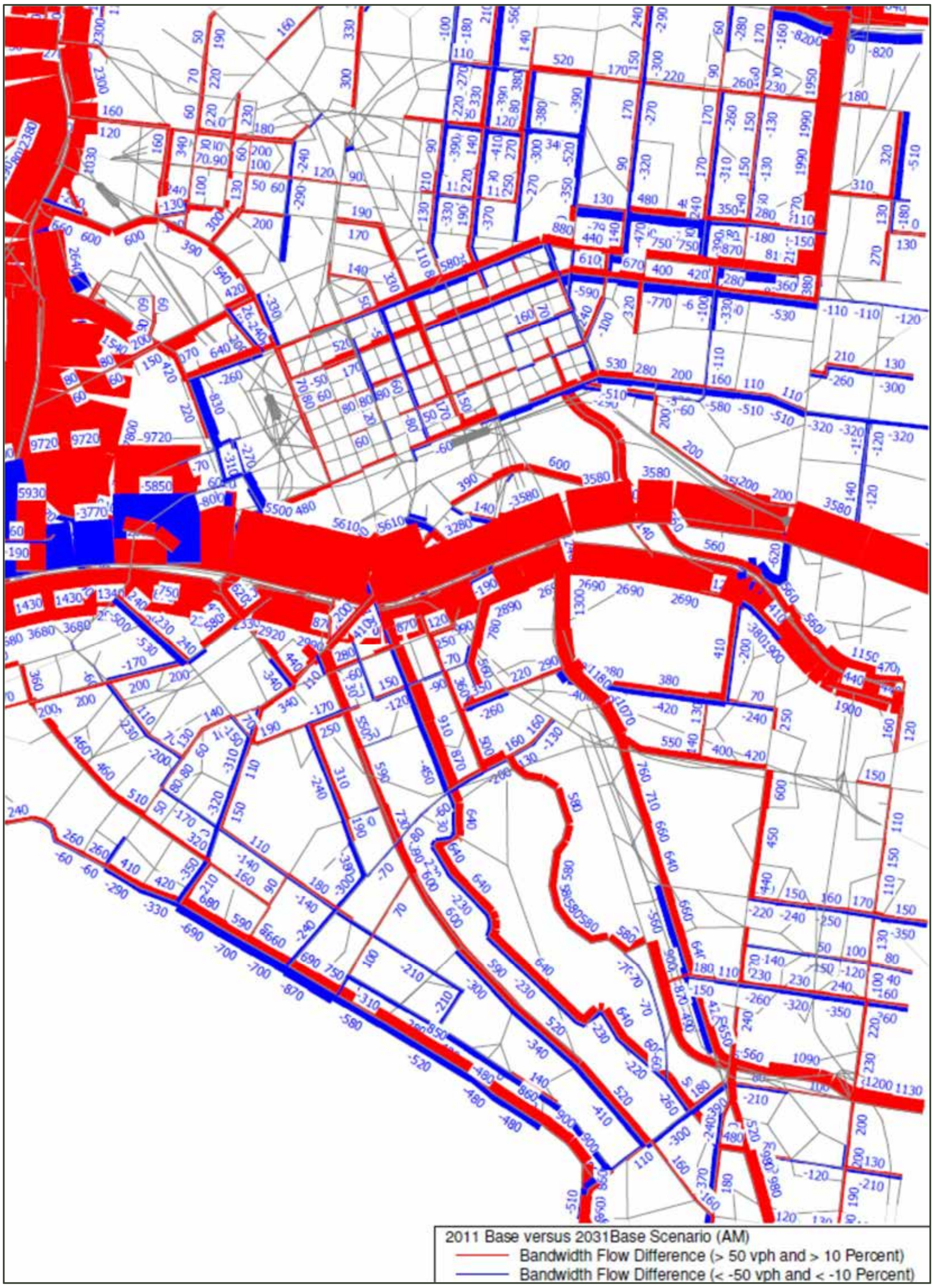


Figure 3-1 Comparison of VITM traffic volumes - AM peak 2011 base v 2031 base

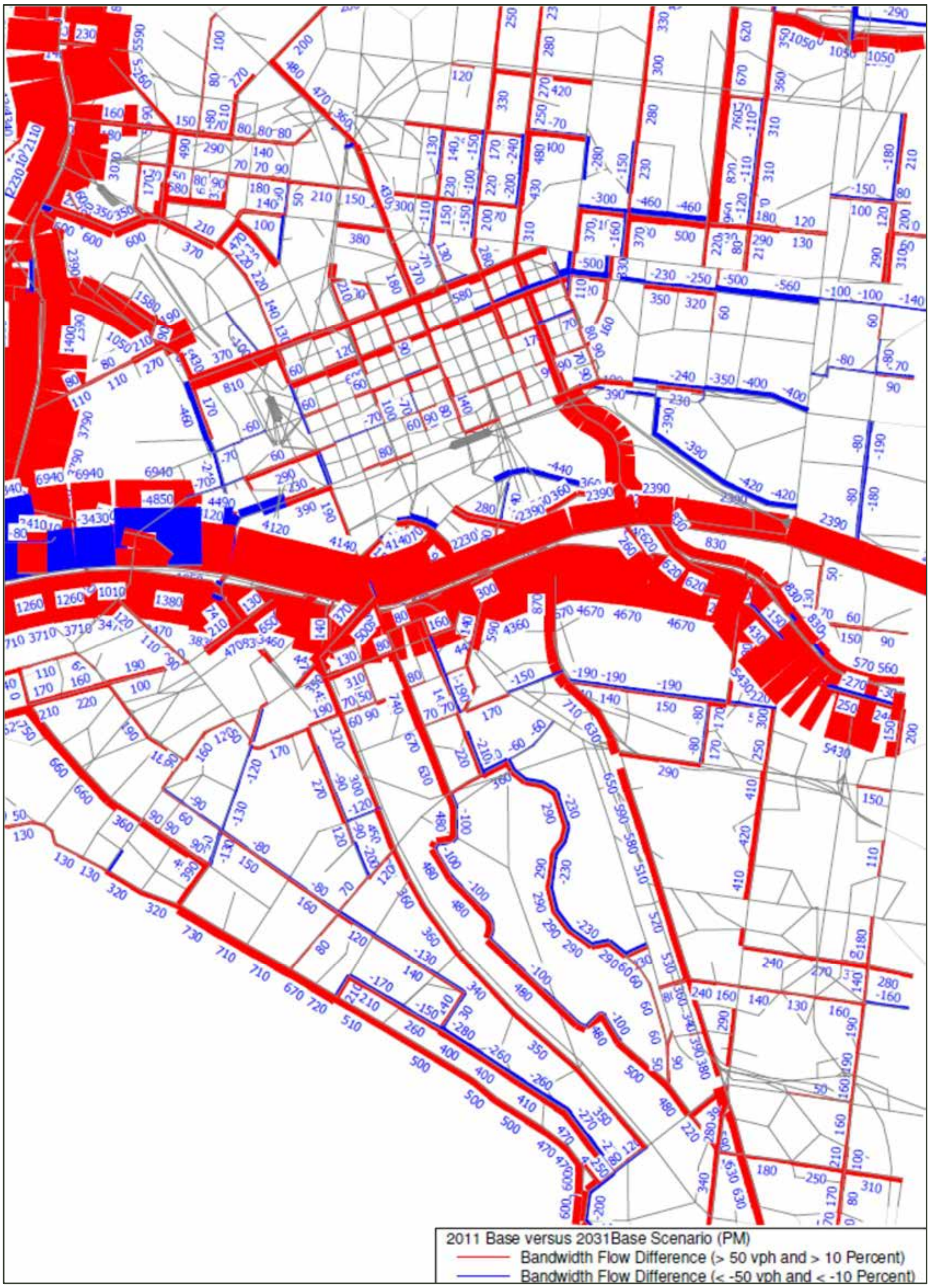


Figure 3-2 Comparison of traffic volumes - PM peak 2011 base v 2031 base

3.1.3 Future Conditions – 2031 Assessment Project

Melbourne Metro is proposed to include a number of changes to the road network, particularly around station precincts. For the 2031 Concept Design Model, the following changes have been made to the 2031 VITM Base model.

Table 3-2 Changes included in the 2031 Concept Design model

Location	Changes included in 2031 project model	Comments
Parkville Precinct	Grattan Street reduced to one lane in each direction between Flemington Road and Leicester Street.	
Parkville Precinct	Royal Parade, southbound, no right turn into Grattan Street.	
CBD South Precinct	Flinders Street, eastbound, between Swanston Street and Elizabeth Street reduced to one lane.	Concept Design: includes two lanes eastbound, however, increased pedestrian activity may require wider footways.
Domain Precinct	St Kilda Road reduced to two lanes both directions between Domain Road and Kings Way.	Option of St Kilda Road remaining three lanes in each direction also tested.

The following general observations are made when comparing outputs from the 2031 Base and Project models:

- Significant changes in traffic volumes on links are localised around locations where traffic lanes are reduced
- For Parkville:
  - Significant drop in traffic volume along Grattan Street, between Flemington Road and Swanston Street
  - General reduction in traffic along east west route centred on Grattan St and Wreckyn Street
  - Some increase in traffic along Victoria Street and Queensberry Street
  - Some increase in north south traffic along Swanston Street and Lygon Street.
- For CBD North, no significant changes in traffic volumes
- For CBD South, there is a reduction in traffic along Flinders Street, resulting from the reduction in traffic lanes eastbound. Consequently, volumes in Elizabeth Street reduce and volumes in King Street increase, although neither are significant. (The current Concept Design retains two lanes eastbound along Flinders Street, and so the changes anticipated in the VITM model are likely to be lower in the CBD)
- For Domain:
  - Significant decrease in traffic along St Kilda Road.

The following figures show traffic volume difference outputs comparing the 2031 Base and Concept Design models.

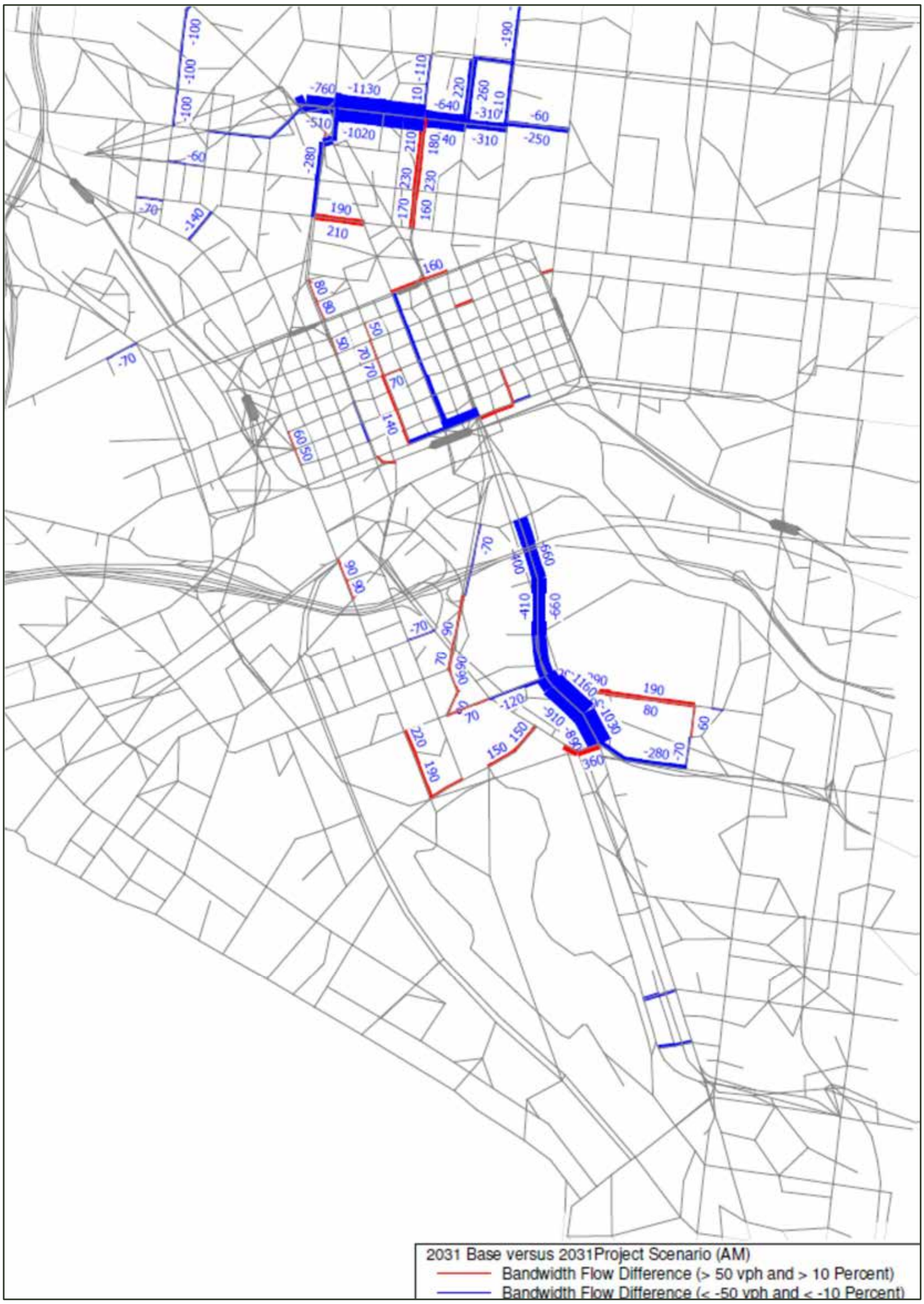


Figure 3-3 Comparison of Traffic Volumes - AM Peak 2031 Concept Design v 2031 Base

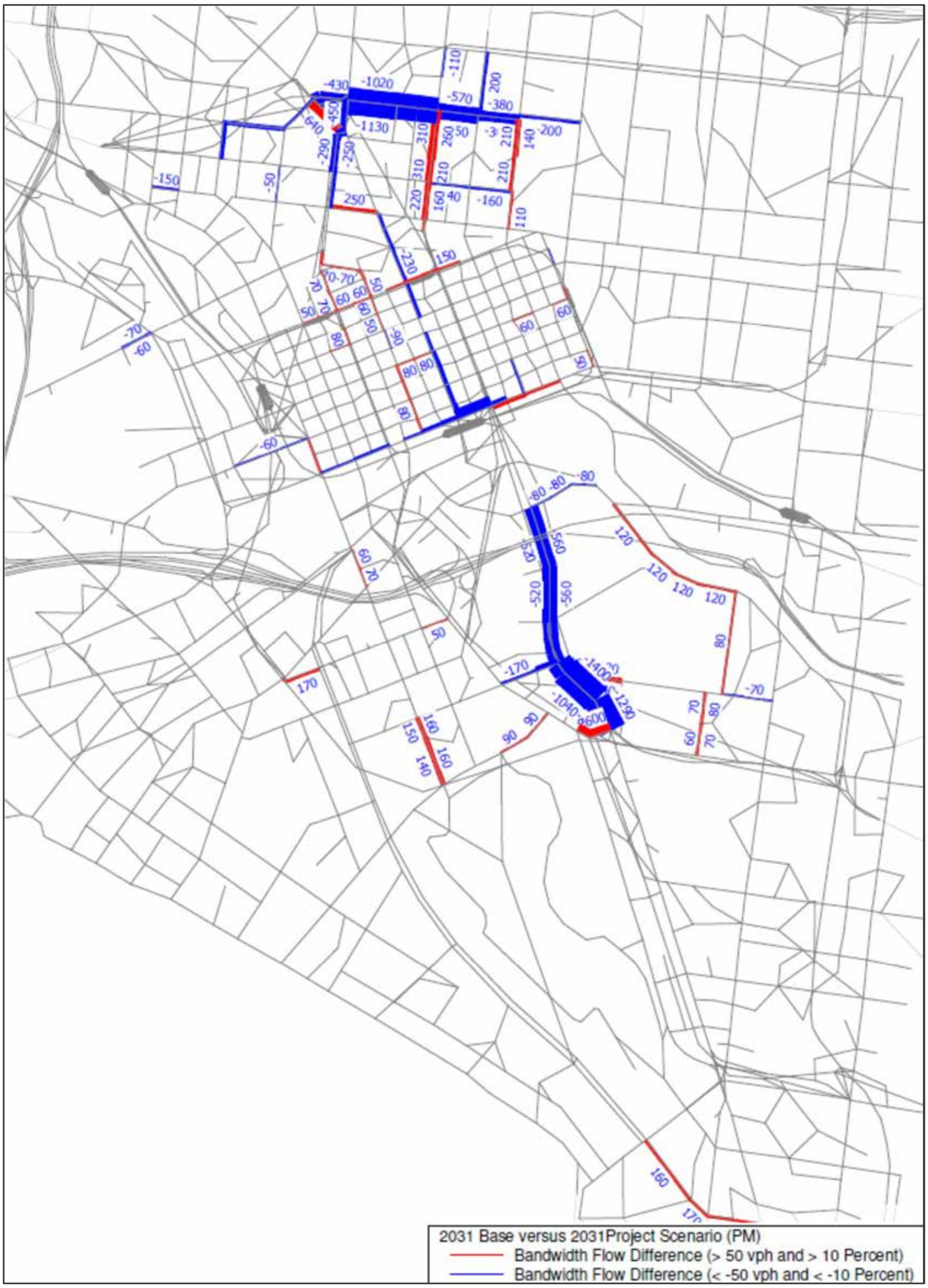


Figure 3-4 Comparison of traffic volumes - PM peak 2031 assessment project v 2031 base

3.2 Precinct 1: Tunnels

Modelling has not been undertaken for the Tunnels precinct in relation to Melbourne Metro Concept Design impacts as there would be no material change in traffic demand or supply in the local network resulting from the 2031 Melbourne Metro Legacy Project when compared with the 2031 Base Case.

3.3 Precinct 2: Western Portal (Kensington)

Modelling has not been undertaken for the Western Portal in relation to Melbourne Metro Concept Design impacts as there would be no material change in traffic demand or supply in the local network resulting from Melbourne Metro when compared with the 2031 Base Case.

3.4 Precinct 3: Arden Station

The proposed Arden Station is located on a diagonal (from south west to north east) wholly within an existing VicTrack owned industrial site. An initial station entrance is on a ramp approximately 120 m south of Arden Street in line with a future southward extension of Fogarty Street. A second future entrance is proposed approximately in the centre of the VicTrack site to service future development.

It is anticipated the layout of the functional road network in the Arden precinct would integrate the station, and be developed through a precinct planning process.

Therefore, modelling has not been undertaken for the Arden station precinct in relation to Melbourne Metro Concept Design impacts as there is no known material change in traffic demand or supply in the local network resulting from Melbourne Metro when compared with the 2031 Base Case.

The current road functional layout is shown in Figure 3-5.

Figure 3-5 Arden precinct road functional layout

3.5 Precinct 4: Parkville Station

3.5.1 Existing Conditions

3.5.1.1 Parkville Aimsun Model

An Aimsun Hybrid model with integrated adaptive SCATS signals has been used to assess performance of the local road network around the proposed Parkville station. The Hybrid model operates as a microsimulation model within user defined cordon area, simulating individual vehicles and their interaction with other vehicles and the surrounding road environment. Outside of this cordon, a mesoscopic model environment is used to replicate the flow, delay and route choice of traffic using more simplistic algorithms.

The model extents included all local roads within the area illustrated in Figure 3-6. The microsimulation area is outlined in green and consists of Grattan Street, Haymarket roundabout and the approaches to the roundabout.

Figure 3-6 Extents of Aimsun hybrid model

3.5.1.2 Network Performance

As with real traffic conditions which vary from day to day, interactions between vehicles can vary for each model run, resulting in unique results.

To obtain statistically meaningful results, the average network performance was taken from multiple simulation runs. Previous experience indicates that five model runs are sufficient to obtain stable results for a network of this size, nature and purpose.

Unlike Sidra, Aimsun provides statistics relating to the performance of the road network within the model, rather than individual intersection statistics. The following discussion provides key statistics for the existing performance of the road network around the proposed Parkville station.

The Base models for 2015 AM and PM have been calibrated and validated against traffic survey data collected in 2015, and reflects traffic conditions observed on site, SCATS data (for intersections outside the microsimulation area) and journey times. This can be characterised as a network nearing its saturation point for a number of traffic movements with some queuing and delay, but overall is performing in a reasonable manner typical of an inner city location.

Table 3-3 Network performance summary - 2015

Peak	Parameters	2015 (Vol.)
AM Peak	Average Travel Time (min:sec)	7:23
	Average Speed (km/h)	13.9
	VKT (veh km)	32,210
	VHT (hours)	2,320
	Total vehicles	18,910
PM Peak	Average Travel Time (min:sec)	7:10
	Average Speed (km/h)	14.1
	VKT (veh km)	33,040
	VHT (hours)	2,340
	Total vehicles	19,560

Source: Aimsun Outputs (2015 Base model)

3.5.2 Future conditions – 2031 No Project Case

3.5.2.1 VITM Demand Summary

An analysis of the historical growth of key roads around Parkville indicates virtually zero growth in daily traffic volumes over the last 10 years (source VicRoads). Outputs from the VITM 2031 Base model indicates a small percentage growth in total traffic going into and out of the Aimsun model area when compared to existing volumes (4.1 per cent growth in AM and 5.9 per cent growth in the PM).

Some specific trips through the model (origin to destination) do show some growth and this information has been used to grow these specific trips within the 2031 Aimsun Base (No Project) model.

3.5.2.2 Aimsun Network Volumes

The tables below summarises the changes in the volumes on key links within the Aimsun model network. Note that these are recorded through movements, not demand and may therefore be impacted by network delay.

Table 3-4 Network volume AM peak summary - 2031 no project

Network	2015 Base	2031 Base	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	840	890	50	6%
Victoria Street, east of Peel Street, westbound	670	680	10	0%
Queensberry Street, east of Peel Street, eastbound	640	690	50	8%
Queensberry Street, east of Peel Street, westbound	530	500	-30	-6%
Gatehouse Street, north of Flemington Road, northbound	390	430	40	10%
Gatehouse Street, north of Flemington Road, southbound	490	490	0	1%
Swanston Street, north of Grattan Street, northbound	200	190	-10	-4%
Swanston Street, north of Grattan Street, southbound	440	350	-90	-19%
Elliot Avenue, east of Flemington Road, eastbound	1140	1200	60	5%
Elliot Avenue, east of Flemington Road, westbound	1100	1060	-40	-4%
College Crescent, between Princes Park Drive and Cemetery Road east, eastbound	1900	1910	10	0%
College Crescent, between Princes Park Drive and Cemetery Road East, westbound	1720	1670	-50	-3%
Royal Parade, north of Grattan Street, northbound	660	590	-70	-11%
Royal Parade, north of Grattan Street, southbound	1110	1020	-90	-8%
Flemington Road, north of Grattan Street, northbound	590	520	-70	-14%
Flemington Road, north of Grattan Street, southbound	1340	1260	-80	-7%
Elizabeth Street, south of Haymarket, northbound	410	380	-30	-8%
Elizabeth Street, south of Haymarket, southbound	1160	1070	-90	-9%
Peel Street, south of Haymarket, northbound	530	460	-70	-14%
Peel Street, south of Haymarket, southbound	680	620	-50	-9%
Grattan Street, between Swanston Street & Leicester Street, EB	760	790	+30	+4%
Grattan Street, between Swanston Street & Leicester Street, WB	930	880	-50	+5%
Grattan Street, west of Royal Parade, EB	660	680	20	+3%
Grattan Street, west of Royal Parade, WB	570	540	-30	-6%

Table 3-5 Network volume PM summary - 2031 no project

Network	2015 Base	2031 Base	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	940	940	0	0%
Victoria Street, east of Peel Street, westbound	920	1110	190	20%
Queensberry Street, east of Peel Street, eastbound	600	520	-80	-12%
Queensberry Street, east of Peel Street, westbound	780	900	120	14%
Gatehouse Street, north of Flemington Road, northbound	430	450	20	6%
Gatehouse Street, north of Flemington Road, southbound	500	510	10	2%
Swanston Street, north of Grattan Street, northbound	560	520	-40	-8%
Swanston Street, north of Grattan Street, southbound	250	330	80	33%
Elliot Avenue, east of Flemington Road, eastbound	920	860	-60	-6%
Elliot Avenue, east of Flemington Road, westbound	1320	1270	-50	-3%
College Crescent, between Princes Park Drive and Cemetery Road East, eastbound	1440	1350	-90	-6%
College Crescent, between Princes Park Drive & Cemetery Road East, westbound	1950	1940	-10	0%
Royal Parade, north of Grattan Street, northbound	1120	1050	-70	-6%
Royal Parade, north of Grattan Street, southbound	780	640	-140	-17%
Flemington Road, north of Grattan Street, northbound	980	950	-30	-3%
Flemington Road, north of Grattan Street, southbound	1130	1060	-70	-6%
Elizabeth Street, south of Haymarket, northbound	720	710	-10	-2%
Elizabeth Street, south of Haymarket, southbound	690	710	20	2%
Peel Street, south of Haymarket, northbound	730	780	50	6%
Peel Street, south of Haymarket, southbound	530	520	-10	-1%
Grattan Street, between Swanston Street & Leicester Street, EB	900	820	80	9%
Grattan Street, between Swanston Street & Leicester Street, WB	760	810	50	7%
Grattan Street, west of Royal Parade, EB	720	620	-100	-15%
Grattan Street, west of Royal Parade, WB	660	690	30	+6%

3.5.2.3 Network Performance

Table 3-6 below provides key outputs from the Aimsun model to compare network performance between the 2015 Existing Conditions model and 2031 Base (No Project) model. As the table shows, with more trips in 2031 the total number of vehicles increased. In the morning period, the mean speed increased, which caused the VHT to decrease. VKT also increased in 2031 as a result of more vehicles. In the afternoon period the increase in vehicles decreased the mean speed and thus resulting to an increase in VHT.

Table 3-6 Network performance summary – 2031 no project case

Peak	Parameters	2031 No project	Difference 2031 no project – 2015 base	
			2015 Base	% change
AM Peak	Average Travel Time (min:sec)	6:53	7:23	-7%
	Average Speed (km/h)	14.7	13.9	6%
	VKT (veh km)	32,870	32,210	2%
	VHT (hours)	2,240	2,320	-4%
	Total vehicles	19,500	18,910	3%
PM Peak	Average Travel Time (min:sec)	7:05	7:10	-1%
	Average Speed (km/h)	13.9	14.1	-1%%
	VKT (veh km)	33,340	33,040	1%
	VHT (hours)	2,390	2,340	2%
	Total vehicles	20,240	19,560	3%

Source: Aimsun outputs

As shown in the table above, with more trips in 2031 the total number of vehicles increased. In the morning period, the mean speed increased, which caused the VHT to decrease. Although the difference is minimal, it is likely due a change in travel patterns and decrease in heavy vehicles. VKT also increased in 2031 as a result of more vehicles. In the afternoon period the increase in vehicles decreased the mean speed and thus resulting to an increase in VHT. It should be noted that the total vehicle growth rates modelled are lower than the rates specified in Section 3.5.2.1, likely due to delay within the capacity constrained model.

3.5.2.4 Travel Time

The travel times were collected along Peel Street/ Flemington Road between Queensberry Street and Grattan Street Avenue and Elizabeth Street/ Royal Parade between Queensberry Street and Grattan Street. These were recorded through the microsimulation area as the detail exists to compare travel times.

Travel times along Flemington Road and Peel Street remained relatively similar to the 2015 base model with the exception of the southbound movement in the afternoon period. In the afternoon period the travel time along Royal Parade and Elizabeth Street is predicted to increase. This is likely due to an increase in the south approach right turn movements from Elizabeth Street onto Grattan Street and longer trams that causes the right turn pocket to over-spill.

3.5.2.5 Intersection Analysis

Table 3-7 illustrates the Level of Service (LOS) criteria which should be used to interpret the results. Due to multiple carriageways and movements in one direction, movements with the subscript 'outer' represent the movement along the kerb side lane and movements with the subscript 'inner' represent movements along the inner tram lane.

Table 3-7 LOS criteria

LOS	Average Delay (s)
A	<10
B	10 to 20
C	20 to 35
D	35 to 55
E	55 to 80
F	>80

Average Delay Difference (s)	
A	-200 to -20
D	-20 to 20
F	20 to 200

The results have been analysed for the signalised intersection within the study area and show the results associated with individual movements of the intersection. The results show that for the three central intersections in the model, there is generally minimum difference from the 2031 No Project model during the morning peak period as shown in Table 3-8.

Table 3-8 LOS comparison - AM peak 2031 no project v 2015 base

Intersection	Approach	2015 Base	2031 Base	Difference
Haymarket Roundabout	Elizabeth Street (N)	40	50	10
	Elizabeth Street (SE)	60	60	0
	Peel Street (S)	60	50	-10
	Flemington Road (NW)	90	70	-20
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	90	80	-10
	Grattan Street (E)	40	40	0
	Elizabeth Street (S)	50	50	0
	Grattan Street (W)	50	50	0
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	40	30	-10
	Flemington Road (SE)	40	30	-10
	Wreckyn Street (SW)	40	30	-10
	Flemington Road (NW)	40	30	-10

With the exception of the Haymarket intersection, the afternoon period shown in Table 3-9 depicted similar results to the morning period in terms of where there are increases or decreases in delay compared to the 2015 Base model. The Haymarket roundabout is predicted to experience longer delays on all approaches. Zero delay values are generally where volumes are too low to produce delay outputs.

Table 3-9 LOS comparison - PM peak 2031 no project v 2015 base

Intersection	Approach	2015 Base	2031 Base	Difference
Haymarket Roundabout	Elizabeth Street (N)	60	70	10
	Elizabeth Street (SE)	100	160	60
	Peel Street (S)	130	150	20
	Flemington Road (NW)	110	160	50
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	50	90	40
	Grattan Street (E)	80	100	20
	Elizabeth Street (S)	40	50	10
	Grattan Street (W)	50	40	-10
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	50	130	80
	Flemington Road (SE)	40	40	0
	Wreckyn Street (SW)	40	50	10
	Flemington Road (NW)	40	50	10

In conclusion, the morning peak period vehicles are expected to experience marginally less delay. Travel time in the morning period remained relatively similar to the 2015 Base model. The afternoon peak period demonstrates more congestion around the Haymarket roundabout and as this is a key controlling intersection in the study area, there was subsequently an increase in local travel times.

3.5.3 Overview of Concept Design Functional Road Layout

Parkville station is located under Grattan Street, to the east of the intersection with Royal Parade/Elizabeth Street. New tram superstops are provided in the centre of Royal Parade just to the north of Grattan Street. Cycle lanes are provided in both Grattan Street and Royal Parade/Elizabeth Street. These changes, along with new station entrances and associated station infrastructure, results in the following changes to the existing road layout as shown in Figure 3-7.

- Reduction in Royal Parade/Elizabeth Street traffic lanes to two through lanes in each direction in the vicinity of Grattan Street
- No right turn from Royal Parade (southbound) into Grattan Street
- Reduction to one through lane on Grattan Street (both directions) between Flemington Road and Leicester Street
- New side platform tram stops in Royal Parade, just north of Grattan Street
- Revision of existing parking provision along Grattan Street, Royal Parade and Elizabeth Street.

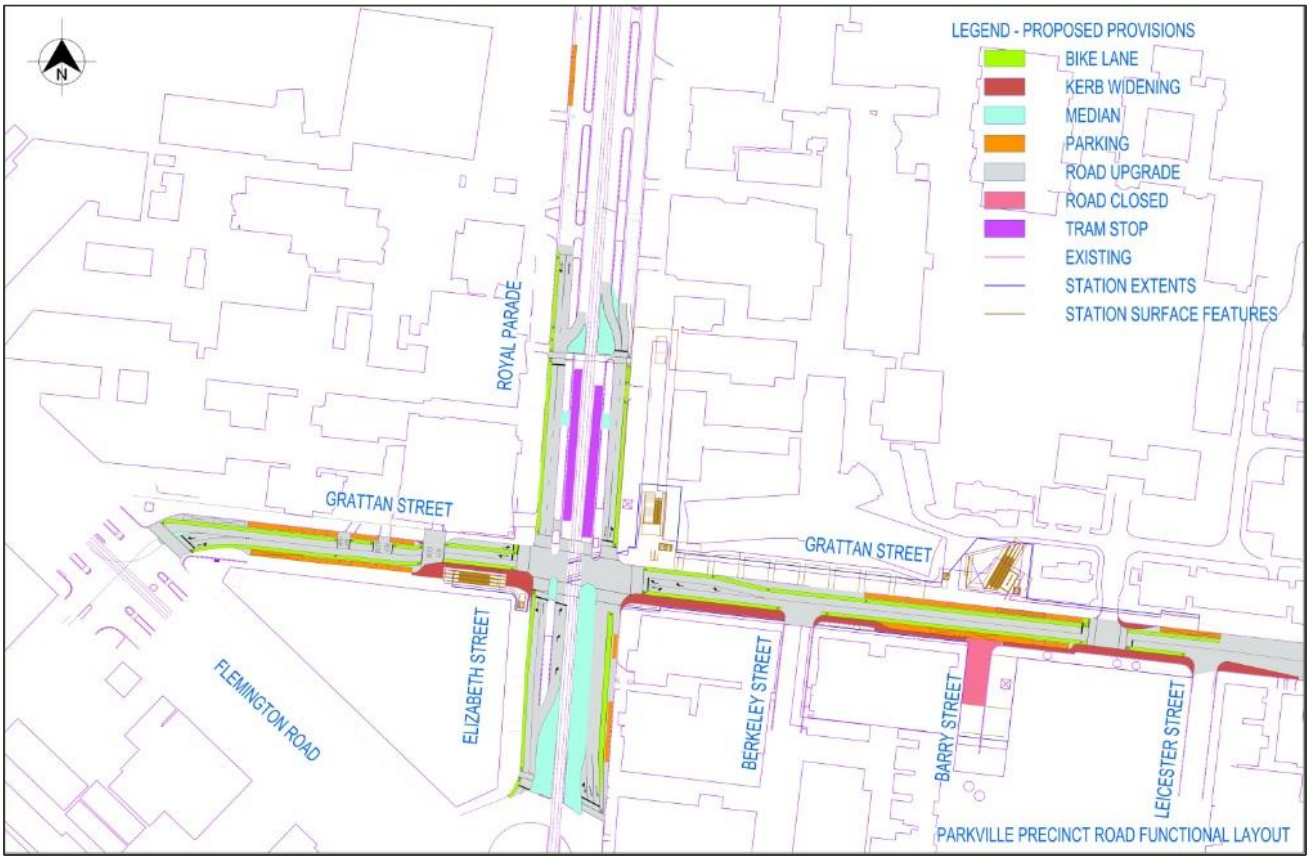


Figure 3-7 Parkville precinct road functional layout

3.5.4 Future Conditions – 2031 Assessment Project

3.5.4.1 VITM Demand Summary

Outputs from the VITM 2031 Melbourne Metro model indicate a small percentage growth in total traffic going into and out of the Aimsun model area when compared to existing volumes (1.9 per cent growth in AM and 4.0 per cent growth in PM). Some specific trips through the model (origin to destination) do show some growth and this information has been used to grow these specific trips within the 2031 Aimsun Concept Design model.

3.5.4.2 Network Performance

Table 3-10 provides key outputs from the Aimsun model to compare network performance between the 2031 No Project to the 2031 Melbourne Metro model. All general statistics decreased in the 2031 Melbourne Metro model in the AM peak, likely due to changes in travel patterns, whereas in the PM peak period there was little change.

Table 3-10 Network performance summary – 2031 assessment project

Peak	Parameters	2031 Assessment project	Difference 2031 Melbourne Metro – 2015 base		Difference 2031 Melbourne Metro - 2031 no project	
			2015 Base	%	2031 No Project	%
AM Peak	Average Travel Time (min:sec)	6:58	7:23	-6%	6:53	1%
	Average Speed (km/h)	14.6	13.9	0%	14.7	-2%
	VKT (veh km)	32,590	32,210	-1%	32,870	-1%
	VHT (hours)	2,230	2,320	-1%	2,240	0%
	Total vehicles	19,240	18,9010	1%	19,500	-1%
PM Peak	Average Travel Time (min:sec)	7:12	7:10	0%	7:05	2%
	Average Speed (km/h)	13.9	14.1	-2%	13.9	0%
	VKT (veh km)	33,120	33,040	-1%	33,340	-1%
	VHT (hours)	2,390	2,340	1%	2,390	0%
	Total vehicles	19,980	19,560	1%	20,240	-1%

Source: Aimsun outputs

Table 3-10 provides key outputs from the Aimsun model to compare network performance between the 2031 Base to the 2031 Project model. In both the morning and afternoon scenarios, the total number of vehicles and mean speed decreased in the Project model. As a result, the total travel time experienced by all vehicles remained relatively similar to the 2031 No Project model, thus signifying that the 2031 Melbourne Metro Legacy Project model may experience more delay per vehicle.

For the Assessment Project, travel time along Flemington Road and Peel Street remained relatively similar to the 2031 No Project model, with the exception of Flemington Road eastbound in the afternoon period. Travel time along Royal Parade and Elizabeth Street is predicted to decrease in the northbound direction and increase in the southbound direction. This is likely due to separating the right turn movement from Elizabeth Street onto Grattan Street and the tram movements which often causes the right turn pocket to over-spill. Based on the results, the new intersection configuration at the Royal Parade and Grattan Street intersection may increase the southbound travel time along Royal Parade.

3.5.4.1 Aimsun Network Volumes

Table 3-11 and Table 3-12 summarise the changes in the volumes on key links within the Aimsun model network. These are recorded through movements, not demand and may be impacted by network delay.

Table 3-11 Comparison of network volumes - AM peak 2031 Melbourne Metro legacy project v 2031 no project

Network	2031 Base	2031 Project	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	890	860	-30	-3%
Victoria Street, east of Peel Street, eastbound	680	730	50	8%
Queensberry Street, east of Peel Street, eastbound	690	650	-40	-6%
Queensberry Street, east of Peel Street, westbound	500	490	-10	-2%
Gatehouse Street, north of Flemington Road, northbound	430	350	-80	-18%
Gatehouse Street, north of Flemington Road, southbound	490	590	100	19%
Swanston Street, north of Grattan Street, northbound	190	220	30	18%
Swanston Street, north of Grattan Street, southbound	350	400	50	12%
Elliot Avenue, east of Flemington Road, eastbound	1200	1160	-40	-3%
Elliot Avenue, east of Flemington Road, westbound	1060	1170	110	10%
College Crescent, between Princes Park Drive and Cemetery Road East, eastbound	1910	2000	90	5%
College Crescent, between Princes Park Drive and Cemetery Road East, westbound	1670	1950	280	17%
Royal Parade, north of Grattan Street, northbound	590	780	190	31%
Royal Parade, north of Grattan Street, southbound	1020	960	-60	-6%
Flemington Road, north of Grattan Street, northbound	520	470	-50	-11%
Flemington Road, north of Grattan Street, southbound	1260	1350	90	7%
Elizabeth Street, south of Haymarket, northbound	380	370	-10	-2%
Elizabeth Street, south of Haymarket, southbound	1070	1170	100	9%
Peel Street, south of Haymarket, northbound	460	530	70	13%
Peel Street, south of Haymarket, southbound	620	630	10	1%
Grattan Street, between Swanston Street & Leicester Street, eastbound	790	520	-270	-34%
Grattan Street, between Swanston Street & Leicester Street, westbound	880	580	-300	-34%
Grattan Street, west of Royal Parade, eastbound	680	470	-210	-31%
Grattan Street, west of Royal Parade, westbound	540	250	-290	-53%

Table 3-12 Comparison of network volumes - PM peak 2031 Melbourne Metro legacy project v 2031 no project

Network	2031 Base	2031 Project	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	940	950	10	1%
Victoria Street, east of Peel Street, westbound	1110	1150	40	3%
Queensberry Street, east of Peel Street, eastbound	520	510	-10	-2%
Queensberry Street, east of Peel Street, westbound	900	850	-50	-5%
Gatehouse Street, north of Flemington Road, northbound	450	400	-50	-13%
Gatehouse Street, north of Flemington Road, southbound	510	490	-20	-3%
Swanston Street, north of Grattan Street, northbound	520	620	100	16%
Swanston Street, north of Grattan Street, southbound	330	310	-20	-9%
Elliot Avenue, east of Flemington Road, eastbound	860	920	60	6%
Elliot Avenue, east of Flemington Road, westbound	1270	1310	40	3%
College Crescent, between Princes Park Drive and Cemetery Road East, eastbound	1350	1450	100	7%
College Crescent, between Princes Park Drive and Cemetery Road East, westbound	1940	1990	50	2%
Royal Parade, north of Grattan Street, northbound	1050	1120	70	6%
Royal Parade, north of Grattan Street, southbound	640	730	90	12%
Flemington Road, north of Grattan Street, northbound	940	950	10	-5%
Flemington Road, north of Grattan Street, southbound	1060	1030	-30	-3%
Elizabeth Street, south of Haymarket, northbound	710	720	10	2%
Elizabeth Street, south of Haymarket, southbound	710	810	100	13%
Peel Street, south of Haymarket, northbound	780	790	10	1%
Peel Street, south of Haymarket, southbound	520	480	-40	-8%
Grattan Street, between Swanston Street & Leicester Street, eastbound	820	490	-330	40%
Grattan Street, between Swanston Street & Leicester Street, westbound	810	560	-250	31%
Grattan Street, west of Royal Parade, eastbound	620	410	-210	-35%
Grattan Street, west of Royal Parade, westbound	690	460	-230	-33%

3.5.4.2 Intersection Analysis

During the morning period, the southbound movement along Royal Parade is more congested in the Project model due to Royal Parade being reduced from three lanes to two lanes at the Grattan Street intersection. Grattan Street eastbound between Flemington Road and Royal Parade occasionally operates at its maximum capacity due to the lane reductions. Consequently, the eastbound queue on Grattan Street often spills back to Flemington Road preventing vehicles from Wreckyn Street flowing into Grattan Street. Grattan Street westbound has fewer vehicles and thus the performance of the westbound movement to Wreckyn Street improves compared to the Base model. Overall, the model does not have vehicles rerouting in the Project model because there are less vehicles in comparison to the 2031 Base model.

In the afternoon period, the southbound movement along Royal Parade is more congested in the Project model in comparison to the Base model. At the intersection of Royal Parade and Grattan Street, there are more vehicles queuing on Grattan Street westbound in the Project model due to the lane reduction. The congested approach limits the traffic flow heading westbound and therefore the east approach of Flemington Road and Grattan Street performance improves due to the arrival of fewer vehicles on this approach. Overall, the model does not have vehicles rerouting in the project model.

Regarding level of service of intersections, the results show an overall decrease in delay at the Haymarket intersection during the morning and afternoon peak period, as shown in Tables 3-13 and 3-14 below. With Grattan Street reduced to one lane, vehicles are expected to experience longer delays at the Elizabeth Street / Grattan Street / Royal Parade intersection. The delays on Grattan Street are also predicted to adversely affect Wreckyn Street.

Table 3-13 Intersection performance –AM peak 2031 Melbourne Metro legacy project

Intersection	Approach	2031 Base	2031 Reference	Difference
Haymarket Roundabout	Elizabeth Street (N)	50	50	0
	Elizabeth Street (SE)	60	50	-10
	Peel Street (S)	50	60	10
	Flemington Road (NW)	70	70	0
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	80	100	20
	Grattan Street (E)	40	70	30
	Elizabeth Street (S)	50	30	-20
	Grattan Street (W)	50	90	40
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	30	30	0
	Flemington Road (SE)	30	30	0
	Wreckyn Street (SW)	30	40	10
	Flemington Road (NW)	30	40	10

Table 3-14 Intersection performance - PM peak 2031 Concept Design

Intersection	Approach	2031 Base	2031 Reference	Difference
Haymarket Roundabout	Elizabeth Street (N)	70	80	10
	Elizabeth Street (SE)	160	110	-50
	Peel Street (S)	150	120	-30
	Flemington Road (NW)	160	120	-40
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	90	130	40
	Grattan Street (E)	100	70	-30
	Elizabeth Street (S)	50	30	-20
	Grattan Street (W)	40	120	80
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	130	30	-100
	Flemington Road (SE)	40	40	0
	Wreckyn Street (SW)	50	70	20
	Flemington Road (NW)	50	40	-10

3.5.4.3 Sensitivity Testing

A sensitivity test has been undertaken for the 2031 Concept Design using cordon trip matrices from the 2031 Base VITM model. These have been reduced by 2-3 per cent to reflect mode shift to public transport as a result of the implementation of Melbourne Metro. The sensitivity test simulates a scenario where existing car trip patterns remain unaltered, even though capacity is constrained along Grattan Street as a result of it being reduced to one lane in each direction. The sensitivity test assumes no wider diversion.

Table 3-15 summarises the general network statistics for the sensitivity model test, in comparison to the Concept Design model. In both morning peak period, the Sensitivity model is expected to deliver marginally lower vehicle trips and mean speed, suggesting a more degraded network. Network performance in the afternoon peak is similar for both Reference Project and Sensitivity models.

Table 3-15 Comparison of Sensitivity Test Network Performance

Peak	Parameters	2031 Sensitivity	Difference 2031 Sensitivity - Melbourne Metro	
			2031 Assessment project	%
AM Peak	Average Speed (km/h)	14.3	14.6	-2%
	VKT (veh km)	32,060	32,590	-2%
	VHT (hours)	2,240	2,230	1%
	Total vehicles	18,860	19,240	-2%
PM Peak	Average Speed (km/h)	13.9	13.9	0%
	VKT (veh km)	32,950	33,120	-1%
	VHT (hours)	2,380	2,390	0%
	Total vehicles	19,850	19,980	-1%
	Total vehicles	19,850	19,980	-1%

Overall, during the morning peak period, the Sensitivity model is predicted to experience longer delays than the Base and Project scenarios, particularly on Royal Parade and Grattan Street. Travel time in the morning period remained relatively similar between the three options along Flemington Road and Peel Street. The southbound travel time along Royal Parade and Elizabeth Street is predicted to increase in the Project and Sensitivity scenarios because of the Concept Design road configuration. However, the northbound direction travel time along Royal Parade and Elizabeth Street is predicted to decrease from the Base scenario. Between the Project and Sensitivity scenario, link volumes are similar with the exception of College Crescent westbound. The difference is likely due to the change in traffic demand.

Further congestion is estimated to occur during the afternoon period around the Haymarket roundabout in the Sensitivity scenario, compared to the Base and Project scenarios. The increase in delay around Haymarket is also reflected in the northbound travel time results. Between the Project and Sensitivity scenario, link volumes are similar. There is a marginal decrease in volume in the Sensitivity scenario in comparison to the Project scenario because of the additional general network delay. In conclusion, the Sensitivity scenario is predicted to perform poorly compared to the other scenarios.

3.6 Precinct 5: CBD North Station

3.6.1 Existing Conditions

3.6.1.1 Intersection Analysis

The following intersections have been modelled using SIDRA, traffic data collected in 2015, SCATS data and VicRoads data sheets outlining existing signal phasing and timing information.

- Swanston Street / La Trobe Street
- Elizabeth Street / Victoria Street
- Swanston Street / Franklin Street
- Swanston Street / Victoria Street
- Victoria Street / Therry Street
- Elizabeth Street / Therry Street.

Existing on-street timings have been used in the Sidra base models to simulate current conditions.

Sidra modelling based on turning count volumes indicates that at the Swanston Street intersection, La Trobe Street is operating within capacity in the AM and PM peak. However, observations in the PM peak showed high demand along the western approach (queues were observed to extend beyond Elizabeth Street). In reality, when considering observed demand, the La Trobe Street western approach operates over capacity during the PM peak hour.

Sidra modelling of the Swanston Street / Franklin Street intersection indicates that it operates close to capacity in the AM peak with a DoS of 0.92 for the right turn movement from Swanston Street (north) into Franklin Street. This movement was observed to queue back to Victoria Street most cycles. During the PM peak the intersection operates satisfactorily with a DoS of 0.65.

Sidra modelling of the Swanston Street / Victoria Street indicates that the intersection operates close to capacity in the AM peak with a DoS of 0.89 for the through movement on Victoria Street (west). During the PM peak the intersection operates with a DoS 0.80 which occur on the eastern approach. In both the AM and PM peak, the west approach was observed to have long queues but moved steadily, highlighting the high level of signal coordination along Victoria Street. Site observations also indicated that, while there is spare capacity at the signals, volumes along Victoria Street were sometimes constrained by capacity at downstream signals in both directions. The current signal timings at the intersection also result in spare capacity on the southern approach which is also reflected in the Sidra modelling results.

Sidra modelling of the Victoria Street / Therry Street intersection indicates that it operates within capacity during the AM and PM peak, using the Sidra timings. In reality, this intersection is coordinated with the adjacent intersections of Victoria Street/Elizabeth Street and Victoria Street/Swanston Street.

Sidra modelling of the Victoria Street / Elizabeth Street intersection indicates that the intersection operates within capacity in the AM peak (DoS 0.76). However, observations of the intersection in the AM peak indicated that the southbound movement on Elizabeth Street often blocked back from Therry Street to Victoria Street. This resulted in southbound vehicles being held back on the northern approach and unable to move and fully utilise the green time provided.

Sidra modelling indicates that in the PM peak the intersection operates with a DoS of 0.95. The critical movement is the right turn from Victoria Street east into Elizabeth Street north. Although this right turn movement had long queues it was observed to fully clear during the green time provided. It was also observed that vehicles turning into the northern Elizabeth Street exit did not fully utilise the inner most lane. This lane provides access to Elizabeth Street and Royal Parade north of the Haymarket roundabout. Perhaps by providing more opportunity for vehicles to access Flemington Road from this lane would make it a more attractive choice.

Sidra modelling of the Elizabeth Street / Therry Street intersection indicates that the intersection operates within capacity in both the AM and PM peak. However, observations indicate that the AM peak southbound demand is blocked due to downstream constraints preventing vehicles from using the entire green time provided (Table 3-16 and Table 3-17).

Sidra Results

AM Peak (08:00 – 09:00)

Table 3-16 Intersection performance - AM peak existing conditions

Intersection	Approach	Degree of saturation / level of Service	Maximum queue length (veh)	Average delay
Swanston Street / La Trobe Street	Swanston Street (N)	0.31	10 (bike +vehicles)	21
	La Trobe Street (E)	0.80	20	10
	Swanston Street (S)	0.25	3 (bike)	24
	La Trobe Street (W)	0.63	11	8
	Overall	**0.80**	**20**	**12**
Elizabeth Street / Victoria Street	Elizabeth Street (N)	0.46	9	25
	Victoria Street (E)	0.76 (RT)	9	22
	Elizabeth Street (S)	0.33 (Tram)	2	29
	Victoria Street (W)	0.75	16	24
	Overall	**0.76**	**16**	**24**
Swanston Street / Franklin Street	Swanston Street (N)	0.92	11	28
	Franklin Street (E)	0.72	15	29
	Swanston Street (S)	0.14	1	10
	Franklin Street (W)	0.21	3	20
	Overall	**0.92**	**15**	**26**
Swanston Street / Victoria Street	Swanston Street (N)	0.28	4	29
	Victoria Street (E)	0.55	12	14
	Swanston Street (S)	0.22	2	25
	Victoria Street (W)	0.89	33	22
	Overall	**0.89**	**33**	**22**
Victoria Street / Therry Street	Bouverie Street	0.18	2	41
	Victoria Street (E)	0.76	4	7
	Therry Street	0.15	2	40
	Victoria Street (W)	0.81	14	6
	Overall	**0.81**	**14**	**8**
Elizabeth Street / Therry Street	Elizabeth Street (N)	0.54	16	10
	Therry Street (E)	0.19	3	41
	Elizabeth Street (S)	0.16	0	0
	Therry Street (W)	0.26	4	41
	Overall	**0.54**	**16**	**13**

Source: Sidra model outputs

PM Peak (17:00 – 18:00)

Table 3-17 Intersection Performance PM peak Existing Conditions

Intersection	Approach	Degree of saturation / Level of Service	Maximum queue length	Average delay
Swanston Street / La Trobe Street	Swanston Street (N)	0.32	8 (bike+ vehicles)	22
	La Trobe Street (E)	0.62	11	8
	Swanston Street (S)	0.25	4 (bike)	23
	La Trobe Street (W)	0.79	20	10
	Overall	**0.79**	**20**	**12**
Elizabeth Street / Victoria Street	Elizabeth Street (N)	0.31	5	25
	Victoria Street (E)	0.95	18	27
	Elizabeth Street (S)	0.60	9	37
	Victoria Street (W)	0.79	19	24
	Overall	**0.95**	**19**	**28**
Swanston Street / Franklin Street	Swanston Street (N)	0.35	3	22
	Franklin Street (E)	0.32	5	28
	Swanston Street (S)	0.14	3	9
	Franklin Street (W)	0.65	12	30
	Overall	**0.65**	**12**	**24**
Swanston Street / Victoria Street	Swanston Street (N)	0.19	2	24
	Victoria Street (E)	0.80	19	10
	Swanston Street (S)	0.32	4	22
	Victoria Street (W)	0.72	20	18
	Overall	**0.80**	**20**	**15**
Victoria Street / Therry Street	Bouverie Street	0.25	4	42
	Victoria Street (E)	0.60	6	6
	Therry Street	0.39	6	43
	Victoria Street (W)	0.53	4	4
	Overall	**0.60**	**6**	**8**
Elizabeth Street / Therry Street	Elizabeth Street (N)	0.15	0	1
	Therry Street (E)	0.45	6	46
	Elizabeth Street (S)	0.40	1	1
	Therry Street (W)	0.31	5	40
	Overall	**0.45**	**6**	**11**

Source: Sidra model outputs

3.6.2 Future Conditions – 2031 No Project Case

3.6.2.1 Intersection Analysis

For the 2031 Base, the traffic volumes within the CBD are expected to remain at 2015 levels, based on the zero growth within the CBD over the last 10 -15 years, and analysis explained in Section 2.8.3. Intersection performance is therefore expected to be as shown in Tables 3.13 and 3.14 above.

A 10 per cent growth for all traffic movements within the CBD for the 2031 Base has been considered as a sensitivity test. The results of this sensitivity test for the intersections around CBD North precinct are shown below in Table 3-18 and Table 3-19.

As expected with a 10 per cent growth, all intersections have a higher DoS. A DoS of 0.9 is generally accepted as the optimum for efficient operation of a movement. Beyond this, movements become increasingly congested with extended queues.

In the AM peak, all intersections apart from Elizabeth Street – Therry Street are operating close to or beyond 0.9. In the PM peak, intersections along Victoria Street are operating close to or beyond capacity. In particular, the intersections of Franklin Street/Swanston Street and Victoria Street/Swanston Street would experience oversaturated conditions for at least one of their traffic movements during the AM peak hour. In the PM peak hour, the Elizabeth Street / Victoria Street intersection experiences oversaturated conditions on the Victoria Street (east) arm.

Sidra Results

AM Peak (08:00 – 09:00)

Table 3-18 Intersection performance - AM peak 2031 no project case with 10% growth

Intersection	Approach	Degree of saturation / level of service	Maximum queue length	Average delay
Swanston Street / La Trobe Street	Swanston Street (N)	0.30	10 (bike)	20
	La Trobe Street (E)	0.88	30	16
	Swanston Street (S)	0.15	2 (bike)	22
	La Trobe Street (W)	0.69	13	8
	Overall	**0.88**	**30**	**14**
Elizabeth Street / Victoria Street	Elizabeth Street (N)	0.51	10	25
	Victoria Street (E)	0.83	11	23
	Elizabeth Street (S)	0.33	2	28
	Victoria Street (W)	0.82	19	28
	Overall	**0.83**	**19**	**25**
Swanston Street / Franklin Street	Swanston Street (N)	1.10	23	68
	Franklin Street (E)	0.78	18	31
	Swanston Street (S)	0.09	1	10
	Franklin Street (W)	0.23	3	20
	Overall	**1.10**	**23**	**40**
Swanston Street / Victoria Street	Swanston Street (N)	0.31	5	29
	Victoria Street (E)	0.60	14	15
	Swanston Street (S)	0.14	2	24
	Victoria Street (W)	1.01	63	75

Intersection	Approach	Degree of saturation / level of service	Maximum queue length	Average delay
	Overall	**1.01**	**63**	**46**
Victoria Street / Therry Street	Bouverie Street	0.20	3	41
	Victoria Street (E)	0.83	4	7
	Therry Street	0.17	2	41
	Victoria Street (W)	0.90	25	12
	Overall	**0.90**	**25**	**12**
Elizabeth Street / Therry Street	Elizabeth Street (N)	0.60	18	10
	Therry Street (E)	0.21	3	41
	Elizabeth Street (S)	0.17	0	0
	Therry Street (W)	0.29	4	41
	Overall	**0.60**	**18**	**14**

Source: Sidra model outputs

PM Peak (17:00 – 18:00)

Table 3-19 Intersection performance - PM peak 2031 no project case with 10% growth

Intersection	Approach	Degree of saturation / level of service	Maximum queue length	Average delay
Swanston Street / La Trobe Street	Swanston Street (N)	0.32	8 (bike)	21
	La Trobe Street (E)	0.68	13	8
	Swanston Street (S)	0.15	4 (bike)	22
	La Trobe Street (W)	0.87	30	15
	Overall	**0.87**	**30**	**14**
Elizabeth Street / Victoria Street	Elizabeth Street (N)	0.34	6	26
	Victoria Street (E)	1.05	27	45
	Elizabeth Street (S)	0.72	10	38
	Victoria Street (W)	0.87	25	29
	Overall	**1.05**	**27**	**37**
Swanston Street / Franklin Street	Swanston Street (N)	0.39	4	24
	Franklin Street (E)	0.35	5	30
	Swanston Street (S)	0.10	3	9
	Franklin Street (W)	0.73	14	25
	Overall	**0.73**	**14**	**23**
Swanston Street / Victoria Street	Swanston Street (N)	0.12	2	24
	Victoria Street (E)	0.87	26	14
	Swanston Street (S)	0.36	5	22
	Victoria Street (W)	0.79	25	20
	Overall	**0.87**	**26**	**17**
Victoria Street /	Bouverie Street	0.28	4	43

Intersection	Approach	Degree of saturation / level of service	Maximum queue length	Average delay
Therry Street	Victoria Street (E)	0.66	7	6
	Therry Street	0.44	6	44
	Victoria Street (W)	0.58	5	4
	Overall	**0.66**	**7**	**8**
Elizabeth Street / Therry Street	Elizabeth Street (N)	0.16	0	1
	Therry Street (E)	0.50	7	47
	Elizabeth Street (S)	0.43	1	1
	Therry Street (W)	0.34	5	41
	Overall	**0.50**	**7**	**12**

Source: Sidra model outputs

3.6.3 Overview of Concept Design Functional Road Layout

CBD North station is located under Swanston Street, between Franklin Street and La Trobe Street. There are station entrances in Franklin Street, east and west of Swanston Street and adjacent to Swanston Street. The station entrances and associated station infrastructure, results in the following changes to the existing road layout.

- Closure of Franklin Street, between Swanston Street and Bowen Street
- Access only to Franklin Street from Victoria Street
- Two lanes of traffic, eastbound along Franklin Street, to the west of Swanston Street
- Kerb extension on the south side of Franklin Street, west of Swanston Street, resulting in a reduction in westbound traffic lanes on Franklin Street to one lane
- Revision of existing parking provision along Franklin Street and Swanston Street.

The functional design is shown in Figure 3-8.

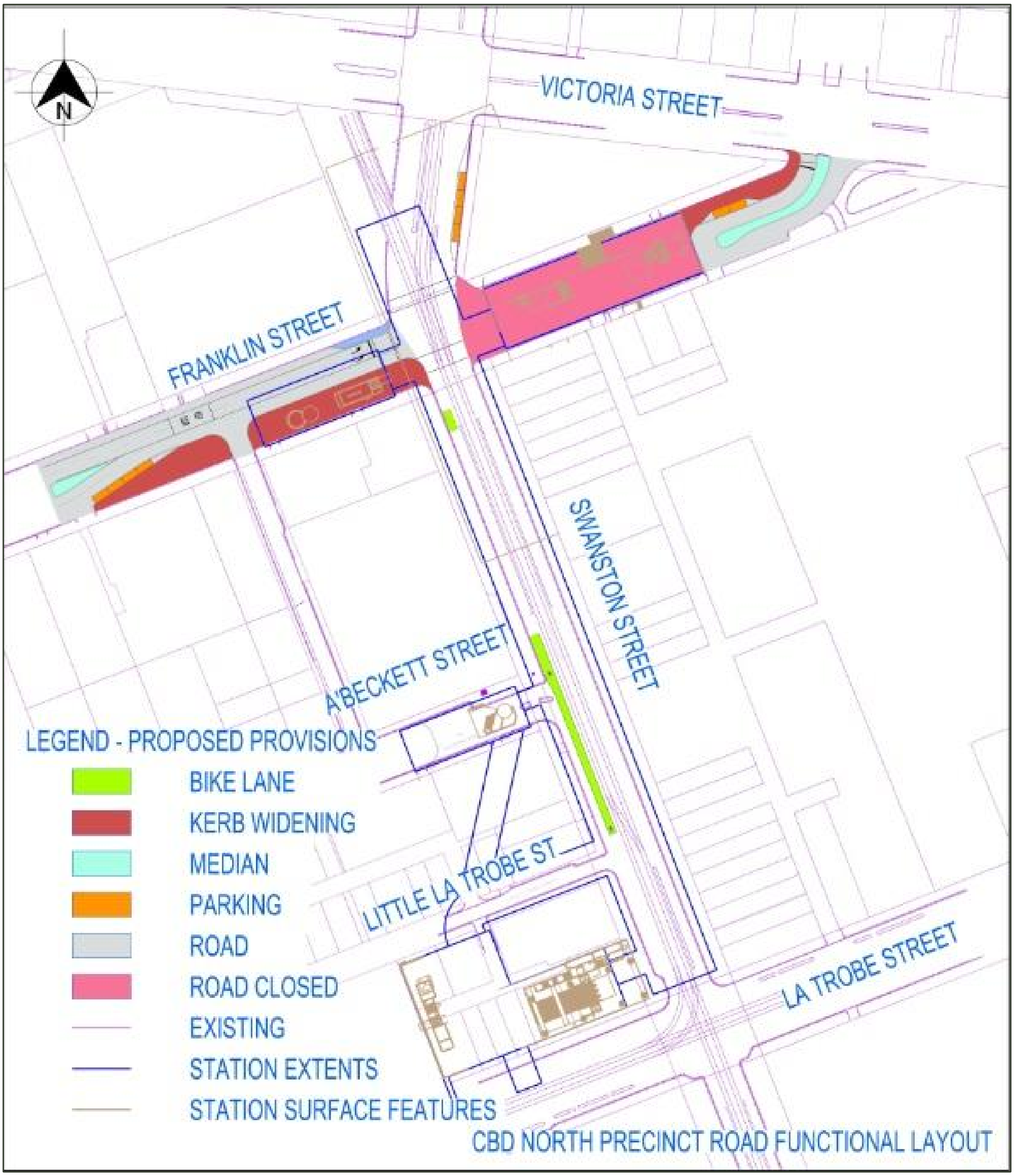


Figure 3-8 CBD North precinct road functional layout

3.6.4 Future Conditions – 2031 Assessment Project

3.6.4.1 Intersection Analysis

The closure of Franklin Street, east of Swanston Street, and reduction to one lane westbound, west of Swanston Street, would lead to a diversion of traffic from Franklin Street onto alternative routes. AJM-JV has reviewed potential alternative routes.

- The main alternative vehicle route identified maintains the use of Franklin Street west of Swanston Street accessed from Swanston Street and Victoria Street. This route can operate in both the eastbound and westbound direction. As the shortest diversion around the Franklin Street closure, it is expected to be used by most diverted traffic
- La Trobe Street - This route can operate in both the eastbound and westbound direction
- Therry Street.

These are shown in Figure 3-9.

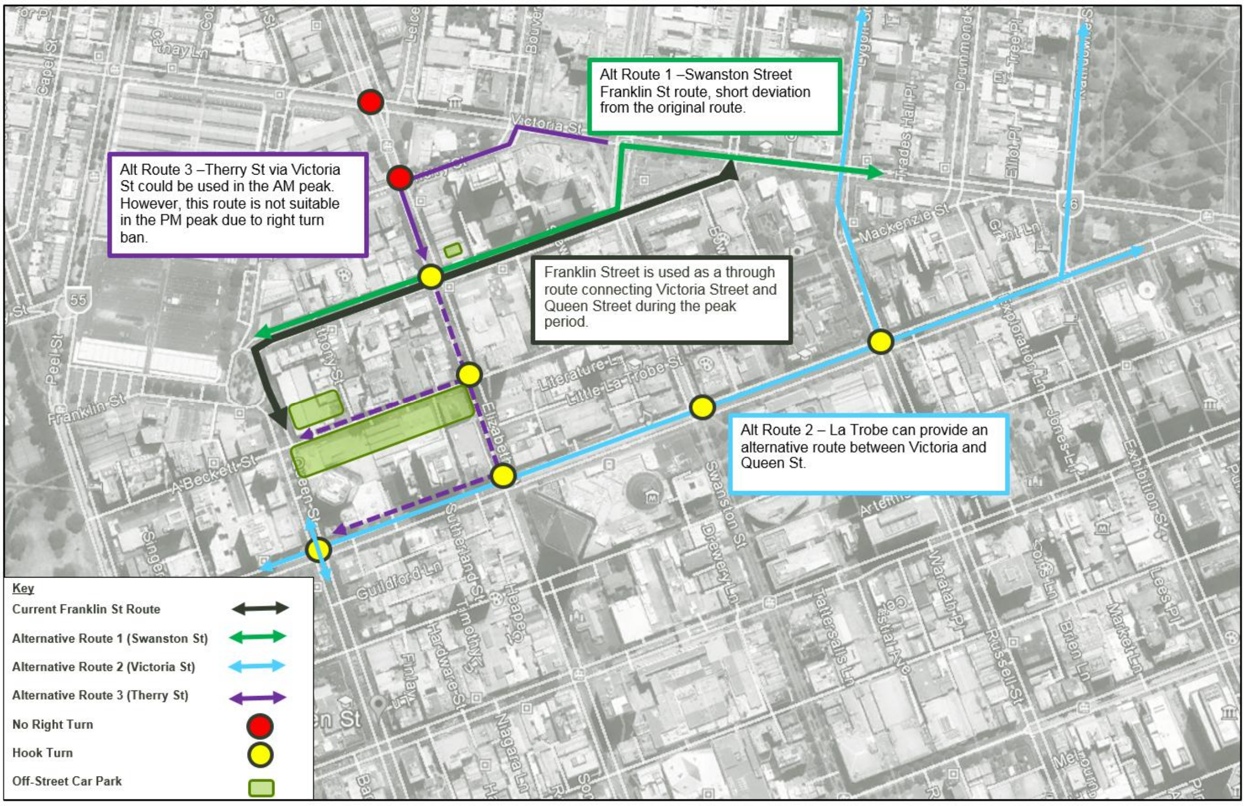


Figure 3-9 Franklin Street closure alternative routes

Sidra modelling has been used to test the capacity of the main alternative route using Victoria and Swanston Streets. Testing has been based on 80 per cent and 60 per cent of diverted traffic using this route. It is expected that the remaining traffic (20 per cent or 40 per cent) would use the other routes or redistribute more widely through the road network (or use alternative forms of travel).

The potential diversion scenarios considered are set out in Figure 3-10. La Trobe Street is expected to be next most attractive alternative route after Victoria/Swanston. This route has therefore been tested with a 20 per cent diversion from Franklin Street.

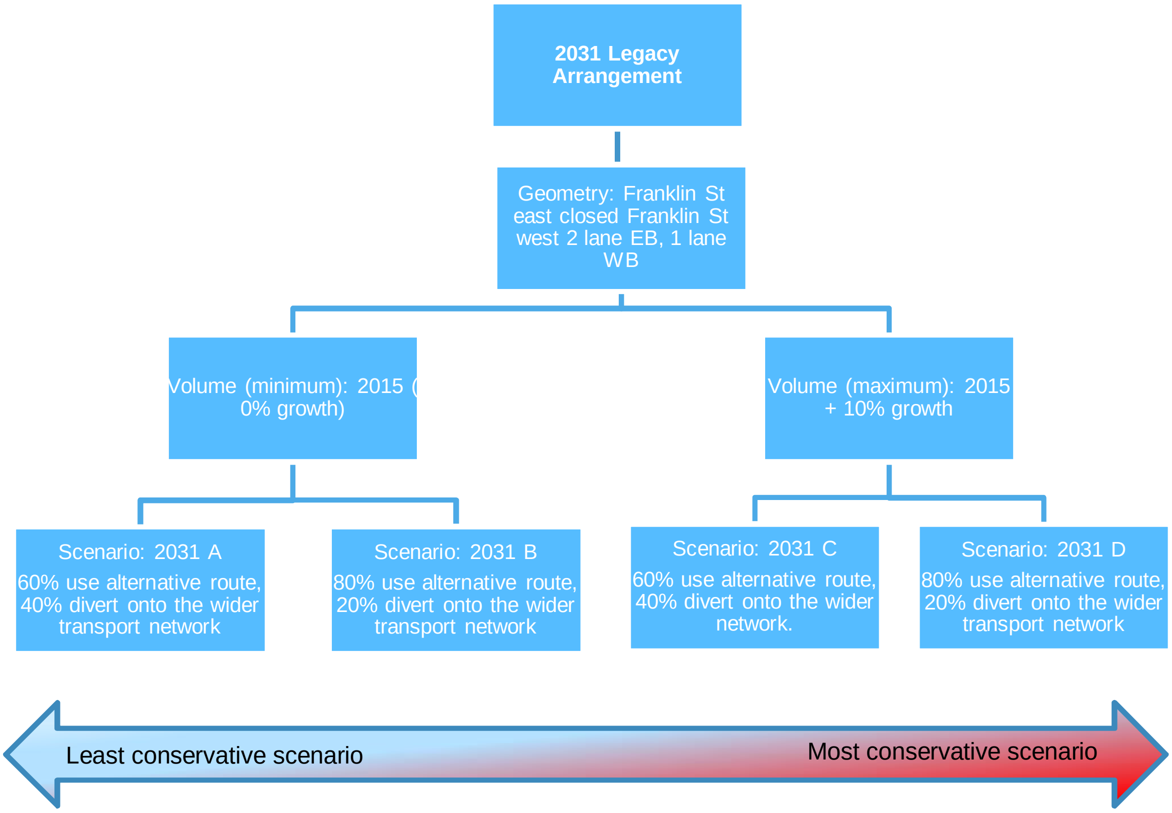


Figure 3-10 Scenario tests for traffic diversion around Franklin Street

Summary

The Sidra modelling indicates that, in both AM and PM peaks, the Victoria Street-Swanston Street-Franklin Street alternative route is likely to be able to accommodate up to 60 per cent of the diverted traffic from Franklin Street. Any additional traffic is likely to experience long delays in the westbound direction in the morning and eastbound in the evening due to high delays turning right from Swanston Street onto Victoria Street.

Modelling of the Swanston Street / La Trobe Street intersection indicates that with 20 per cent diversion onto La Trobe Street, in addition to the 10 per cent background growth, the intersection would be operating just beyond practical capacity, with a DoS of 1.00 in the AM peak and 0.98 in the PM peak.

On-street parking is currently allowed along La Trobe Street between 7:30am and 6:30pm. Introducing clearways during the AM and PM peak periods would provide additional capacity to more than meet the demand from the 20 per cent diverted traffic.

Sidra Results

These models have maintained the existing cycle times but green splits have been optimised by Sidra, while maintaining the existing pedestrian crossing timings.

Concept Design – AM Peak Results

Table 3-20 Intersection performance - AM Peak 2031 Melbourne Metro legacy project (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.22	9 (bike)	20
	La Trobe Street (E)	0.92	38	21
	Swanston Street (S)	0.18	2 (bike)	22
	La Trobe Street (W)	0.67	12	8
	Overall	**0.92**	**38**	**17**
Elizabeth Street / Victoria Street (no change from 2031 No Project)	Elizabeth Street (N)	0.46	9	25
	Victoria Street (E)	0.76 (RT)	9	22
	Elizabeth Street (S)	0.33 (Tram)	2	29
	Victoria Street (W)	0.75	16	24
	Overall	**0.76**	**24**	**16**
Swanston Street / Franklin Street	Swanston Street (N)	0.92	13	36
	Franklin Street (E)		Closed	
	Swanston Street (S)	0.24	3	37
	Franklin Street (W)	0.16	1	6
	Overall	**0.92**	**13**	**31**
Swanston Street / Victoria Street	Swanston Street (N)	0.89	12	36
	Victoria Street (E)	0.84	21	23
	Swanston Street (S)	1.01	9	49
	Victoria Street (W)	0.94	37	41
	Overall	**1.01**	**37**	**34**
Victoria Street / Therry Street (no change from 2031 No Project)	Bouverie Street	0.18	2	41
	Victoria Street (E)	0.76	4	7
	Therry Street	0.15	2	40
	Victoria Street (W)	0.81	14	6
	Overall	**0.81**	**14**	**8**
Elizabeth Street / Therry Street (no change from 2031 No Project)	Elizabeth Street (N)	0.54	16	10
	Therry Street (E)	0.19	3	41
	Elizabeth Street (S)	0.16	0	0
	Therry Street (W)	0.26	4	41
	Overall	**0.54**	**16**	**13**

Source: Sidra model outputs

Concept Design – PM Peak Results

Table 3-21 Intersection performance - PM peak assessment project (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.16	5 (bike)	20
	La Trobe Street (E)	0.64	11	8
	Swanston Street (S)	0.18	4 (bike)	22
	La Trobe Street (W)	0.89	32	15
	Overall	**0.89**	**32**	**15**
Elizabeth Street / Victoria Street (no change from 2031 No Project)	Elizabeth Street (N)	0.31	5	25
	Victoria Street (E)	0.95	18	27
	Elizabeth Street (S)	0.60	9	37
	Victoria Street (W)	0.79	19	24
	Overall	**0.95**	**19**	**28**
Swanston Street / Franklin Street	Swanston Street (N)	0.49	8	30
	Franklin Street (E)		Closed	
	Swanston Street (S)	0.45	10 (Bike)	37
	Franklin Street (W)	0.48	5	3
	Overall	**0.49**	**10**	**22**
Swanston Street / Victoria Street	Swanston Street (N)	0.66	7	56
	Victoria Street (E)	0.72	12	8
	Swanston Street (S)	0.73	12	30
	Victoria Street (W)	0.69	19	16
	Overall	**0.73**	**19**	**18**
Victoria Street / Therry Street (no change from 2031 No Project)	Bouverie Street	0.25	4	42
	Victoria Street (E)	0.60	6	6
	Therry Street	0.39	6	43
	Victoria Street (W)	0.53	4	4
	Overall	**0.60**	**6**	**8**
Elizabeth Street / Therry Street (no change from 2031 No Project)	Elizabeth Street (N)	0.15	0	1
	Therry Street (E)	0.45	6	46
	Elizabeth Street (S)	0.40	1	1
	Therry Street (W)	0.31	5	40
	Overall	**0.45**	**6**	**11**

Source: Sidra model outputs

Concept Design – AM Peak Results With 10% Growth

Table 3-22 Intersection Performance - AM peak assessment project with 10% growth (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.22	9 (bike)	20
	La Trobe Street (E)	1.00	67	61
	Swanston Street (S)	0.15	2 (bike)	22
	La Trobe Street (W)	0.73	15	8
	Overall	**1.00**	**67**	**30**
Elizabeth Street / Victoria Street (no change from 2031 No Project)	Elizabeth Street (N)	0.51	10	25
	Victoria Street (E)	0.83	11	23
	Elizabeth Street (S)	0.33	2	28
	Victoria Street (W)	0.82	19	28
	Overall	**0.83**	**19**	**25**
Swanston Street / Franklin Street	Swanston Street (N)	1.19	13	150
	Franklin Street (E)		Closed	
	Swanston Street (S)	0.17	3 (Bike)	31
	Franklin Street (W)	0.23	1	7
	Overall	**1.19**	**13**	**116**
Swanston Street / Victoria Street	Swanston Street (N)	0.98	14	72
	Victoria Street (E)	0.92	26	49
	Swanston Street (S)	1.04	10	121
	Victoria Street (W)	0.99	54	64
	Overall	**1.04**	**54**	**46**
Victoria Street / Therry Street (no change from 2031 No Project)	Bouverie Street	0.20	3	41
	Victoria Street (E)	0.83	4	7
	Therry Street	0.17	2	41
	Victoria Street (W)	0.90	25	12
	Overall	**0.90**	**25**	**12**
Elizabeth Street / Therry Street (no change from 2031 No Project)	Elizabeth Street (N)	0.60	18	10
	Therry Street (E)	0.21	3	41
	Elizabeth Street (S)	0.17	0	0
	Therry Street (W)	0.29	4	41
	Overall	**0.60**	**18**	**14**

Source: Sidra model outputs

Concept Design – PM Peak Results With 10% Growth

Table 3-23 Intersection performance - PM peak assessment project with 10% growth (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.16	5 (bike)	20
	La Trobe Street (E)	0.70	14	8
	Swanston Street (S)	0.15	4 (bike)	22
	La Trobe Street (W)	0.98	56	37
	Overall	**0.98**	**56**	**25**
Elizabeth Street / Victoria Street (no change from 2031 No Project)	Elizabeth Street (N)	0.34	6	26
	Victoria Street (E)	1.05	27	45
	Elizabeth Street (S)	0.72	10	38
	Victoria Street (W)	0.87	25	29
	Overall	**1.05**	**27**	**37**
Swanston Street / Franklin Street	Swanston Street (N)	0.55	10	21
	Franklin Street (E)		Closed	
	Swanston Street (S)	0.24	8	31
	Franklin Street (W)	0.55	4	7
	Overall	**0.55**	**10**	**21**
Swanston Street / Victoria Street	Swanston Street (N)	0.81	7	57
	Victoria Street (E)	0.85	19	8
	Swanston Street (S)	0.89	12	37
	Victoria Street (W)	0.73	20	14
	Overall	**0.89**	**20**	**18**
Victoria Street / Therry Street (no change from 2031 No Project)	Bouverie Street	0.28	4	43
	Victoria Street (E)	0.66	7	6
	Therry Street	0.44	6	44
	Victoria Street (W)	0.58	5	4
	Overall	**0.66**	**7**	**8**
Elizabeth Street / Therry Street (no change from 2031 No Project)	Elizabeth Street (N)	0.16	0	1
	Therry Street (E)	0.50	7	47
	Elizabeth Street (S)	0.43	1	1
	Therry Street (W)	0.34	5	41
	Overall	**0.50**	**7**	**12**

Source: Sidra model outputs

3.7 Precinct 6: CBD South Station

3.7.1 Existing Conditions

3.7.1.1 Intersection Analysis

The following intersections have been modelled using Sidra, traffic data collected in 2015, SCATS data and VicRoads data sheets outlining existing signal phasing and timing information.

- Swanston Street / Flinders Street
- Swanston Street / Collins Street
- Elizabeth Street / Flinders Street.

Site observations undertaken by AJM-JV at Swanston Street / Flinders Street indicate that queue lengths along Swanston Street (St Kilda Road) are dictated by upstream traffic signals. The modelling results indicate that this intersection is at capacity with Swanston Street south approach right turn movement and the Flinders Street east approach through movement both shown to have a DoS greater than 0.9 in both the AM and PM peak.

The Sidra modelling indicates that the Swanston / Collins St intersection operates within capacity during the AM and PM peak hour. Queue lengths of around ten vehicles in the AM peak and between six and 14 vehicles in the PM are experienced on Collins St. Average vehicle delays are around 10 sec on Collins St.

Site observations undertaken by AJM-JV at Elizabeth Street / Flinders Street indicate that queue lengths along Flinders Street (east) are dictated by the POS on Flinders Street. Both observation and modelling results indicate that the intersection of Flinders Street / Elizabeth Street operates within capacity during the AM and PM peak.

Sidra Results

AM Peak (08:00 - 09:00)

Table 3-24 Intersection performance - AM peak existing conditions

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / Flinders Street	Swanston Street (N)	0.22	8	28
	Flinders Street (E)	1.0	37	34
	Swanston Street (S)	1.0	25	45
	Flinders Street (W)	0.83	14	22
	Overall	**1.0**	**37**	**35**
Swanston Street / Collins Street	Swanston Street (N)	0.15	4 (Bike)	7
	Collins Street (E)	0.65	10	10
	Swanston Street (S)	0.27	7 (Bike)	10
	Collins Street (W)	0.63	8	9
	Overall	**0.65**	**10**	**9**
Elizabeth Street / Flinders Street	Elizabeth Street (N)	0.82	5	51
	Flinders Street (E)	0.75	9	4
	Flinders Street (W)	0.64	10	14
	Overall	**0.82**	**10**	**12**

Source: Sidra model outputs

PM Peak (17:00 – 18:00)

Table 3-25 Intersection performance PM peak existing conditions

Intersection	Approach	Degree of saturation / Level of Service	Maximum queue length (veh)	Average delay (s)
Swanston Street / Flinders Street	Swanston Street (N)	0.34	13	20
	Flinders Street (E)	0.96	21	26
	Swanston Street (S)	0.90	13	26
	Flinders Street (W)	0.62	10	22
	Overall	**0.96**	**21**	**25**
Swanston Street / Collins Street	Swanston Street (N)	0.16	4 (Bike)	7
	Collins Street (E)	0.51	6	9
	Swanston Street (S)	0.16	4 (Bike)	9
	Collins Street (W)	0.76	14	11
	Overall	**0.76**	**14**	**9**
Elizabeth Street / Flinders Street	Elizabeth Street (N)	0.61	6	42
	Flinders Street (E)	0.70	3	7
	Flinders Street (W)	0.68	12	18
	Overall	**0.70**	**12**	**14**

Source: Sidra model outputs

3.7.2 Future Conditions – 2031 No Project Case

3.7.2.1 Intersection Analysis

For the 2031 Base, the traffic volumes within the CBD are expected to remain at 2015 levels, based on the zero growth within the CBD over the last 10 -15 years, and analysis explained in Section 2.8.3. Intersection performance is therefore expected to be as shown in Tables 3.23 and 3.24.

A 10 per cent growth for all traffic movements within the CBD for the 2031 Base has been considered as a sensitivity test. The results of this sensitivity test for the intersections around CBD North precinct are shown in Table 3-26 and Table 3-27.

Summary

As expected with a 10 per cent growth, all intersections operate closer to their practical capacity. A DoS of 0.9 is generally accepted as the optimum for efficient operation of a movement. Beyond this, movements become increasingly congested with extended queues. However, apart from the Flinders Street /Swanston Street intersection in the AM peak, all intersections still operate within capacity.

Sidra Results

AM Peak (08:00 - 09:00)

Table 3-26 Intersection Performance - AM peak 2031 no project case with 10% growth

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / Flinders Street	Swanston Street (N)	0.22	8 (Bike+vehicles)	28
	Flinders Street (E)	1.13	56	161
	Swanston Street (S)	1.13	40	92
	Flinders Street (W)	0.90	17	26
	Overall	**1.13**	**56**	**64**
Swanston Street / Collins Street	Swanston Street (N)	0.14	4 (Bike)	7
	Collins Street (E)	0.70	11	10
	Swanston Street (S)	0.27	7 (Bike)	10
	Collins Street (W)	0.69	10	10
	Overall	**0.70**	**11**	**9**
Elizabeth Street / Flinders Street	Elizabeth Street (N)	0.89	5	58
	Flinders Street (E)	0.82	24	16
	Flinders Street (W)	0.69	12	14
	Overall	**0.89**	**24**	**18**

Source: Sidra model outputs

PM Peak (17:00 – 18:00)

Table 3-27 Intersection performance - PM peak 2031 no project case with 10% Growth

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / Flinders Street	Swanston Street (N)	0.35	13 (Bike)	20
	Flinders Street (E)	1.06	32	118
	Swanston Street (S)	0.99	17	50
	Flinders Street (W)	0.68	12	23
	Overall	**1.06**	**32**	**33**
Swanston Street / Collins Street	Swanston Street (N)	0.16	4 (Bike)	7
	Collins Street (E)	0.56	7	9
	Swanston Street (S)	0.15	4 (Bike)	9
	Collins Street (W)	0.82	18	15
	Overall	**0.82**	**18**	**11**
Elizabeth Street / Flinders Street	Elizabeth Street (N)	0.74	6	49
	Flinders Street (E)	0.75	17	11
	Flinders Street (W)	0.70	13	16
	Overall	**0.75**	**17**	**17**

Source: Sidra model outputs

3.7.3 Overview of Concept Design Functional Road Layout

CBD South station is located at the southern edge of the CBD directly beneath Swanston Street, between Collins Street and Flinders Street. There are station entrances in Flinders Street, east and west of Swanston Street, in Collins Street, at the northern end of City Square, and in Swanston Street. The station entrances and associated station infrastructure results in no significant change to the existing road layout. However, given the strategic location of the station, modelling has been undertaken for key intersections within and adjacent to the station precinct. Outputs from this modelling are described in the following sections.

The functional design is shown in Figure 3-11.

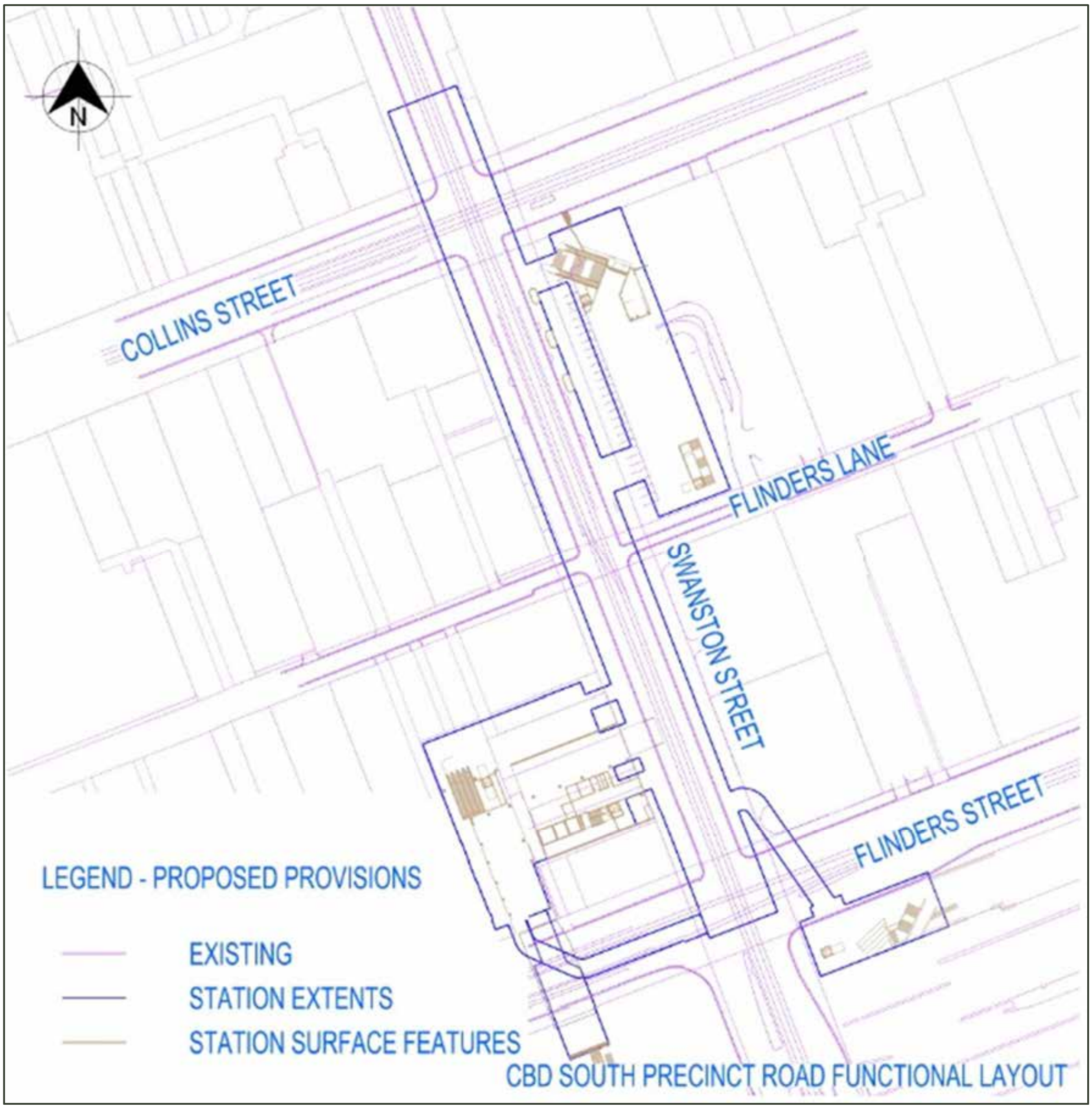


Figure 3-11 CBD South precinct road functional layout

3.7.4 Future Conditions – 2031 Melbourne Metro Legacy Project

As described in Section 3.7.3, Melbourne Metro does not materially affect the existing road layout within the CBD South precinct when compared with the No Project case. Therefore, network impacts with Melbourne Metro are expected to be the same as for the 2031 Base Case as described in Section 3.7.2.

3.8 Precinct 7: Domain Station

3.8.1 Existing Conditions

3.8.1.1 Domain VISSIM Model

VISSIM microsimulation modelling has been used to assess performance of the local road network around the proposed Domain station.

The model extents include all local roads within the area illustrated in Figure 3-12 and Figure 3-13 including the following key intersections:

- St Kilda Road/ Domain Road/ Albert Road
- St Kilda Road/ Bowen Crescent
- St Kilda Road/ Toorak Road/ Kings Way
- St Kilda Road/ Arthur Street/ Slater Street
- Park Street/ Kings Way
- Albert Road/ Kings Way
- Toorak Road/ Millswyn Street
- Kings Way/ Queens Road.

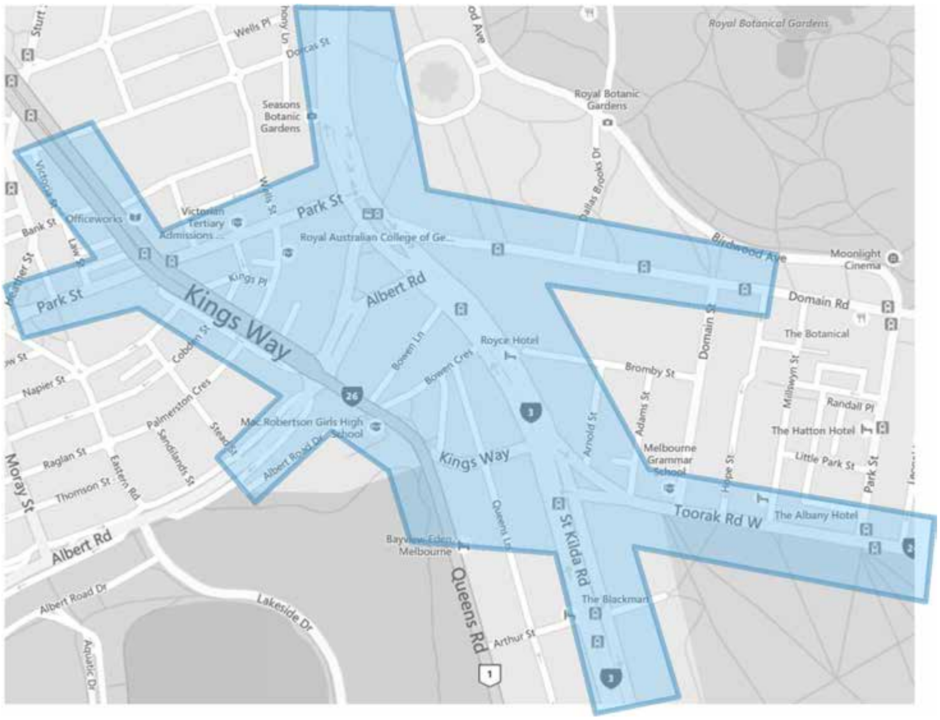


Figure 3-12 Extent of inputs into Domain VISSIM model

Figure 3-13 Domain microsimulation area

3.8.1.2 Network Analysis

As microsimulaton models are stochastic, they can produce different outcomes depending on their starting conditions. Therefore it is necessary to assess how the model behaves under a variety of starting conditions (referred as seeds) using the same input parameters.

In order to assess the model and to determine an appropriate seed run for reporting, a total of five seed runs were simulated for both peak periods, namely seed runs 42, 292, 542, 792 and 1,042. Outputs from the median seed were used for reporting purposes.

Unlike Sidra, VISSIM provides statistics relating to the performance of the road network within the model, rather than individual intersection statistics. Sections 3.8.1.2 and 3.8.1.3 provide key statistics for the existing performance of the road network around the proposed Domain station.

The Base models for 2015 AM and PM have been calibrated and validated against traffic survey data collected in 2015, and reflects traffic conditions observed on site. This can be characterised as a network approaching capacity for a number of traffic movements, with some queuing and delay but overall is performing in a reasonable manor typical of an inner city location.

Table 3-28 Network Performance Summary - 2015 Base

Peak	Parameters	2015 (Vol.)
AM Peak	Average Travel Time (min)	3.23
	Average delay per vehicle (s)	80
	Average Speed (km/h)	20
	VHT – Total Travel Time	1030
	VKT - Total Distance Travelled (km)	20690
	Total Completed Trips	18240
PM Peak	Average Travel Time (min)	3.33
	Average delay per vehicle (s)	90
	Average Speed (km/h)	20
	VHT – Total Travel Time	1070
	VKT - Total Distance Travelled (km)	21620
	Total Completed Trips	18090

Source: VISSIM model

3.8.1.3 Intersection Analysis

Movement delays have been collected using travel time sections for the key intersections of the study area.

The tables below demonstrate the maximum queue, movement delay and LOS for each approach based on the HCM 2000 criteria. The movement delay difference criteria are also indicated below.

LOS	Average Delay (s)
A	<10
B	10 to 20
C	20 to 35
D	35 to 55
E	55 to 80
F	>80

Average Delay Difference (s)	
A	-200 to -20
D	-20 to 20
F	20 to 200

The results have been analysed for the signalised intersections within the study area and show the results associated with individual approaches to the intersections.

Table 3-29 Intersection Analysis - 2015 (Existing Conditions) - AM Peak

Period	Intersection	Approach	Max queue (m)	Avg Delay (s)
7:30-8:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	100	20
		Domain Road	400	150
		St Kilda Road South	300	20
		Park Street	310	150
		Albert Road	70	80
	St Kilda Road/ Toorak	St Kilda Road North	130	40

Period	Intersection	Approach	Max queue (m)	Avg Delay (s)
	Road/ Kings Way	Toorak Road	210	80
		St Kilda Road South	230	30
		Kings Way	120	60
8:30-9:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	60	20
		Domain Road	510	270
		St Kilda Road South	190	30
		Park Street	290	120
		Albert Road	90	120
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	170	40
		Toorak Road	210	80
		St Kilda Road South	230	50
		Kings Way	130	60

Table 3-30 Intersection Analysis - 2015 (Existing Conditions) - PM Peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)
4:30-5:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	60	20
		Domain Road	180	100
		St Kilda Road South	190	30
		Park Street	390	290
		Albert Road	30	70
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	230	40
		Toorak Road	250	80
		St Kilda Road South	340	40
		Kings Way	170	60
5:30-6:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	100	20
		Domain Road	90	80
		St Kilda Road South	190	20
		Park Street	320	120
		Albert Road	40	80
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	240	40
		Toorak Road	120	80
		St Kilda Road South	400	40
		Kings Way	130	60

3.8.1.4 Overview of Existing Network Performance

Overall, the 2015 Base model reflects observations made on site and correlates well with turn counts and journey times surveyed on site. Traffic generally moves well along St Kilda Road with any delays primarily occurring to vehicles on side roads, such as Park Street, Domain Road, Toorak Road and Kings Way entering or crossing St Kilda Road. This reflects the priority to tram and traffic movement along St Kilda Road.

3.8.2 Future Conditions – 2031 No Project Case

3.8.2.1 VITM Demand Summary

A cordon screenline around the Domain precinct area has been used to compare growth of traffic volumes through Domain between the 2011 and 2031 Base networks. This analysis indicated negligible growth in total traffic volumes between the models. However, some specific origin – destination trips through the area have shown an increase or decrease. Generally, increases are predicted to occur in the contra-peak direction, for example, southbound along St Kilda Road in the morning, with decreases in the peak direction.

3.8.2.2 VISSIM Network Volumes

Table 3-31 and Table 3-32 summarise the changes in the volumes on key links within the VISSIM model network. Note that these are recorded through movements, not demand and may therefore be impacted by network delay.

Table 3-31 VISSIM demand summary – 2031 no project case (2 hr volumes)

Period	Road	Section	Direction	2015 Base	2031 Base (no project)	Difference
7:30-9:30AM	St Kilda Road	South of Dorcas Street	NB	3120	3070	-50
			SB	1530	2050	520
	Park Street	East of Kings Way	EB	710	840	130
			WB	790	780	-10
	St Kilda Road	North of Toorak Road	NB	4100	4060	-40
			SB	1490	1820	330
	Kings Way	West of Queens Lane	EB	1500	1700	200
			WB	1380	1370	-10
	Toorak Road	East of Park Street	EB	1090	1360	270
			WB	1750	1610	-150
	St Kilda Road	South of Arthur Street	NB	4520	4520	0
			SB	2700	2860	160

Table 3-32 VISSIM demand summary - PM peak 2031 no project case (2 hr volumes)

Period	Road	Section	Direction	2015 Base	2031 Base (no project)	Difference
4:30-6:30PM	St Kilda Road	South of Dorcas Street	NB	2110	2450	340
			SB	2720	2720	0
	Park Street	East of Kings Way	EB	890	890	0
			WB	1050	1040	-10

Period	Road	Section	Direction	2015 Base	2031 Base (no project)	Difference
	St Kilda Road	North of Toorak Road	NB	2560	2860	300
			SB	2940	2940	-4
	Kings Way	West of Queens Lane	EB	2140	2060	-80
			WB	1610	1610	0
	Toorak Road	East of Park Street	EB	2080	1960	-120
			WB	1390	1580	190
	St Kilda Road	South of Arthur Street	NB	2980	2980	0
			SB	3720	3640	-80

Volumes in 2031 are generally comparable with 2015, with the maximum different being approximately 260 vehicles per hour along St Kilda Road (southbound), south of Dorcas Street during the AM Peak period in the 2031 Base, whilst the PM results indicate an increase of approximately 170 vehicles travelling north at the same location.

3.8.2.3 Network Performance

Sections 3.8.2.3 and 3.8.2.4 compare network performance of the 2015 Existing and 2031 Base (No Project) models.

Table 3-33 Network performance summary - 2031 No project case

Peak	Parameters	2015 Existing conditions	Difference 2031 no project – 2015 existing	
			Value	Diff (%)
AM Peak	Average Travel Time (min)	3.23	3.33	0.10 (5%)
	Average delay per vehicle (s)	80	90	10 (13%)
	Average Speed (km/h)	20	20	0 (0%)
	VHT – Total Travel Time	1030	1100	70 (7%)
	VKT - Total Distance Travelled (km)	20690	21580	890 (4%)
	Total Completed Trips	18240	18630	390 (2%)
PM Peak	Average Travel Time (min)	3.33	3.28	-0.05 (-2%)
	Average delay per vehicle (s)	90	90	0 (0%)
	Average Speed (km/h)	20	20	0 (0%)
	VHT – Total Travel Time	1070	1060	-10 (-1%)
	VKT - Total Distance Travelled (km)	21620	22020	400 (2%)
	Total Completed Trips	18090	18270	180 (1%)

Source: VISSIM Model

Table 3-33 indicates that difference in network performance between 2015 and 2031, in both peaks, is marginal. There is a small decline in all network performance parameters in the AM Peak. The PM peak experiences a slight increase in overall network performance parameters due to the decrease in traffic movements turning right into Toorak Road from St Kilda Road. This in return allows for more time to be allocated to other phases in the peak direction.

When comparing travel times. The 2031 No project model indicates a longer travel time for both routes during the AM peak period, and a decline in travel time for both routes in the PM peak. However, the travel times changes are minor, with the maximum increase being 15 seconds during the AM Peak (7:30-8:30AM), and maximum decrease being 11 seconds in the PM Peak (4:30-5:30PM).

3.8.2.4 Intersection Analysis

Movement delays have been collected using travel time sections for the key intersections of the study area.

Table 3-34 and Table 3-35 demonstrate the maximum queue, movement delay and LOS for each approach based on the High Capacity Metro (HCM) 2000 criteria. The movement delay difference criteria is also indicated below. The results are compared to the 2015 Base Case.

Table 3-34 Intersection analysis – 2031 no project case – AM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2015 existing (s)
7:30-8:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	110	30	10
		Domain Road	160	100	-50
		St Kilda Road South	220	20	0
		Park Street	390	280	130
		Albert Road	90	130	50
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	100	40	0
		Toorak Road	180	80	0
		St Kilda Road South	210	30	0
		Kings Way	110	50	-10
8:30-9:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	110	30	10
		Domain Road	220	120	-150
		St Kilda Road South	330	30	0
		Park Street	390	300	180
		Albert Road	60	100	-20
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	160	40	0
		Toorak Road	180	80	0
		St Kilda Road South	230	50	0
		Kings Way	120	60	0

Table 3-35 Intersection analysis – 2031 no project case – PM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2015 existing (s)
4:30-5:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	40	20	0
		Domain Road	260	110	10
		St Kilda Road South	210	30	0
		Park Street	410	230	-60
		Albert Road	30	70	10
	St Kilda Road/ Toorak	St Kilda Road North	190	40	0

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2015 existing (s)
	Road/ Kings Way	Toorak Road	300	100	20
		St Kilda Road South	210	30	-10
		Kings Way	160	60	0
5:30-6:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	40	20	0
		Domain Road	80	70	-10
		St Kilda Road South	210	30	10
		Park Street	200	90	-30
		Albert Road	40	60	-20
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	270	40	0
		Toorak Road	230	90	10
		St Kilda Road South	130	20	-20
		Kings Way	130	60	0

Comparison of the 2031 No Project and 2015 Base model indicates similar movement delays on all approaches apart from Park Street in the AM peak which experiences increased movement delays and Domain Road, where movement delays reduce. This reflects increased trips along Park Street predicted by the 2031 No Project VITM model.

Generally, the 2031 No Project model has a similar level of performance as the 2015 Existing model. Although there are differences, these are generally small, and the network continues to perform at an acceptable level.

3.8.3 Overview of Concept Design Functional Road Layout

Domain station is located under St Kilda Road, between Domain Road and Bowen Crescent. There are three entrances to the station located to the east and west of St Kilda Road and in the centre of St Kilda Road, near its intersections with Domain Road and Albert Road. The latter entrance provides a direct interchange with tram services along St Kilda Road. The new station entrances and associated station infrastructure, results in the following changes to the existing road layout.

- Closure of the southern arm of Albert Road at its intersection with St Kilda Road
- Removal of the existing tram interchange and associated pedestrian crossings at Domain
- Removal of the existing tram stops between Bowen Lane and Bowen Crescent, and the southbound tram stop just north of Kings Way
- Provision of new tram superstops on St Kilda Road adjacent to Domain station and just south of Toorak Road West
- Provision of new pedestrian crossings along St Kilda Road, aligned with the new station and tram stops
- Removal of existing nature strip medians separating traffic lanes along St Kilda Road
- Reconfiguration of traffic lanes along St Kilda Road between the intersections with Domain Road and Kings Way; two options are still being considered:
  - Reduction in traffic lanes to two through lanes, and one cycle lane, in each direction
  - Retention in traffic lanes to three through lanes, and one cycle lane, in each direction.

Outputs from the modelling of each lane configuration are described in the following sections.

The functional design is shown in Figure 3-14.

Figure 3-14 Road functional layout around Domain station

3.8.4 Future Conditions – 2031 Assessment Project

3.8.4.1 VITM Demand Summary

As described in Section 3.8.3, two road configurations for the legacy state of St Kilda Road are still being reviewed:

- RC1 – a two lane configuration for general traffic between Kings Way and Domain Road
- RC2 – a three lane configuration for general traffic between Kings Way and Domain Road during the morning and evening peak.

For both options, a cordon screenline around the Domain precinct area has been used to compare growth of traffic volumes through Domain between the 2031 networks, with and without Melbourne Metro. This analysis indicated negligible growth in total traffic volumes between the base and options. However, some specific origin – destination trips through the area have shown an increase or decrease.

3.8.4.2 VISSIM Network Volumes

Table 3-36 and Table 3-37 summarise the changes in the volumes on key links within the VISSIM model network. Note that these are recorded through movements, not demand and may therefore be impacted by network delay.

Table 3-36 VISSIM network volumes summary – AM peak 2031 Concept Design

Period	Road	Section	Direction	2031 No Project	2031 RC1	Difference from no Project	2031 RC2	Difference from no Project
7:30-9:30AM	St Kilda Road	South of Dorcas Street	NB	3070	2543	-525	3010	-60
			SB	2050	1750	-298	1910	-140
	Park Street	East of Kings Way	EB	840	841	1	840	0
			WB	780	778	3	880	0
	St Kilda Road	North of Toorak Road	NB	4060	3190	-870	4050	-10
			SB	1820	1595	-227	1930	110
	Kings Way	West of Queens Lane	EB	1700	1755	53	1700	0
			WB	1370	1575	205	1530	160
	Toorak Road	East of Park Street	EB	1360	1307	-50	1350	-10
			WB	1610	1367	-238	1570	-30
	St Kilda Road	South of Arthur Street	NB	4520	3935	-583	4500	-20
			SB	2860	2571	-287	2770	-90

Table 3-37 VISSIM network volumes summary – PM peak 2031 Concept Design

Period	Road	Section	Direction	2031 No Project	2031 RC1	Difference from no Project	2031 RC2	Difference from no Project
4:30-6:30PM	St Kilda Road	South of Dorcas Street	NB	2450	2140	-310	2320	-130
			SB	2720	2350	-370	2570	-150
	Park Street	East of Kings Way	EB	890	890	0	890	0
			WB	1040	1060	20	1060	20

Period	Road	Section	Direction	2031 No Project	2031 RC1	Difference from no Project	2031 RC2	Difference from no Project
	St Kilda Road	North of Toorak Road	NB	2860	2510	-350	2640	-220
			SB	2940	2510	-430	2930	-10
	Kings Way	West of Queens Lane	EB	2060	2130	70	2060	0
			WB	1610	1720	110	1550	-60
	Toorak Road	East of Park Street	EB	1960	1790	-170	1830	-130
			WB	1580	1520	-60	1520	-60
	St Kilda Road	South of Arthur Street	NB	2980	2900	-80	2940	-40
			SB	3640	3320	-320	3620	-20

The both peak periods, traffic volumes along St Kilda Road are reduced in the two lane option (RC1) when compared to the No Project model. This is primarily due to the reduction in the number of traffic lanes along this section of road encouraging some traffic to use alternative routes. Reductions are up to 450 vehicles per hour in the morning peak along St Kilda Road, north of Toorak Road, in the northbound direction.

For the three lane option (RC2) volumes are similar to the 2031 No Project case, and all differences are within expected daily fluctuations (usually taken as 10 per cent).

3.8.4.3 Network Performance

Table 3-38 Network performance summary - 2031 Concept Design

Peak	Parameters	2031 No Project	Difference 2031 RC1 - 2031 no Project		Difference 2031 RC2 - 2031 no Project	
			Value	Diff (%)	Value	% Diff
AM Peak	Average Travel Time (Min)	3:33	2:47	14 (7%)	3:41	0.08 (4%)
	Average delay per vehicle (s)	90	99	12.8 (15%)	90	0 (0%)
	Average Speed (km/h)	20	17.6	-2.0 (-10%)	20	0 (0%)
	VHT – Total Travel Time	1100	1090	-9.4 (1%)	1120	20 (2%)
	VKT - Total Distance Travelled (km)	21580	19180	-2395.6 (-11%)	21330	-250 (-1%)
	Total Completed Trips	18630	17260	-1366 (-7%)	18250	-380 (-2%)
PM Peak	Average Travel Time (min)	3:28	235	27 (13%)	3:21	-0.07 (-3%)
	Average delay per vehicle (s)	90	105	19.1 (22%)	80	-10 (-11%)
	Average Speed (km/h)	20	18.1	-2.7 (-13%)	20	0 (0%)
	VHT – Total Travel Time	1060	1140	86.1 (8%)	1000	-60 (-6%)
	VKT - Total Distance Travelled (km)	22020	20690	-1326.8 (-6%)	21260	-760 (-3%)
	Total Completed Trips	18270	17480	-782 (-4%)	17870	-400 (-2%)

Overall, there is a slight decline in all network performance parameters for the two lane option (RC1) due to the reduced number of lanes along St Kilda Road. During the AM peak, there is a longer travel time for northbound traffic (peak direction) of up to 50 seconds in the second peak hour during RC1, primarily due to reduced capacity along St Kilda Road south of Toorak Road and the relocation of the pedestrian crossings on St Kilda Road. However, travel time for southbound traffic along St Kilda Road decreases by up to 25 seconds, due primarily to the decrease in traffic volumes in RC1 and changes at the St Kilda Road/ Toorak Road/ Kings Way intersection resulting from an increase in frequency of the right turn movement on St Kilda Road (southbound) to accommodate additional vehicles U-Turning.

During the PM peak in Option RC1, there is an increase in travel time in both directions due to the build-up of vehicles waiting at the St Kilda Road/ Kings Way/ Toorak Road intersection and reduced capacity along St Kilda Road. The relocation of the pedestrian crossings on St Kilda Road, adjacent to the new station, also increase travel times between Domain Road and Park Street in both directions.

With the additional capacity in the three lane option (RC2), the network performance parameters indicate a more similar result to the 2031 Base. In the AM peak, while there is still an increase in travel time northbound along St Kilda Road, this is less at 37 seconds maximum. Again, southbound traffic along St Kilda Road experiences a decrease in travel time, of up to 25 seconds.

During the PM peak in Option RC2, there is a decrease in travel times in comparison to the 2031 Base, of up to 15 seconds travelling southbound. This, like the AM peak, is also due to the increase in frequency of the phase accommodating the right turn movement at the intersection of St Kilda Road/ Toorak Road/ Kings Way.

3.8.4.4 Intersection Analysis

Movement delays have been collected using travel time sections for the key intersections of the study area.

Table 3-39 to Table 3-42 demonstrate the maximum queue, movement delay and LOS for each approach based on the HCM 2000 criteria for the two Concept Design options. The results are compared to the 2031 No Project model.

Table 3-39 Intersection analysis – 2031 RC1 – AM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2031 base (s)
7:30-8:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	117	36	8
		Domain Road	164	85	-16
		St Kilda Road South	104	18	0
		Park Street	390	214	-65
		Albert Road	111	226	101
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	129	39	0
		Toorak Road	318	111	31
		St Kilda Road South	402	49	19
		Kings Way	150	73	20
8:30-9:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	111	59	30
		Domain Road	262	100	-21
		St Kilda Road South	332	31	-2
		Park Street	373	205	-93
		Albert Road	69	124	27
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	144	40	0
		Toorak Road	194	80	0
		St Kilda Road South	512	73	23
		Kings Way	129	79	17

Table 3-40 Intersection analysis – 2031 RC1 – PM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2031 base (s)
4:30-5:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	71	23	0
		Domain Road	93	63	-49
		St Kilda Road South	417	78	52
		Park Street	389	183	-42
		Albert Road	62	152	75
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	290	35	-1
		Toorak Road	155	80	-22
		St Kilda Road South	506	42	16
		Kings Way	185	74	14
5:30-6:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	58	20	0
		Domain Road	126	59	-11
		St Kilda Road South	285	43	14
		Park Street	185	90	4
		Albert Road	60	135	73
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	365	73	34
		Toorak Road	284	106	12
		St Kilda Road South	367	44	19
		Kings Way	184	87	31

Table 3-41 Intersection analysis – 2031 RC2 – AM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2031 base
7:30-8:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	80	20	-10
		Domain Road	170	80	-20
		St Kilda Road South	120	30	10
		Park Street	400	280	0
		Albert Road	160	330	210
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	130	40	0
		Toorak Road	200	90	10
		St Kilda Road South	300	40	10
		Kings Way	120	60	10
8:30-9:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	100	20	-10
		Domain Road	130	80	-50
		St Kilda Road South	190	40	0
		Park Street	390	260	-40
		Albert Road	120	220	120
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	140	40	0
		Toorak Road	350	130	50

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2031 base
		St Kilda Road South	510	70	20
		Kings Way	220	90	30

Table 3-42 Intersection analysis – 2031 RC2 – PM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2031 base (s)
4	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	80	20	-10
		Domain Road	100	60	-50
		St Kilda Road South	300	40	20
		Park Street	300	150	-70
		Albert Road	70	140	60
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	90	30	-10
		Toorak Road	210	90	-10
		St Kilda Road South	400	30	10
		Kings Way	130	60	0
5:30-6:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	160	20	0
		Domain Road	110	70	-10
		St Kilda Road South	200	30	0
		Park Street	90	80	-10
		Albert Road	50	130	60
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	170	40	0
		Toorak Road	330	120	30
		St Kilda Road South	210	30	10
		Kings Way	14	60	10

The results indicate that there is an increase in queues on St Kilda Road south of Toorak Road (up to 300 m) due to the reduced capacity of St Kilda Road after the intersection in RC1.

The results also indicate that during the Option RC1 in the PM peak, the decrease in capacity on St Kilda Road at the intersection of St Kilda Road/ Kings Way/ Toorak Road causes vehicles to queue back on St Kilda Road in both directions. Option RC2 results indicate a similar trend to the 2031 No Project, with the exception of St Kilda Road, north of Domain Road travelling southbound, by up to 140 m.

Results for RC2 indicate a similar to trend to the 2031 No Project, with the exception of an increase of approximately 150m along Toorak Road.

3.8.4.5 Conclusion

Comparing the two 2031 Assessment Case options to the 2031 No Project, the results indicate the following:

- Network performance parameters incur a moderate decrease for Option RC1, and comparable results with a slight improvement in the PM Peak for Option RC2.
- Travel times generally increase in the peak direction for both the AM and PM peaks, with the exception of Option RC2 which indicates a slight improvement in peak direction. In the contra-peak direction, there

are improvements to the travel times in the AM peak period for both options and the first peak hour during the PM peak.

- Queues along St Kilda Road are expected to increase in Option RC1 (i.e. by up to 300 m south of Toorak Road in the AM and PM peak) due to the decrease in capacity and increase in traffic volumes avoiding St Kilda Road. Although queues increases are relatively high, they do not impact the operation of the nearby signalised intersections as the queue is considered to be a rolling queue.
  Queues for Option RC2 indicate comparable results to the 2031 No Project with the exception of Toorak Road by up to 150 m in the AM Peak and St Kilda Road (north of Domain Road) by up to 140 m in the PM Peak.
- The average speed plots indicate that there is a reduction in speed along St Kilda Road between Domain Road and Arthur Street due to the reduced capacity on St Kilda Road, during both the AM and PM peak for options RC1. Option RC2 indicates a similar average speed plot to the 2031 No Project.
- On average, there is a slight increase in delay in most movements during both peak periods, with large increases in delay occurring mainly along Toorak Road and Albert Road in the AM and PM peak periods. There is a decrease in delay along Domain Road and Park Street in both peak periods.
- Volumes indicate that, between the two options, there is a decrease of up to 400 vehicles per hour in the AM peak on St Kilda Road, and a decrease of approximately 200 vehicles in the PM peak in Option RC1, whilst the volumes in Option RC2 are comparable to the 2031 No Project case.

Overall the network continues to operate within acceptable standards for both the two Concept Design options.

3.8.5 Sensitivity Test

For RC1, a sensitivity test was undertaken whereby traffic volumes were considered to have no increase or decrease from the 2031 Base. The only changes made were where traffic movements in RC1 functional layout were not allowed, for example a number of right turns from St Kilda Road (southbound) into several side roads. For these movements, traffic was reassigned using professional judgement.

It is noted that a sensitivity test was not undertaken for RC2, as the traffic volumes were similar to the Base Case already.

The outcome of the sensitivity test is summarised below:

- Network performance parameters incur a moderate decrease for both the RC1 and RC1 Sensitivity Test, with a greater negative impact occurring during the RC1 Sensitivity Test in the AM peak.
- Travel times generally increase in the peak direction for both the AM and PM peaks, with a higher increase occurring in the peak direction during the second peak hour in the RC1 Sensitivity Test. In the contra-peak direction, there are improvements to the travel times in the AM peak period in the sensitivity test, due to lower volumes along St Kilda Road (southbound).
- Queues for the RC1 Sensitivity Test indicate comparable results to RC1 with the exception of Park Street, Domain Road and St Kilda Road in the PM Peak due to the build-up of traffic travelling southbound along St Kilda Road.
- On average, there is a slight increase in delay in most movements during both peak periods, with large increases in delay occurring mainly along Toorak Road and Albert Road in the AM and PM peak periods, as well as St Kilda Road north of Toorak Road, Park Street and Domain Road in the RC1 Sensitivity test due to the build-up of traffic travelling southbound.
- Volumes in the RC1 Sensitivity Test are more comparable to the 2031 Base.

3.9 Precinct 8: Eastern Portal (South Yarra)

Modelling has not been undertaken for the eastern portal in relation to Melbourne Metro Concept Design impacts as there is no material change in traffic demand or supply in the local network resulting from the 2031 Melbourne Metro Legacy Project when compared with the 2031 Base Case.

3.10 Precinct 9: Western Turnback

Modelling has not been undertaken for the western turnback in relation to Melbourne Metro Concept Design impacts as there is no material change in traffic demand or supply in the local network resulting from the 2031 Melbourne Metro Legacy Project when compared with the 2031 Base Case.

4 Active Transport Analysis by Precinct

4.1 Methodology to Derive Pedestrian Flows

4.1.1 Overview

This section provides an overview of the methodology used to estimate pedestrian flows on footpaths and road crossings in selected station precincts. The focus of the analysis has been on the intersections in the vicinity of CBD South, CBD North and Parkville stations, which are considered to be most heavily affected by the introduction of Melbourne Metro.

The estimation of pedestrian flows draws on four primary data sources:

- Estimates of entry and exit flows of pedestrians at each station from the ClicSim passenger demand model
- The distribution of walk-access trips to each station from the Victorian Integrated Transport Model (VITM)
- The distribution of tram-access trips from the VITM.

The analysis separated pedestrian flows into three components:

- Station walk access journeys (walking to or from a nearby land-use zone)
- Station tram access journeys (walking to or from a nearby tram stop)
- Background pedestrian flows (i.e. not related to station access).

Background pedestrian flows were calculated for the current year (2015). For future scenarios, the base-year flows were scaled in accordance with car and public transport growth forecast by VITM. Future station-related trip volumes were estimated using the ClicSim model and distributed according to land use and tram usage contained in the VITM scenarios.

4.1.2 Future Year Volumes

The future year volumes for the 2031 No Project Case and the 2031 Melbourne Metro Legacy Project Case were estimated using a process that involved:

- Subtracting the modelled ClicSim flows for 2012 (scaled up to 2015) from the 2015 survey data to obtain the background flows (i.e. non-station related pedestrian flows)
- Scaling up the background flows based on underlying growth rates derived from the 2031 ClicSim demand matrices for the City Loop and Inner Core stations (ClicSim matrices are based on the VITM assumed land-use changes in the future)
- Adding in the modelled station pedestrian volumes from ClicSim
- Calculating the dispersal of pedestrians to different parts of the intersection network by analysing modelled land-use changes around the intersection.

As part of the wider pedestrian intersection analysis, pedestrian survey, the origin-destination flows were disaggregated into the likely routes taken by pedestrians to complete their trips inside the intersection network. Once the routes for all combinations of origins and destinations were established, the volumes for each OD pair were assigned to parts of the network (e.g. footpaths and pedestrian crossings).

4.2 Precinct 1: Tunnels

The modelling of the tunnel operations is not relevant to this transport impact assessment report.

4.3 Precinct 2: Western Portal (Kensington)

4.3.1 Existing Conditions

During the AM peak period there are typically 400 passenger entries to South Kensington Station and 130 passengers exiting (Table 4-1).

Table 4-1 South Kensington Station - 2012 weekday passenger entries and exits

Station	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2012	400	130	100	210

Source: 2012 Base Run ClicSim passenger modelling

4.3.2 Future Conditions – 2031 No Project Case

In the 2031 No Project case it is predicted there would be an increase of approximately 370 passenger entries and exits in the AM Peak and over 600 passenger entries and exits in the PM Peak at South Kensington station compared to 2012.

Table 4-2 South Kensington station - 2031 No Project case weekday passenger entries and exits

Year	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2012	400	130	100	210
2031 No Project	450	450	570	400
Difference 2031 No project - 2012	50	320	470	190
	13%	246%	470%	90%

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

4.3.3 Future Conditions – 2031 Melbourne Metro Legacy Project Case

Compared to 2031 No Project Case, there is projected to be an 11 per cent increase in passenger entries and exits combined at South Kensington station during the AM peak period with Melbourne Metro. In the PM peak period there would be a 14 per cent increase in passengers entries and exits combined (a change of 140 passengers) at South Kensington station (refer to Table 4-3).

Table 4-3 South Kensington station - 2031 Melbourne Metro weekday passenger entries and exits

Year	M Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2031 No Project	450	450	570	400
2031 Melbourne Metro	560	440	520	590
Difference 2031 - Melbourne Metro2012	160	310	420	380
	40%	238%	420%	181%

Year	M Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)
	Entry	Exit	Entry	Exit
Difference (nos.) 2031 Melbourne Metro- 2031 No Project	110	-10	-50	190
	24%	-2%	-9%	48%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.4 Precinct 3: Arden Station

4.4.1 Existing Conditions

During the AM peak there are approximately 450 passengers entering North Melbourne station compared to 2,160 exiting. Macaulay station has relatively low levels of passenger use, with around 110 (weekday) boardings during the AM peak in 2012. Over 5,000 passengers transfer at North Melbourne during the AM peak (refer to Table 4-4).

Table 4-4 Arden precinct stations - 2012 weekday passenger entries, exits and transfers

Station	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
Macaulay	110	120	0	90	110	0
North Melbourne	450	2,160	5,040	1,160	730	3,930

Source: 2012 Base Run ClicSim passenger modelling

4.4.2 Future Conditions – 2031 No Project Case

In the 2031 No Project case it is predicted there would be a large increase in AM peak passenger entries and exits at North Melbourne station. There is predicted to be more than 5,400 additional passengers entering / exiting North Melbourne station during the AM peak period, and nearly 6,000 in the PM peak compared to 2012. Transfers between platforms in the PM peak are predicted to increase by just over 4,000 passengers (refer to Table 4-5).

Table 4-5 North Melbourne station – 2031 No Project case weekday passenger entries, exits and transfers

Year / Difference	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	**450**	**2,160**	**5,040**	**1,160**	**730**	**3,930**
2031 No Project	720	7,310	6,970	6,020	1,800	8,040
Difference 2031 No Project - 2012	270	5,150	1,930	4,860	1,070	4,110
	60%	238%	38%	419%	147%	105%

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

At Macaulay station in the 2031 No Project case it is predicted there would be a slight decrease in AM peak passenger entries and exits. During the PM peak there is expected to be an increase of about 80 people entering / exiting Macaulay station during the AM peak period.

Table 4-6 Macaulay station - 2031 No Project case weekday passenger entries and exits

Year / Difference	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2012	110	120	90	110
2031 No Project	100	100	230	50
Difference 2031 No Project - 2012	-10	-20	140	-60
	-9%	-17%	156%	-55%

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

4.4.3 Future Conditions – 2031 Melbourne Metro Legacy Project Case

Modelled station pedestrian entries and exits for Arden station for the busiest two-hours in the AM and PM in 2031 are shown in Table 4-7. Initial land use forecasts for redevelopment at Arden have resulted in relatively low passenger volumes using the station. These numbers are likely to increase substantially if development assumptions increase.

Table 4-7 Arden Station - 2031 Melbourne Metro weekday passenger entries and exits

Year	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2031 Melbourne Metro	30	850	720	80

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

At North Melbourne Station in the 2031 Melbourne Metro project case, there would be a 59 per cent decrease in passenger entries/ exits during the AM peak period and a 52 per cent decrease during the PM peak compared to the 2031 No Project case. There would be a small increase in the number of passengers transferring between platforms at North Melbourne Station in the AM peak, and a slightly larger increase in transfers in the PM peak. Compared to 2012, the 2031 Melbourne Metro case represents an increase of approximately 680 pedestrian entries/ exits during the AM peak period, and approximately 1,800 entries/ exits in the PM peak.

Table 4-8 North Melbourne station - 2031 legacy project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 No Project	720	7,310	6,970	6,020	1,800	8,040
2031 Melbourne Metro	630	2,660	7,490	2,400	1,320	9,600
Difference 2031 Melbourne Metro - 2012	180	500	2,450	1,240	590	5,670
	40%	23%	49%	107%	81%	144%
Difference 2031 Melbourne Metro - 2031 No Project	-90	-4,650	520	-3,620	-480	1,560
	-13%	-64%	7%	-60%	-27%	19%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

At Macaulay station in the 2031 Melbourne Metro case it is predicted there would be a slight increase in AM and PM peak passenger entries and exits.

Table 4-9 Macaulay station - 2031 legacy project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
2031 No Project	100	100	230	50
2031 Melbourne Metro	100	130	230	80
Difference 2031 Melbourne Metro- 2012	-10	10	140	-30
	-9%	8%	156%	-27%
Difference 2031 Melbourne Metro- 2031 No Project	0	30	0	30
	0%	30%	0%	60%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.5 Precinct 4: Parkville Station

4.5.1 Future Conditions – 2031 Melbourne Metro Legacy Project Case

Modelled station pedestrian entries, exits, and transfers for Parkville station for the busiest two-hours in the AM and in the PM are shown in Table 4-10. It is expected that when Parkville station opens there would be approximately 12,000 passenger entries and exits during the 2-hour AM peak period and approximately 13,000 in the PM peak

The VCCC entrance on the corner of Grattan Street south / Royal Parade west is expected to be the busiest entrance with 42 per cent of entries and exits during the AM peak (and 39 per cent in the PM). The Melbourne University entrance on Grattan Street east is expected to be the second busiest entrance with 35 per cent of all entries and exits during the AM peak (and 38 per cent in the PM).

Table 4-10 Parkville station - 2031 Melbourne Metro– AM peak passenger entry and exits volumes

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Melbourne University	50	4090	4520	390
	12%	36%	39%	32%
Royal Parade East	80	2620	2730	270
	19%	23%	23%	22%
VCCC	290	4710	4460	550
	69%	41%	38%	45%
TOTAL	420	11420	11710	1210

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.6 Precinct 5: CBD North Station

4.6.1 Existing Conditions

The existing Melbourne Central Station passenger entry, exit and transfer flows for the busiest two-hour periods in the AM and PM periods are shown in Table 4-11. In 2012 there were just under 1,000 passenger entries observed in the AM peak period compared to over 15,000 passengers exiting Melbourne Central Station.

Table 4-11 Melbourne Central Station - 2015 weekday passenger entries, exits and transfers

Station	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
Melbourne Central	920	15,070	0	15,430	6,100	0

Source: 2012 Base Run ClicSim passenger modelling

4.6.2 Future Conditions – 2031 No Project Case

In the 2031 No Project case, it is predicted that there would be a large increase in AM and PM peak passenger entries and exits at Melbourne Central station compared to 2012. There is an increase of approximately 11,000 additional passengers entering / exiting North Melbourne station during the AM peak and over 18,000 more during the PM peak (refer to Table 4-12). There would be an increase of over almost 1,000 passengers transferring between platforms at Melbourne Central station in the PM peak compared to 2012.

Table 4-12 Melbourne Central station - 2031 no project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	920	15,070	0	15,430	6,100	0
2031 No Project case	2,500	24,440	390	29,250	10,400	1,060
Difference (nos.) 2031 No Project case - 2012	1,580	9,370	390	13,820	4,300	1,060
Difference (%) 2031 No Project case - 2012	63%	38%	100%	47%	41%	100%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

Two thirds of Melbourne Central Station users access the station via Swanston Street (refer to Table 4-13). There are a greater number of entries and exits during the PM peak especially via Swanston Street in the 2031 No Project case.

Table 4-13 Melbourne Central Station - 2031 No Project - Passenger entry and exits volumes

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Swanston Street	1580	15890	19010	6690
	63%	65%	65%	64%
Elizabeth Street	930	8550	10240	3710
	37%	35%	35%	36%
TOTAL	2510	24440	29250	10400

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

4.6.3 Future Conditions – 2031 Melbourne Metro Legacy Project Case

The modelled 2031 Melbourne Metro case pedestrian entry, exit and transfer flows for Melbourne Central Station during the busiest two-hour periods in the AM and PM are shown in Table 4-5. Compared to the 2031 No Project case, there would be a decrease of over 10,000 passenger entries/ exits during the AM peak and a decrease of almost 12,000 entries / exits during the PM peak, as these trips shift to CBD North Station.

Table 4-14 Melbourne Central station - 2031 legacy project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 No Project case	2,500	24,440	390	29,250	10,400	1,060
2031 Project Case	1,790	15,090	7,180	20,760	6,950	9,400
Difference 2031 Melbourne Metro - 2012	870	20	7,180	5,330	850	9,400
	49%	0%	100%	26%	12%	100%
Difference 2031 Melbourne Metro- 2031 No project	-710	-9,350	6,790	-8,490	-3,450	8,340
	-40%	-62%	95%	-41%	-50%	89%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

Passenger transfers would increase as a result of people being able to transfer between Melbourne Central and CBD North stations (refer to Table 4-15).

Table 4-15 CBD North station - 2031 legacy project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 Project Case	850	15,380	6,910	13,770	2,500	8,720

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

There would be a significant change in pedestrian movements across the CBD North precinct with the opening of CBD North station. Entry/ exit movements to Melbourne Central and CBD North stations would be reasonably evenly split during the AM peak (Table 4-16). This represents a reduction of approximately 64% in the total number of people using the Swanston Street entrance / exit.

During the PM peak, Melbourne Central station would have a higher proportion of pedestrians entering / exiting with 60 per cent of all pedestrians using Swanston Street and Elizabeth Street entrances / exits.

Table 4-16 CBD North precinct stations - 2031 Melbourne Metro - Total weekday passenger entries and exits

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Melbourne Central				
Elizabeth Street	720	7,080	8,850	2,730
	34%	27%	30%	37%
Swanston Street	610	5,680	7,970	2,320
	29%	21%	27%	32%
CBD North				
La Trobe Street	380	7,460	6,610	1,130
	18%	28%	23%	15%
Franklin Street	420	6,370	5,640	1,160
	20%	24%	19%	16%
Total	2,130	26,590	29,070	7,340

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.7 Precinct 6: CBD South Station

4.7.1 Existing Conditions

The existing Flinders Street Station passenger entry, exit and transfer flows are shown for the busiest two-hour periods in the AM and PM in Table 4-15. In 2012, there were approximately 3,350 passenger entries in the AM peak period compared to over 29,000 passengers exiting Flinders Street Station. Flinders Street Station has a high proportion of transfer passengers, meaning people arrive by train, transfer to another train to leave the station with approximately 25,000 transfers during the AM peak period.

Table 4-17 Flinders Street Station - 2012 weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	3,350	29,010	24,820	28,450	15,120	19,490

Source: 2012 Base Run ClicSim passenger modelling

4.7.2 Future Conditions – 2031 No Project Case

The modelled future Flinders Street Station passenger entry, exit and transfer flows for the busiest two-hour periods in the AM and PM are shown in Table 4-18. In the 2031 No Project case compared to 2012 it is predicted there would be an increase of almost 100 per cent in AM peak passenger entries/ exits at Flinders Street Station. There would be a decrease of over 15,000 passengers transferring between platforms at

Flinders Street Station compared to 2012. There is a higher volume of passengers exiting Flinders Street Station in the PM peak compared to entries during the AM peak due to people visiting the city in the evening for recreational purposes.

Table 4-18 Flinders Street station – 2031 No Project weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	3,350	29,010	24,820	28,450	15,120	19,490
2031 No Project	5,510	58,120	9,330	60,330	18,940	7,990
Difference 2031 No Project - 2012	2,160	29,110	-15,490	31,880	3,820	-11,500
	64%	100%	-62%	112%	25%	-59%

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

Approximately 50 per cent of all station entries and exits during the AM peak would be via Elizabeth Street with a further 29 per cent using the Federation Square Crossing entrance / exit (refer to Table 4-19). During the PM peak the Elizabeth Street entrance / exit has the highest volume of pedestrian movements. Flinders Street and the Federation Square crossing have 24 per cent and 25 per cent of total movements respectively (refer to Appendix D). The Degraves Street entrance /exit would not be widely used as a primary entrance or exit during the AM and PM peaks.

Table 4-19 Flinders Street station - 2031 No Project case - passenger entry and exit movements

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Flinders Street (Under the Clocks)	950	13,700	15,300	3,820
	17%	24%	25%	20%
Federation Square crossing	1,900	12,840	14,820	4,850
	34%	22%	25%	26%
Degraves Street	80	1,310	1350	420
	1%	2%	2%	2%
Elizabeth Street	1740	23,890	22970	6840
	32%	41%	38%	36%
Flinders Walk (Yarra River)	840	6390	5890	3010
	15%	11%	10%	16%
Total	5510	58130	60330	18940

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

There is a large growth in the number of pedestrian entries and exits at Flinders Street Station between 2012 and the 2031 No Project case. It is expected that this growth would have a major impact on the pedestrian network around the station, in particular at the Elizabeth Street and Federation Square crossing entrances / exits.

4.7.3 Future Conditions – 2031 Melbourne Metro Legacy Project Case

The modelled future Flinders Street Station pedestrian entries, exits, and transfers for the busiest two-hour periods in the AM and PM are shown in Table 4-20.

It is expected that there would be a decrease of over 13,000 passengers entering / exiting Flinders Street Station during the AM peak period. In the PM peak there would be a decrease of nearly 25,000 passengers entering / exiting via Flinders Street Station.

Compared to the 2031 No Project Case, there would also be a small increase in the number of passengers transferring between platforms at Flinders Street Station in the 2031 Melbourne Metro case AM peak.

Table 4-20 Flinders Street station - 2031 legacy project case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 No Project case	5,510	58,120	9,330	60,330	18,940	7,990
2031 Project Case	4,740	45,850	10,710	41,860	12,920	7,750
Difference 2031 Melbourne Metro - 2012	2,160	29,110	-15,490	31,880	3,820	-11,500
	64%	100%	-62%	112%	25%	-59%
Difference 2031 Melbourne Metro- 2031 No project	-770	-12,270	1,380	-18,470	-6,020	-240
	-14%	-21%	15%	-31%	-32%	-3%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

Passenger volumes for CBD South station are shown in Table 4-18. It is predicted that there would be over 19,000 passengers entering / exiting CBD South station during the AM peak in 2031 with Melbourne Metro. It is predicted that there would be approximately 5,000 passengers transferring at CBD South station in the AM peak

Table 4-21 CBD South station - 2031 legacy project case weekday entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 Project Case	740	18,410	5,040	18,190	2,620	4,080

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

In 2031 with Melbourne Metro, approximately 29 per cent of all station entries / exits during the AM peak (for CBD South and Flinders Street combined) would be via Elizabeth Street with a further 18 per cent using the Flinders Street entrance / exit (refer to Table 4-22). During the PM peak the Elizabeth Street entrance / exit has the highest volume of pedestrian movements. The Federation Square crossing and City Square entrance / exit would both have 15 per cent of total movements (refer to Appendix D). The Degraves Street entrance /exit would not be widely used during the AM and PM peaks.

Table 4-22 CBD South stations - 2031 Melbourne Metro - Passenger entry and exit movements

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Flinders Street Station				
Flinders Street (Under the Clocks)	890	11,940	11,330	2,950
	19%	26%	27%	23%

Station Entrance	AM Peak (7:00am-9:00am)		PM (4:30pm - 6:30pm)	
	Entry	Exit	Entry	Exit
Federation Square crossing	1,430	7,720	8540	2610
	30%	17%	20%	20%
Degraves Street	80	1220	1110	360
	2%	3%	3%	3%
Elizabeth Street	1,410	18,960	16,010	4,350
	30%	41%	38%	34%
Flinders Walk (Yarra River)	920	6010	4,860	2,640
	19%	13%	12%	20%
CBD South Station				
Federation Square	100	2,220	2500	300
	14%	12%	14%	11%
City Square	380	9,490	9,610	1,410
	51%	52%	53%	54%
Swanston Street	260	6,700	6,080	910
	35%	36%	33%	35%
Total	5,470	6,4260	60,040	15,530

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

In the 2031 Legacy Project Case, Flinders Street Station handles fewer train passengers as Melbourne Metroalters the operation of the rail lines into the CBD, taking pressure of Flinders Street. Tram stops at these intersections are platform stops and are bi-directional.

4.8 Precinct 7: Domain Station

4.8.1 Future Conditions – 2031 Melbourne Metro Legacy Project Case

Modelled station pedestrian entries, exits, and transfers for Domain station for the busiest two hours in the AM and in the PM are shown in Table 4-23 and Table 4-24. It is expected that when Domain station opens there would be 9140 passenger entries and exits in the AM peak period. This is expected to increase slightly in the PM peak period.

Approximately 50 per cent of all station entries and exits during the AM and PM peak periods would be to / from the Tram Superstop in St Kilda Road. During the peak period The Shrine of Remembrance stop is not expected to be widely used. The remainder of pedestrians would use the entry / exit on Albert Road Plaza.

Table 4-23 Domain station - 2031 Melbourne Metro Weekday AM peak passenger entries and exits

Entrance / Exit	Walk entries	Tram entries	Walk exits	Tram exits	Total entries	Total exits
Albert Road Plaza North	410	0	1,430	0	440	1,580
	61%	0%	43%	0%	34%	20%
Albert Road Plaza South	240	0	1,200	0	260	1,320
	36%	0%	36%	0%	20%	17%
Shrine Of Remembrance North	0	0	40	0	10	40
	0%	0%	1%	0%	1%	1%
Shrine Of Remembrance South	20	0	620	0	20	690
	3%	0%	19%	0%	2%	9%
Tram Superstop	0	540	0	3810	570	4,210
	0%	100%	0%	100%	44%	54%
Total	670	540	3,290	3,810	1,300	7,840

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

Table 4-24 Domain Station - 2031 Melbourne Metro Weekday PM peak passenger entry and exits volumes

Entrance/Exit	Walk entries	Tram entries	Walk exits	Tram exits	Total entries	Total exits
Albert Road Plaza North	1,510	0	530	0	1,660	570
	43%	0%	60%	0%	21%	32%
Albert Road Plaza South	1,250	0	300	0	1,380	320
	36%	0%	34%	0%	18%	18%
Shrine Of Remembrance North	40	0	10	0	40	10
	1%	0%	1%	0%	1%	1%
Shrine Of Remembrance South	720	0	50	0	790	50
	20%	0%	6%	0%	10%	3%
Tram Superstop	0	3570	0	800	3,940	850
	0%	100%	0%	100%	50%	47%
Total	3,520	3,570	890	800	7,810	1,800

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.9 Precinct 8: Eastern Portal (South Yarra)

4.9.1 Existing Conditions

In 2012 there were nearly 3,000 passenger entries and around 3,400 passenger exits at South Yarra Station in the AM peak period (refer to Table 4-25). In addition there were around 1,100 passengers transferring at South Yarra station in 2012.

Table 4-25 South Yarra Station - 2012 weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	2,830	3,470	950	2,360	2,840	300

Source: 2012 Base Run ClicSim passenger modelling

4.9.2 Future Conditions – 2031 No Project Case

In 2031 No Project case it is predicted there would be a 48 per cent and 70 per cent increase in AM peak passenger entries and exits respectively at South Yarra Station compared to 2012. There would be an increase of over 1,600 passengers transferring at South Yarra Station in the PM peak compared to 2012, (refer to Table 4-26).

Table 4-26 South Yarra station - 2031 No Project Case weekday passenger entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2012	2,830	3,470	950	2,360	2,840	300
2031 No Project	3,960	5,390	1,610	4,530	4,010	1,460
Difference 2031 No Project - 2012	1,130	1,920	660	2,170	1,170	1,160
	40%	55%	69%	92%	41%	387%

Source: 2031 Base Case ClicSim passenger modelling (Run B24)

4.9.3 Future Conditions – 2031 Melbourne Metro Legacy Project Case

In the 2031 Melbourne Metro case, there would be a 20 per cent and 13 per cent decline in passenger entries/ exits during the AM and PM peak periods respectively at South Yarra Station from the 2031 No Project case, (refer to Table 4-27). There would also be a decrease of approximately 72 per cent passengers transferring at South Yarra station during the PM peak. When the 2031 Melbourne Metro case is compared to 2012, there would be a 19 per cent (1,180) increase in pedestrian entry/ exits during the AM peak and 43 per cent (2,250) during the PM peak.

Table 4-27 South Yarra station - 2031 Melbourne Metro station entries, exits and transfers

Year	AM Peak (7:00am-9:00am)			PM (4:30pm - 6:30pm)		
	Entry	Exit	Transfer	Entry	Exit	Transfer
2031 No Project	3,960	5,390	1,610	4,530	4,010	1,460
2031 Project Case	3,860	3,620	990	3,600	3,850	410
Difference 2031 Melbourne Metro - 2012	1,030	150	40	1,240	1,010	110
	36%	4%	4%	53%	36%	37%
Difference 2031 Melbourne Metro - 2031 No project	-100	-1,770	-620	-930	-160	-1,050
	-3%	-33%	-39%	-21%	-4%	-72%

Source: 2031 Project Case ClicSim passenger modelling (B23 (PM) and B26 (AM)

4.10 Precinct 9: Western Turnback

There is no pedestrian modelling of the Western Turnback that is relevant to this transport impact assessment report.

4.11 Precinct 10: Broader Network

There is no pedestrian modelling of the broader network that is relevant to the transport impact assessment report.

5 Construction Modelling by Precinct

5.1 Broader Network Impacts

5.1.1 Assessment of the Broader Network Impacts

The VITM Project Models, developed by Public Transport Victoria, have been used to assess the wider impacts of Melbourne Metro at a strategic level. The following sections summarise outputs from the various models. As VITM is a strategic application and does not model traffic in detail, impacts on the wider network have been confined to changes greater than 10 per cent (plus or minus).

The following section discusses VITM difference plots comparing traffic volumes on links of the network for the various models, where red indicates increases in volumes and blue decreases. It is noted that the numbers relate to 2-hour volume changes.

5.1.2 Future Conditions – 2021 No Project Case

The 2021 VITM Base (No Project) model includes updates to the rail, tram and bus networks (and services) as advised by Public Transport Victoria. Also included in the 2021 Base model are a number of highway projects, such as the City-Tullamarine upgrade, expected to be implemented across Victoria by 2021 and designed to improve capacity of the highway network as well as improvements to the public transport networks.

The 2021 VITM Base model for the project was provided to AJM-JV by Public Transport Victoria. A number of minor changes have been made to the model to provide a more robust highway network around Melbourne Metro station locations. These are shown in Table 5-1.

Table 5-1 Updates Included in 2011 and 2021 base (no project) models

Location	Changes Included in 2021 Project model	Comments
Network wide	Tram and bus network changes during construction as advised by Public Transport Victoria.	Changes generally result from anticipated road closures to facilitate construction.
CBD	Speed limit reduced to 40km/h (from 50km/h)	
Princes Bridge	Reduced to one lane northbound (approaching CBD).	.
Swanston Street, north of CBD	Reduced to one lane in each direction.	
CBD	Inclusion of banned right turns within the CBD	

Comparison of the 2011 and 2021 traffic volumes, for both AM and PM peaks, as shown in Figure 5-1 and Figure 5-2, indicate significant increases in traffic flow along the CityLink-Tullamarine and Monash freeways.

Elsewhere, changes in traffic flow are much less in scale, and it is noted that increases in traffic flow tend to be in the contra-peak direction, rather than the peak direction. In discussion with MMRA, DEDJTR and Public Transport Victoria we believe the changes can be explained by the following differences within the 2011 and 2021 Base models:

- For counter peak traffic flows, there is more road capacity available in the 2011 model for growth. Therefore, as demand increases, contra-peak routes are more attractive to facilitate additional trips.

- The 2021 model includes increased parking costs in the CBD – higher than CPI growth – therefore car trips to the CBD are reduced, particularly in the AM commuter peak period
- The 2031 model includes some increased public transport capacity, particularly for trips to the CBD, that will attract more travel to public transport modes, rather than car travel
- In combination these two factors produce a greater demand for public transport compared to car in the peak direction – thereby reducing the peak period car travel in the peak direction
- The 2021 VITM demand model includes an increase in the population in the CBD – in combination with the above factors this increases the counter peak car travel demand in VITM
- The fuel prices are assumed to increase in the future.

In particular, it is noted that increases around Parkville and the CBD are limited, while those around Domain are again generally in the contra-peak direction.

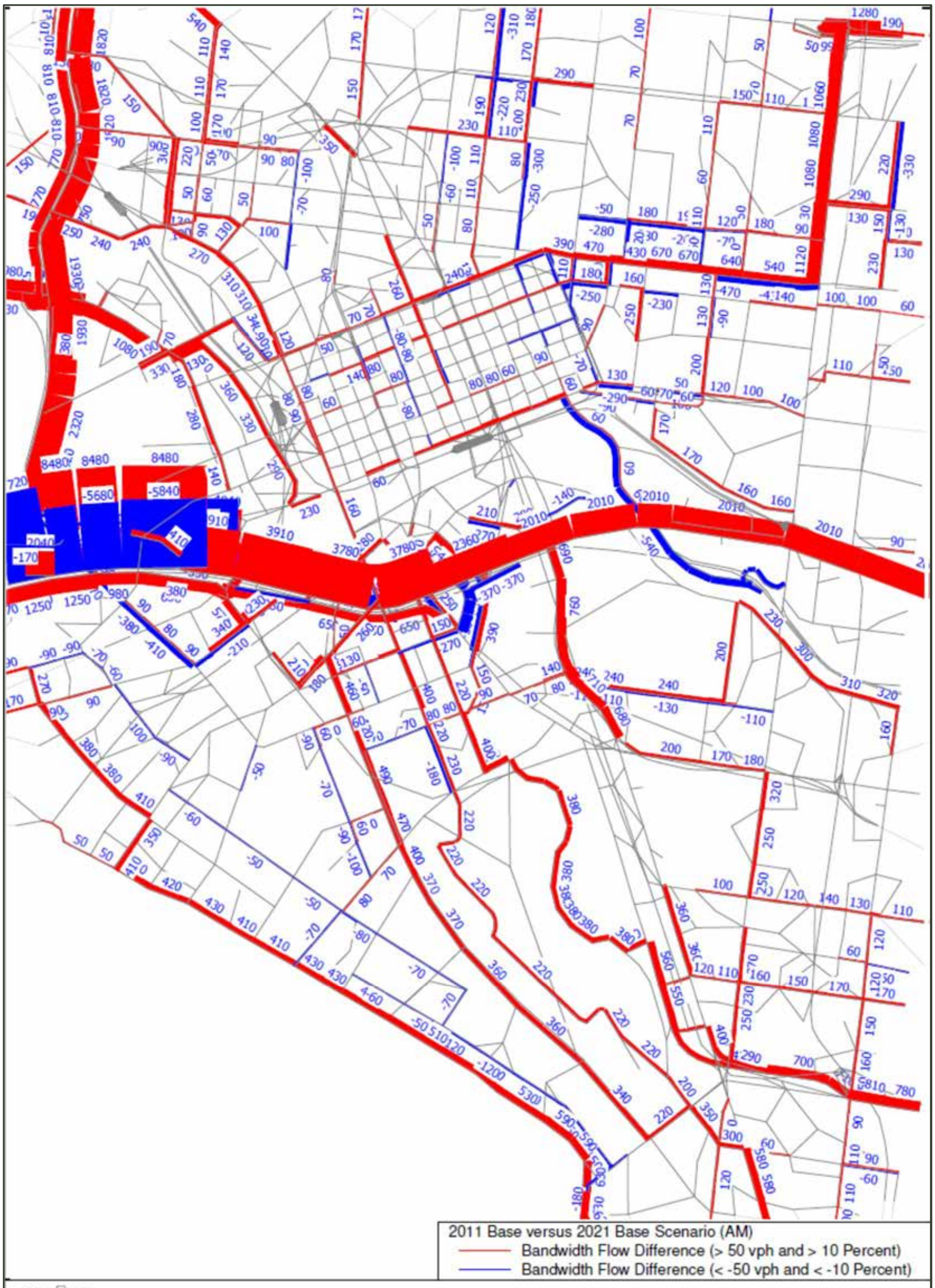


Figure 5-1 Comparison of VITM traffic volumes - AM peak 2011 base v 2021 base

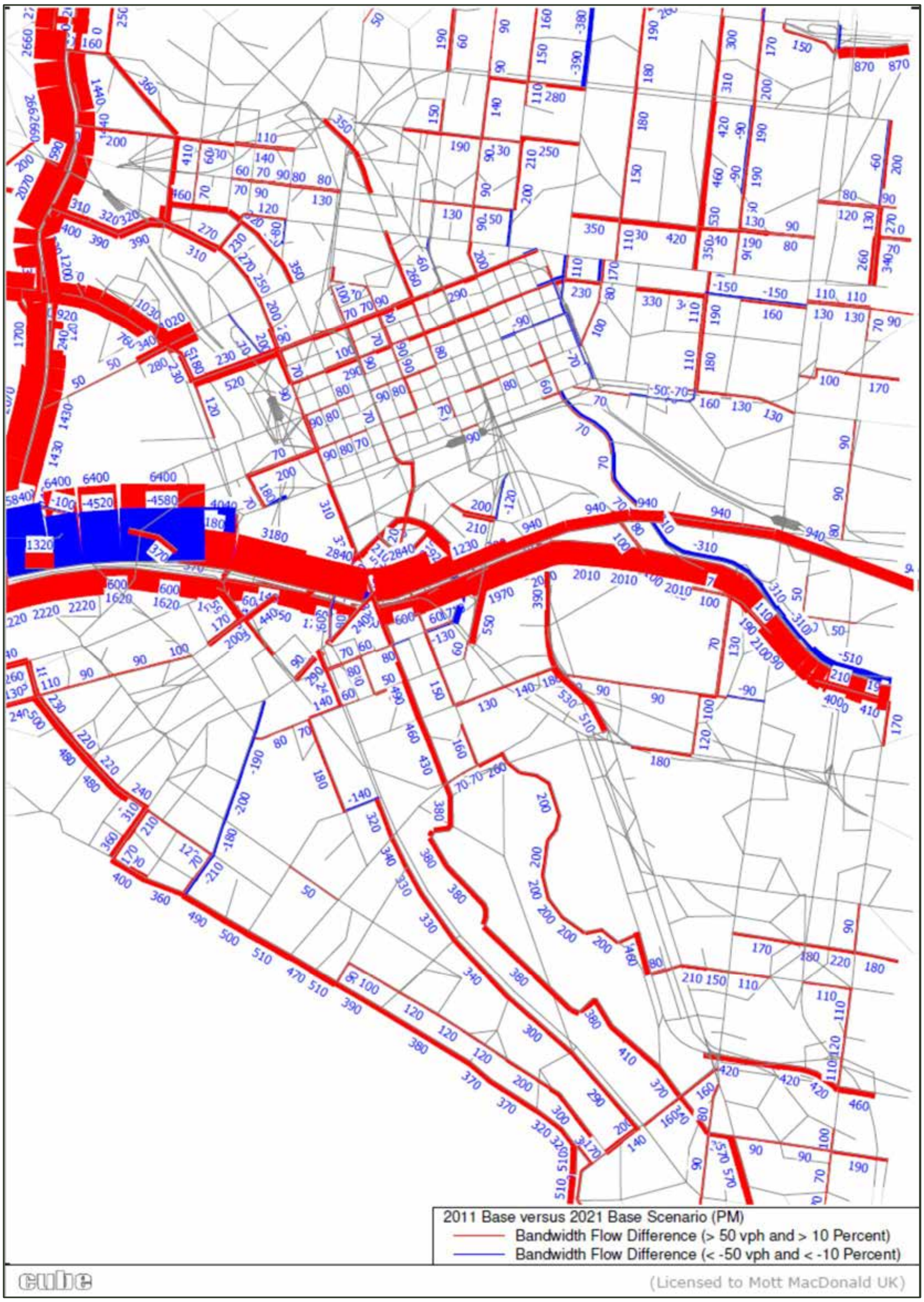


Figure 5-2 Comparison of traffic volumes - PM peak 2011 base v 2021 base

5.1.3 Future Conditions – 2021 Construction Project

As outlined below the construction of Melbourne Metro is proposed to include a number of changes to the road network, particularly around station precincts. For the 2021 Construction Model, a scenario has been considered, described in Table 5-2 where both the Grattan Street closure (for Parkville works) and reduction in St Kilda Road to one lane (for Domain works) occur at the same time. This scenario is likely to be the case for long periods during construction of Melbourne Metro.

Table 5-2 Scenario 2 - Changes included in the VITM 2021 construction project model

Location	Description of change
Grattan Street, between Royal Parade and Leicester Street	Closed to all traffic in both directions
St Kilda Road, between Dorcas Street and Kings Way	One lane in each direction. Speed limit reduced to 40km/h.
Domain Road	Closed to all traffic at the intersection of St Kilda Road
Toorak Road, between Park Street and St Kilda Road	One lane in each direction

5.1.3.1 Results

The following general observations are made when comparing outputs from the 2021 Base and Construction models:

- Impacts within the CBD are limited, although there are some increases along La Trobe Street, probably due to the Grattan Street closure
- Grattan Street traffic appears to redistribute to Queensberry Street and Victoria Street, particularly between Peel Street and Swanston Street
- Traffic in both Flemington Road and Royal Parade, between Haymarket roundabout and Grattan Street, increases
- For Domain, traffic volumes along St Kilda Road (between Kings Way and Linlithgow Avenue) drop dramatically (approximately halved) as a result of the capacity constraints due to the reduction in traffic lanes
- Volumes also reduce along Toorak Road as a result of the capacity constraint due to the segregated tram tracks. However right turn from Toorak Road (E) to Punt Road (N) increases, which may have implications for trams
- There appears to be two decision points for traffic diverting from St Kilda Road from the south; namely approach to St Kilda junction and at Kings Way
- Volumes on Sturt Street increases as traffic leaves or re-joins St Kilda Road north of the construction works
- At St Kilda junction, several parallel routes (to St Kilda Road) are used including routes through Albert Park and Clarendon Street, to the west
- There is less diversion to the east, probably due to roads such as Punt Road already being at capacity
- Significant diversion from St Kilda Road into Kings Way in both peaks and direction
- Traffic uses Alexandra Avenue and Linlithgow to bypass St Kilda Road to the east.

The following figures show traffic volume difference outputs (over 2 hours) comparing the 2021 Base and Construction models. Blue represents reductions in volume and red increases.

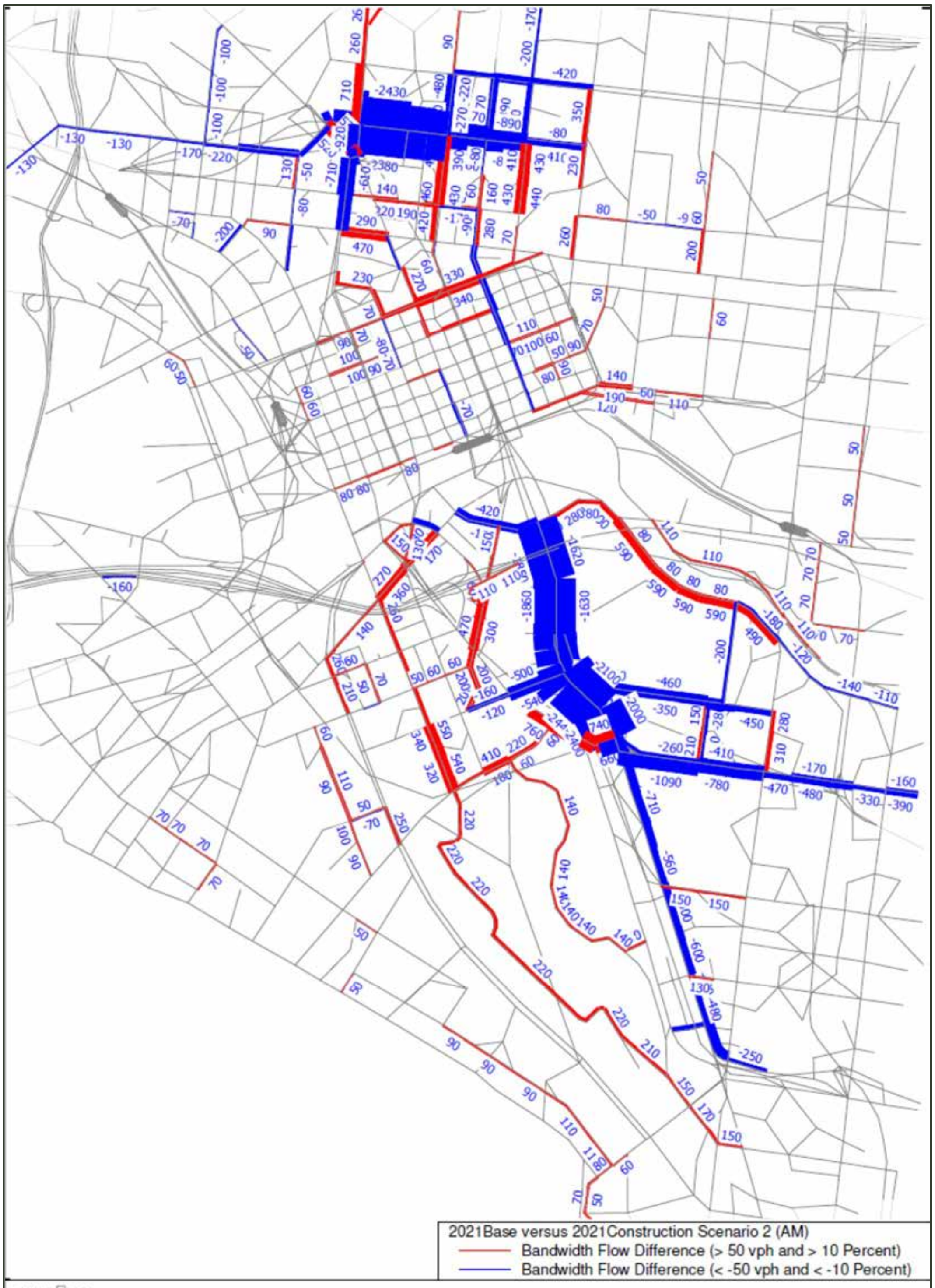


Figure 5-3 Volume Changes - AM Peak Construction Scenario 2

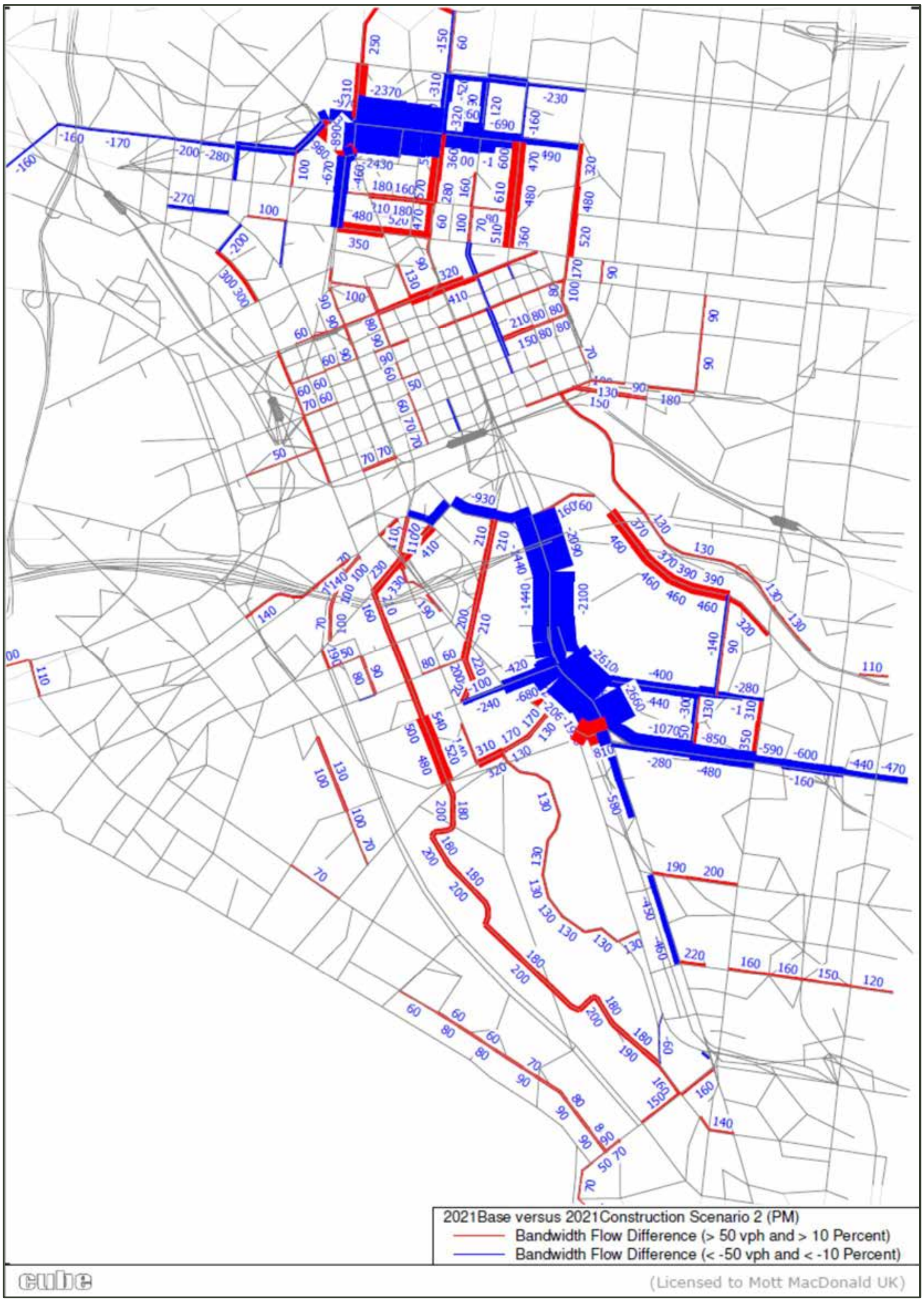


Figure 5-4 Volume changes - PM Peak construction scenario 2

To quantify some of these wider impacts outside the CBD, VITM has been used to understand the scale of change in journey times along potential diversion routes through the Parkville and Domain areas, resulting from the temporary closure of Grattan Street and reduction to one lane each direction along St Kilda Road during construction.

Tables 5-3 and 5-4 look at journey times on routes around Parkville. It is noted that journey times along an east west route incorporating Grattan Street show little change (when Grattan Street is closed, the alternative route is taken to be via Queensberry Street for comparison purposes). The largest change occurs on a broadly parallel east west route using Macarthur Road and College Crescent to the north, where the journey time increase is about 2 minutes in the PM peak. This is within daily fluctuations in journey time for a route such as this in inner Melbourne.

Table 5-3 Comparison of Travel Times Along Routes Around Parkville (W to E and N to S Directions)

Route No.	Route	Total Distance	2021 Base AM	2021 Con AM	Diff.	%	2021 Base PM	2021 Con PM	Diff.	%
Route 1A	Dynon Road / Lloyd Street / Arden Street / Gratton Street / Rathdowne Street / Johnson Street	8.35	23.45	23.95	0.5	2%	16.26	16.79	0.53	3%
Route 1B	Dynon Road / Dryburgh Street / Arden Street / Grattan Street / Rathdowne Street / Johnson Street	8.76	23.43	23.95	0.52	2%	16.13	16.72	0.59	4%
Route 2	Princess Highway / Elliott Avenue / Macarthur Road / College Crescent	6.29	23.56	23.47	-0.09	0%	17.51	18.36	0.85	5%
Route 3	Elizabeth Street / Flemington Road / Mount Alexandra Road	4.79	10.85	10.75	-0.1	-1%	17.73	17.89	0.16	1%
Route 4	Elizabeth Street / Royal Parade	3.91	6.42	6.51	0.09	1%	11.32	11.37	0.05	0%

Table 5-4 Comparison of Travel Times Along Routes Around Parkville (E to W and S to N Directions)

Route No.	Route	Total Distance	2021 Base AM	2021 Con AM	Diff.	%	2021 Base PM	2021 Con PM	Diff.	%
Route 1A	Dynon Road / Lloyd Street / Arden Street / Grattan Street / Rathdowne Street / Johnson Street	8.35	17.27	18.24	0.97	6%	27	23.41	-3.59	-13%
Route 1B	Dynon Road / Dryburgh Street / Arden Street / Grattan Street / Rathdowne Street / Johnson Street	8.76	17.22	18.27	1.05	6%	25.11	23.83	-1.28	-5%
Route 2	Princess Highway / Elliott Avenue / Macarthur Road / College Crescent	6.29	17.76	18.27	0.51	3%	22.91	24.97	2.06	9%
Route 3	Elizabeth Street / Flemington Road / Mount Alexandra Road	4.79	17.96	17.29	-0.67	-4%	10.04	9.86	-0.18	-2%
Route 4	Elizabeth Street / Royal Parade	3.91	12.63	12.72	0.09	1%	7.09	7.4	0.31	4%

Tables 5-5 and 5-6 look at journey times on routes around Domain. As anticipated, journey times along the St Kilda Road route indicate an increase in journey times of up to 2.5 minutes on a journey of approximately 9 minutes. While this represents and relatively large percentage change, the actual time difference is within normal journey time variations along this route.

Journey times along other routes around Domain generally show journey time differences of less than a minute.

Table 5-5 Comparison of Travel Times Along Routes Around Domain (S to N Direction)

Route No.	Route	Total Distance	2021 Base AM	2021 Con AM	Diff.	%	2021 Base PM	2021 Con PM	Diff.	%
Route 1	Beaconsfield Parade - Bay Street - Montague Street to Normanby Road	6.11	10.85	10.94	0.09	1%	11.48	11.86	0.38	3%
Route 1a	Beaconsfield Parade - Kerford Road - Canterbury Road	5.16	9.2	9.38	0.18	2%	9.75	10.08	0.33	3%
Route 2	Inkerman Street - Gray Street - Canterbury Road - Ferrars Street - City Road	5.37	12.16	12.68	0.52	4%	11.03	11.51	0.48	4%
Route 3	Queens Road - Kings Way	4.65	14.13	14.88	0.75	5%	14.36	12.75	-1.61	-11%
Route 4	St Kilda junction to Linlithgow Avenue	4.16	9.13	11.01	1.88	21%	7.79	9.67	1.88	24%
Route 5	Punt Road - Alexandra Avenue - Linlithgow	4.90	11.09	12.52	1.43	13%	10.9	11.89	0.99	9%
Route 5 a	Punt Road - Hoddle Street - Brunton Avenue	4.92	13.31	14.18	0.87	7%	11.31	11.79	0.48	4%

Table 5-6 Comparison of Travel Times Along Routes Around Domain (N to S Direction)

Route No.	Route	Total Distance	2021 Base AM	2021 Con AM	Diff.	%	2021 Base PM	2021 Con PM	Diff.	%
Route 1	Beaconsfield Parade - Bay St - Montague Street to Normanby Road	6.11	10.1	10.44	0.34	3%	10.93	11.63	0.7	6%
Route 1a	Beaconsfield Parade - Kerford Road - Canterbury Road	5.16	8.28	8.5	0.22	3%	9.49	10.25	0.76	8%
Route 2	Inkerman Street - Gray Street - Canterbury Road - Ferrars Street - City Road	5.37	10.38	10.78	0.4	4%	11.27	11.64	0.37	3%
Route 3	Queens Road - Kings Way	4.65	11.1	11.52	0.42	4%	12.89	12.84	-0.05	0%
Route 4	St Kilda junction to Linlithgow Avenue	4.16	7.36	8.56	1.2	16%	8.58	11.05	2.47	29%
Route 5	Punt Road - Alexandra Avenue - Linlithgow	4.90	10.23	10.52	0.29	3%	11.69	12.36	0.67	6%
Route 5 a	Punt Road - Hoddle Street - Brunton Avenue	4.92	10.2	10.51	0.31	3%	12.96	13.83	0.87	7%

5.1.3.2 Conclusion

The VITM modelling indicates that the various closures would result in a wide redistribution of traffic across the network. In practice, some of this traffic may adjust their travel patterns by using other modes or changing the time of their journey.

While VITM indicates relatively modest changes in journey times along impacted routes, given the extent of the redistribution of traffic, it is recommended that a travel demand strategy is prepared that considers both physical changes to the network that can enhance network performance and mitigate impacts along identified diversion routes, encourage use of non-car modes for trips and encourage a change in travel patterns.

5.2 Precinct 1: Tunnels

Modelling has not been undertaken for the Tunnels in relation to Melbourne Metro Construction impacts as there is no material change in traffic demand or supply in the local network resulting from the 2021 Construction when compared with the 2021 Base (No Project) Case.

5.3 Precinct 2: Western Portal (Kensington)

Modelling has not been undertaken for the western portal in relation to Melbourne Metro Construction impacts as there is no material change in traffic demand or supply in the local network resulting from the 2021 Construction when compared with the 2021 Base (No Project) Case.

5.4 Precinct 3: Arden Station

Modelling has not been undertaken for the western portal in relation to Melbourne Metro Construction impacts as there is no material change in traffic demand or supply in the local network resulting from the 2021 Construction when compared with the 2021 Base (No Project) Case.

5.5 Precinct 4: Parkville Station

5.5.1 Overview of Construction Activities

Construction of Parkville station would require the closure of Grattan Street, between Royal Parade and Leicester Street for an extended period. Royal Parade / Elizabeth Street would also be restricted to two traffic lanes plus a tram lane and bicycle lane in each direction during the works.

It is noted that there would several key stages of construction for Parkville station. However, modelling has been undertaken for the main stage, described above, only as this is expected to have the most significant traffic impacts and be operating for the longest duration.

5.5.2 Future Conditions – 2021 Construction

5.5.2.1 VITM Demand Summary

Outputs from the VITM 2021 Construction model indicates a small percentage growth in total traffic going into and out of the Aimsun model area when compared to existing volumes (1.4 per cent growth in AM and 2.0 per cent growth in the PM). Some specific trips through the model (origin to destination) do show some growth or reduction, and this information has been used to grow or reduce these specific trips within the 2021 Aimsun Construction model.

5.5.2.2 Network Performance

Table 5-7 provides key outputs from the Aimsun model to compare network performance between the 2021 No Project to the 2021 Construction model. Average travel time increases and travel speeds reduce significantly in both peak periods. This is likely due to additional congestion on routes where traffic has diverted from Grattan Street, most notably along Swanston Street and College Street, and the approaches to Haymarket roundabout.

Table 5-7 Network performance summary - 2021 construction

Peak	Parameters	2021 construction	Difference 2021 construction - 2021 no project	
			2021 No project	%
AM Peak	Average Travel Time (min:sec)	7:55	6:58	14%
	Average Speed (km/h)	12.9	14.7	-12%
	VKT (veh km)	31,140	32,900	-5%
	VHT (hours)	2,410	2,240	8%
	Total vehicles	18,230	19,280	-5%
PM Peak	Average Travel Time (min:sec)	8:02	6:58	15%
	Average Speed (km/h)	12.8	14.5	-12%
	VKT (veh km)	33,420	33,370	0%
	VHT (hours)	2,600	2,300	13%
	Total vehicles	19,380	19,851	-2%

Source: Aimsun model

The table above provide key outputs from the Aimsun model to compare network performance between the Base and Construction model. In the morning period, there is a significant drop in vehicles in the Construction scenario. Although the demands are identical, the cause of the difference is likely attributed to vehicles waiting to enter the model and is unable to enter due to congestion. This congestion point is likely at Cemetery Road East (westbound). All general model statistics suggests that the Construction scenario would experience more delay in comparison to the Base scenario. In the afternoon period, the results illustrate that the Construction scenario is likely to be more congested than the Base scenario, shown by the higher travel time experienced by vehicles and lower mean speeds.

5.5.2.3 Aimsun Network Volumes

Table 5-8 and Table 5-9 summarise the changes in the volumes on key links within the Aimsun model network. These are recorded through movements, not demand and may be impacted by network delay.

In the morning period, as a result of the Grattan Street closure, vehicles are expected to reroute and therefore the Construction scenario is predicted to have a higher traffic volume along the key roads. Swanston Street is predicted to experience the most significant increase due to the Grattan Street closure.

The afternoon period results illustrate similar results to the morning period. The results show an overall increase in volume along the major roads, apart from Flemington Road, in the Construction scenario. The Flemington Road reduction is due to the major reduction in volumes along Grattan Street resulting from the eastern closure.

Table 5-8 Comparison of network volumes - AM peak 2021 construction project v 2021 no project

Network	2021 Base	2021 Construction	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	860	910	50	6%
Victoria Street, east of Peel Street, westbound	710	720	10	1%
Queensberry Street, east of Peel Street, eastbound	670	750	80	12%
Queensberry Street, east of Peel Street, westbound	490	630	140	30%
Gatehouse Street, north of Flemington Road, northbound	400	400	-0	0%
Gatehouse Street, north of Flemington Road, southbound	510	540	30	6%
Swanston Street, north of Grattan Street, northbound	170	490	320	184%
Swanston Street, north of Grattan Street, southbound	390	610	220	56%
Elliot Avenue, east of Flemington Road, eastbound	1180	1240	60	5%
Elliot Avenue, east of Flemington Road, westbound	1170	1080	-90	-8%
College Crescent, between Princes Park Drive and Cemetery Road East, eastbound	1890	1800	-90	-4%
College Crescent, between Princes Park Drive and Cemetery Road East, westbound	1870	1870	0	0%
Royal Parade, north of Grattan Street, northbound	610	740	130	21%
Royal Parade, north of Grattan Street, southbound	1080	970	-110	-10%
Flemington Road, north of Grattan Street, northbound	550	430	-120	-23%
Flemington Road, north of Grattan Street, southbound	1356	1256	-100	-7%
Elizabeth Street, south of Haymarket, northbound	360	400	40	13%
Elizabeth Street, south of Haymarket, southbound	1160	1290	130	12%
Peel Street, south of Haymarket, northbound	480	560	80	16%
Peel Street, south of Haymarket, southbound	680	720	40	5%
Grattan Street, east of Royal Parade, eastbound	660	240	-420	-64%
Grattan Street, east of Royal Parade, westbound	470	40	-430	-92%

Table 5-9 Comparison of network volumes - PM peak 2021 construction project v 2021 no project

Network	2021 Base	2021 Construction	Difference	
	Vol.	Vol.	Vol.	%
Victoria Street, east of Peel Street, eastbound	930	1000	70	8%
Victoria Street, east of Peel Street, westbound	1000	1040	40	4%
Queensberry Street, east of Peel Street, eastbound	600	590	-10	-1%
Queensberry Street, east of Peel Street, westbound	770	990	220	28%
Gatehouse Street, north of Flemington Road, northbound	460	580	120	27%
Gatehouse Street, north of Flemington Road, southbound	470	570	100	21%

Network	2021 Base	2021 Construction	Difference	
	Vol.	Vol.	Vol.	%
Swanston Street, north of Grattan Street, northbound	550	870	320	59%
Swanston Street, north of Grattan Street, southbound	260	600	340	126%
Elliot Avenue, east of Flemington Road, eastbound	900	1010	110	12%
Elliot Avenue, east of Flemington Road, westbound	1300	1270	-30	-2%
College Crescent, between Princes Park Drive and Cemetery Road East, eastbound	1485	1846	361	24%
College Crescent, between Princes Park Drive and Cemetery Road East ,westbound	1916	2000	86	5%
Royal Parade, north of Grattan Street, northbound	1130	1236	103	9%
Royal Parade, north of Grattan Street, southbound	736	837	101	14%
Flemington Road, north of Grattan Street, northbound	918	710	-204	-22%
Flemington Road, north of Grattan Street, southbound	1110	1010	-101	-9%
Elizabeth Street, south of Haymarket, northbound	645	807	162	25%
Elizabeth Street, south of Haymarket, southbound	719	940	223	31%
Peel Street, south of Haymarket, northbound	766	860	98	13%
Peel Street, south of Haymarket, southbound	530	679	147	28%
Grattan Street, east of Royal Parade, eastbound	699	240	-455	-65%
Grattan Street, east of Royal Parade, westbound	670	38	-634	-94%

5.5.2.4 Intersection Analysis

With the closure of Grattan Street, traffic along Leicester Street and Swanston Street increases during the morning period. Swanston Street is mainly a single lane corridor and thus the additional re-routed traffic is expected to cause longer delay in the Construction scenario. The model shows that there are bottlenecks at the Elgin Street \ Swanston Street Intersection and Cemetery Road East \ College Crescent \ Swanston Street Roundabout. These bottlenecks may cause additional queuing along College Crescent towards Royal Parade. The Wreckyn Street right turn movement onto Flemington Road eastbound is expected to increase due to the closure of Grattan Street. The increase in the right turn volume attributes to longer queues on Wreckyn Street in the Construction scenario.

Figure 5-5 illustrates the morning period density plots. Green represents that the network is operating satisfactory whilst red indicates congestion. As shown, the Construction scenario is predicted to experience more congestion in the micro-simulation area and around the northern section of the model in the morning period.

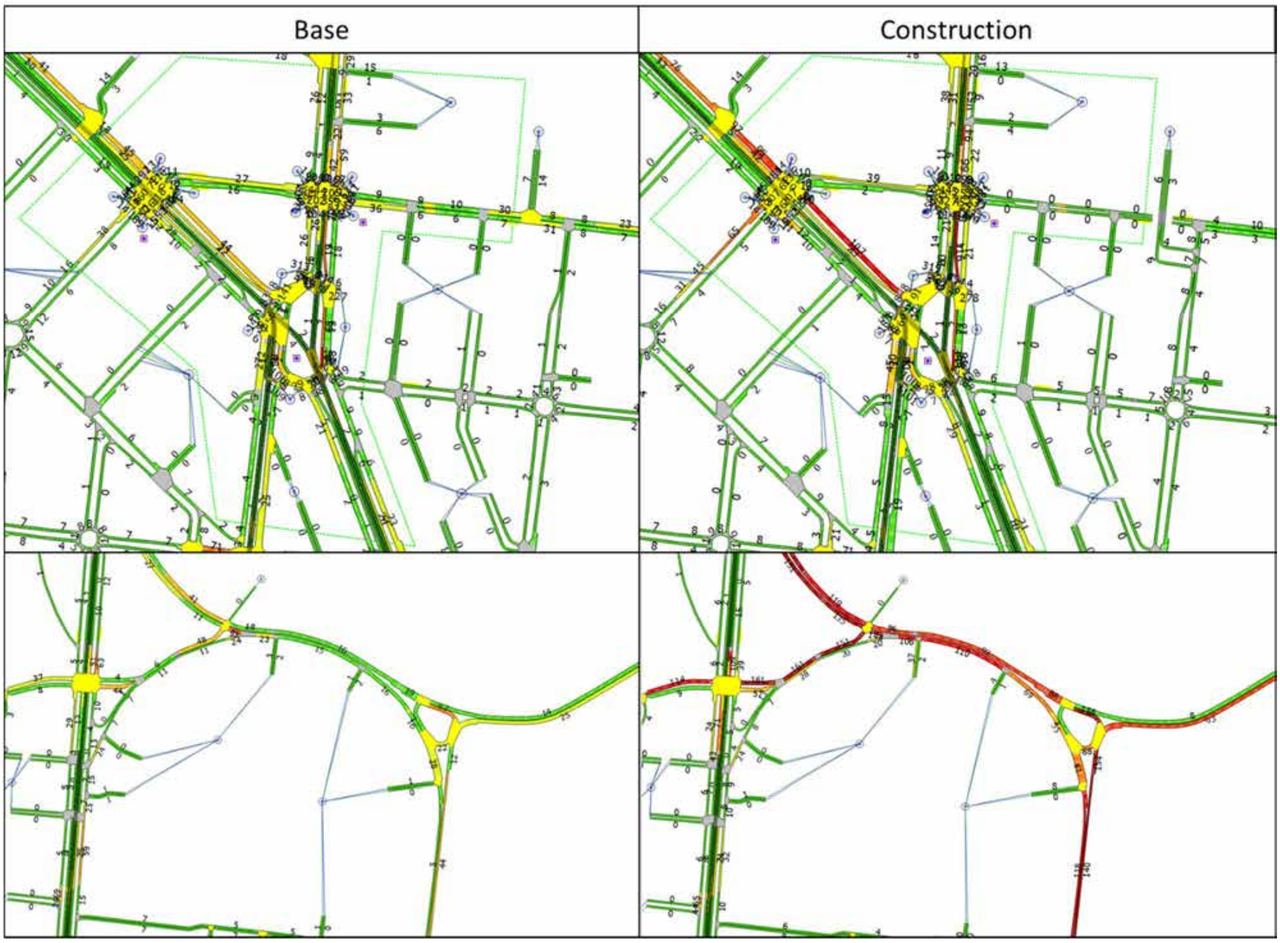


Figure 5-5 Density plots - AM peak

In the afternoon period, there is a general increase in traffic along College Crescent, Swanston Street and Leicester Street. The closure of Grattan Street is predicted to cause additional delay along College Crescent, Royal Parade, Peel Street and Flemington Road. It is indicated that the Cemetery Road East \ College Crescent \ Swanston Street roundabout may be the bottleneck that causes additional delay along the surrounding roads in the Construction scenario. The afternoon period density plot shown below, illustrates that the Construction scenario is also predicted to experience additional congestion as a result of the Grattan Street closure.

Figure 5-6 Density plots - PM peak

Regarding level of service of intersections, delay at the Haymarket roundabout north-west approach (Flemington Road) is predicted to increase due to the closure of Grattan Street, east of Royal Parade. The north approach of the roundabout is predicted to remain similar to the 2021 Base. This is likely due to the congestion along around College Crescent restricting the traffic travelling southbound along Royal Parade. In the 2021 Construction scenario vehicles on Wreckyn Street are also predicted to experience longer delays.

In the afternoon period, Haymarket roundabout in the Construction scenario is predicted to experience more delay on all approaches. All approaches to Grattan Street are predicted to experience longer delays in the Construction scenario. The remaining intersections are predicted to experience marginal increase in delay.

Table 5-10 Intersection performance –AM peak 2021 construction

Intersection	Approach	2021 Base	2021 Construction	Difference
Haymarket roundabout	Elizabeth Street (N)	50	60	10
	Elizabeth Street (SE)	60	80	20
	Peel Street (S)	40	60	20
	Flemington Road (NW)	70	150	70
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	50	40	-10
	Grattan Street (E)	40	N/A	N/A
	Elizabeth Street (S)	30	20	-10
	Grattan Street (W)	50	70	20
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	30	30	0
	Flemington Road (SE)	30	30	0
	Wreckyn Street (SW)	30	100	70
	Flemington Road (NW)	30	70	40

Table 5-11 Intersection performance - PM peak 2021 construction

Intersection	Approach	2021 Base	2021 Construction	Difference
Haymarket Roundabout	Elizabeth Street (N)	50	50	0
	Elizabeth Street (SE)	70	130	60
	Peel Street (S)	60	120	60
	Flemington Road (NW)	60	120	60
Elizabeth Street / Grattan Street / Royal Parade	Royal Parade (N)	50	40	-10
	Grattan Street (E)	70	N/A	N/A
	Elizabeth Street (S)	30	30	0
	Grattan Street (W)	40	110	70
Flemington Road / Grattan Street / Wreckyn Street	Grattan Street (E)	50	30	-20
	Flemington Road (SE)	40	40	0
	Wreckyn Street (SW)	40	30	10
	Flemington Road (NW)	30	30	0

The morning travel time along Flemington Road \ Peel Street and Royal Parade \ Elizabeth Street remained relatively similar, with a maximum increase in travel time of 20 seconds. Royal Parade southbound exhibited a decrease in travel time due to fewer vehicles along Royal Parade, attributed to the congestion on College Crescent. In the afternoon period, the northbound travel time is predicted to increase in the Construction scenario. However, the southbound direction travel time remained comparable to the Base model. The results are reflective of the LOS outputs, shown in Table 5-10, where the Construction scenario is predicted to perform significantly worse in terms of intersection delay at the Haymarket roundabout.

5.5.2.5 Conclusion

During the morning peak period, the closure of Grattan Street is predicted to cause majority of the vehicles to reroute via Swanston Street and Queensberry Street. Swanston Street currently does not have the capacity for the increase in traffic and thus would likely be a bottleneck. The bottleneck on Swanston Street may cause further congestion along College Crescent towards Royal Parade. Therefore, with College Crescent congested, the number of vehicles travelling along Royal Parade southbound is expected to be reduced, improving the performance of some of the intersections within the micro-simulation area.

In the afternoon peak period, additional congestion is expected around the Haymarket roundabout. The congestion at Haymarket is predicted to spread further south along Elizabeth Street and Peel Street northbound. Significant delays are also predicted along College Crescent and Swanston Street because of a bottleneck in the general Swanston Street area.

A travel demand strategy is recommended to mitigate these impacts, both within the Aimsun modelled area, and wider network.

5.5.3 Impact of Closing Grattan Street on Cyclists

Grattan Street plays a key east-west linking role for cyclists to destinations around Carlton. It provides an important connection for riders from the north, along with local riders travelling between the North Melbourne and Kensington area and Clifton Hill and Fitzroy North.

Due to Grattan Street's location in the Parkville education and health precinct, there is a significant number of work and Tertiary Education related bike trips. Work trips account for 81 per cent, while tertiary students account for a further 18 per cent of trips along Grattan Street. Only a relatively small number of school-aged riders use this road for bike trips.

Table 5-12 Journeys to work and education bike users of Grattan Street (2016)

Trip Purpose	Modelled cycle volumes	Proportion
Work	747	81%
Tertiary Education	170	18%
Secondary Education	1	0%
Primary Education	2	0%
TOTAL	920	100%

SGS Economics and Planning

To understand the impact of closing Grattan Street, between Royal Parade and Leicester Street, during construction, AJM-JV has undertaken strategic modelling using a Switch Route Model (SRM), developed by SGS.

The SRM combines origin and destination data with rider route preferences across different sections of the network to model rider flows. Actual rider route data is used to calibrate preferences where users extend the length of their trip to align with better bicycle infrastructure. The SRM then computes and aggregates rider trips to map the magnitude of bicycle flows along different segments of the network and how this may change with new infrastructure.

The SRM does not model all cycle trips. For Melbourne Metro, only journeys to work and education trips are modelled. However, given the function of Parkville, this is deemed to be acceptable to model changes in potential cycle behaviour as a result of the closure of Grattan Street during construction. The model can help identify those routes where cycle may divert if appropriate cycle infrastructure is in place.

5.5.3.1 Results

Closure of Grattan Street is projected to have wide-ranging effects on the bicycle network. As illustrated in Figure 5-7, riders from Sydney Road are likely to divert from Royal Parade, taking a route through Bowen Crescent, Rathdowne Street, increasing bicycle traffic on these roads. It is important to note that there is a preference for Rathdowne Street over Lygon Street, likely due to the limited bicycle infrastructure on Lygon Street. Tin Alley and Elgin Street, along with Pelham and Queensberry Streets, would be expected to take on greater east-west connecting role. Cycle use along Bouverie Street also increases as it becomes an access road to enter the university from the south.

If Grattan Street is closed during the construction of Melbourne Metro, options to improve safety in locations with high number of incidents, such as the Haymarket roundabout, should be investigated. This would reduce risk not only for riders switching to Pelham Street in the event of a closure, but also benefit riders currently using Royal Parade and Flemington Road. Improving access to Tin Alley (which runs across the Melbourne University campus) would also provide a reasonable alternative connection for riders, however it is noted that this is a private, one-way road.

In addition, if bicycle infrastructure were provided along Lygon Street north of Elgin Street, this would provide an alternative route closer than Rathdowne Street could provide for riders coming from Sydney Road. This could potentially reduce projected levels of increased cycle traffic at the Haymarket junction.

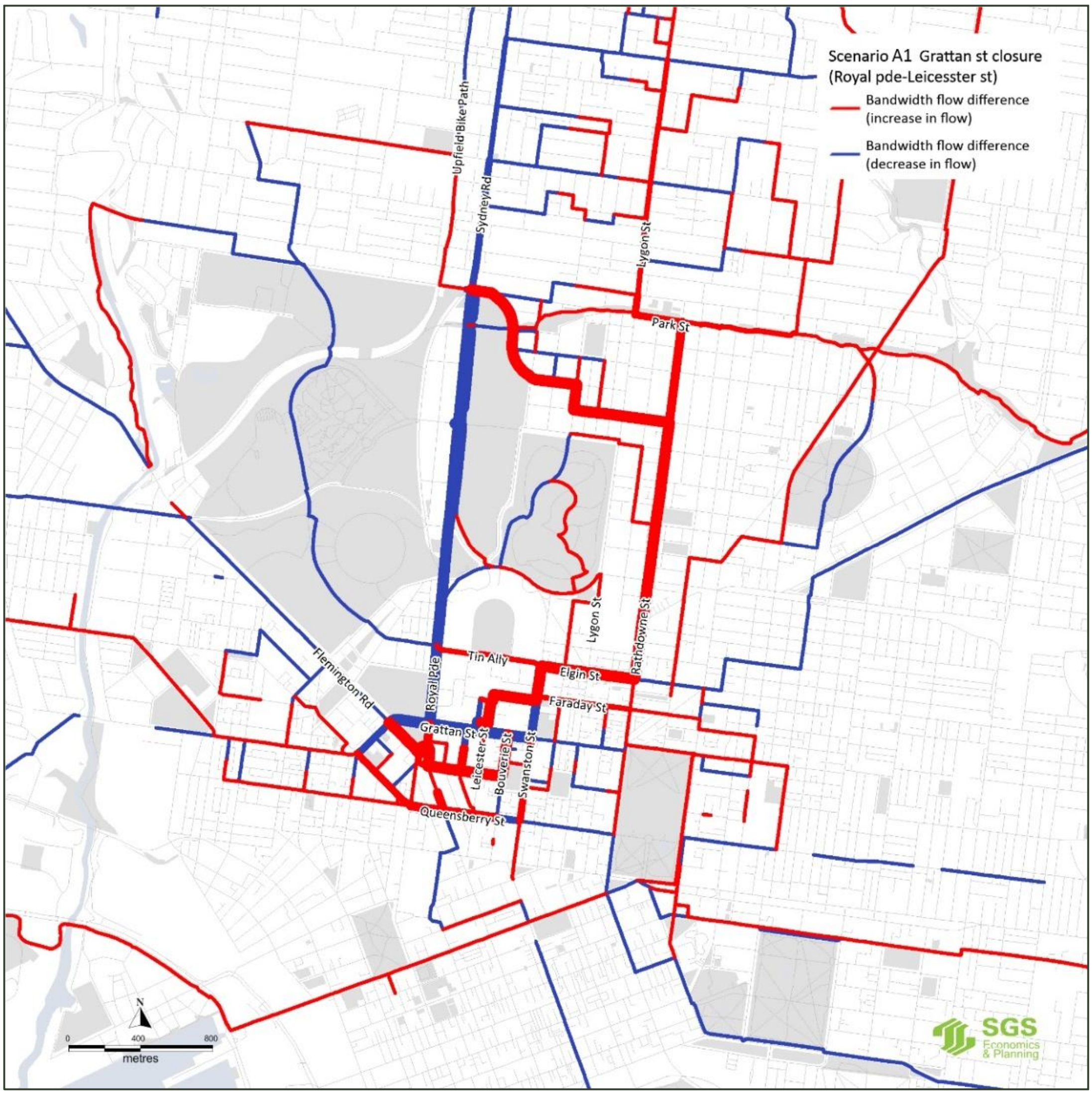


Figure 5-7 Cycle volumes - changes in bicycle rider flows during construction

5.6 Precinct 5: CBD North Station

5.6.1 Overview of Construction Activities

The proposed construction methodology for the CBD North Station would enable Swanston Street to remain open through the CBD. However, Franklin Street between Victoria Street and Swanston Street would need to be closed for approximately 36 months to allow for construction of the station.

Access to Franklin Street, west of Swanston Street, would remain during Melbourne Metro construction with vehicle access to and from Swanston Street being maintained. However, the capacity of Franklin Street (west) would be reduced down from two lanes in each direction to one lane in each direction.

5.6.2 Impact of Construction Activities

As with the Concept Design, the closure of Franklin Street, east of Swanston Street, and reduction to one lane in both directions, west of Swanston Street, would lead to a diversion of some traffic from Franklin Street onto alternative routes. AJM-JV has reviewed potential alternative routes.

- The main alternative vehicle route identified maintains the use of Franklin Street west of Swanston Street accessed from Swanston Street and Victoria Street; this route can operate in both the eastbound and westbound direction. As the shortest diversion around the Franklin Street closure, it is expected to be used by most diverted traffic
- La Trobe Street - This route can operate in both the eastbound and westbound direction
- Therry Street.

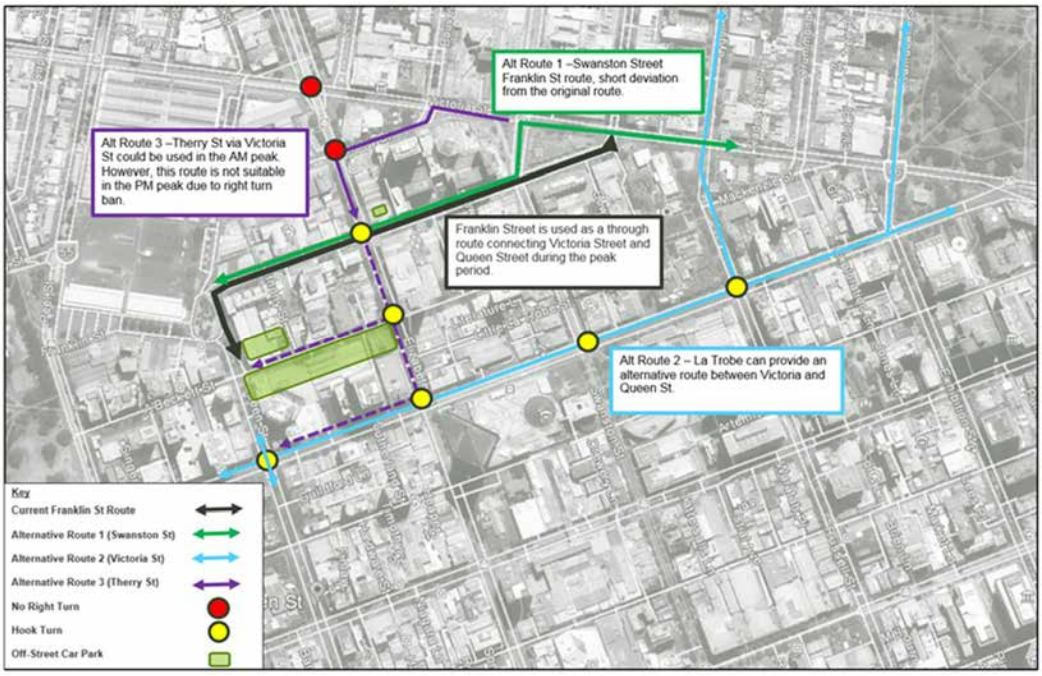


Figure 5-8 Franklin Street closure alternative routes

Sidra modelling has been used to test the capacity of the main alternative route using Victoria and Swanston Streets. Testing has been based on 80 per cent and 60 per cent of diverted traffic using this route. It is expected that the remaining traffic (20 per cent or 40 per cent) would use the other routes or redistribute more widely through the road network (or use alternative forms of travel).

5.6.2.1 2021 Traffic Volume

Due to the high level of construction activity within the CBD during Melbourne Metro construction it is not anticipated that overall traffic volumes would grow from the existing 2015 traffic volumes. Instead, the existing level of traffic would divert onto particular roads less affected by construction activity, resulting in some roads such as Victoria Street and La Trobe Street carrying increased traffic volumes while other roads have a reduction in traffic volume.

5.6.2.2 Intersection analysis

It is considered that between 60 per cent and 80 per cent of vehicles would use the Victoria Street – Swanston Street – Franklin street detour. The two diversion route scenarios have therefore been considered as shown in Figure 5-9.

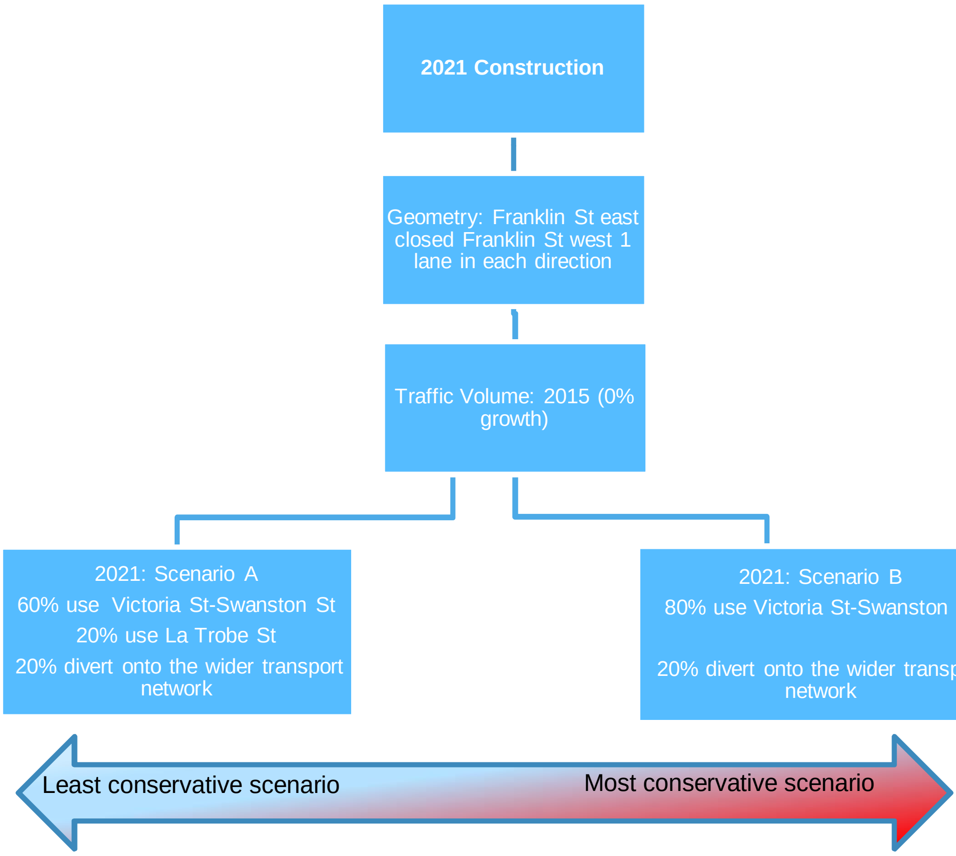


Figure 5-9 Diversion route scenarios

5.6.2.3 Results

Modelling results for the AM and PM peaks are shown in Table 5-13 and Table 5-14. These indicate that in the AM Peak, the diversion route of Victoria Street – Swanston Street – Franklin Street can potentially accommodate up to 60 per cent of the diversion traffic. Additional vehicles are not likely to find the alternative route attractive due to potential vehicle delays particularly in the westbound direction.

In the PM peak it is anticipated that this alternative route can accommodate up to 80 per cent of the Franklin Street diversion traffic.

In both the AM and PM peak, Swanston Street is likely to have vehicles fully occupying the right turn lanes in both directions. To minimise vehicle delays the left turns from Victoria Street or Franklin Street into Swanston Street would need to be coordinated with the following right turn movement.

Although the Sidra modelling indicates that the existing cycle time of 110 seconds can be maintained, the green splits at both intersections would need to be adjusted.

La Trobe Street Operation

AJM-JV has considered the suitability of La Trobe Street to accommodate some of the diverted traffic from Franklin Street.

Modelling of the Swanston Street / La Trobe Street intersection indicates that with 20 per cent diversion onto La Trobe Street, the intersection would be operating at practical capacity, with a DoS of 0.92 in the AM peak and 0.89 in the PM peak. However, long queues would be expected to form in both peaks.

On-street parking is currently allowed along La Trobe Street between 7:30am and 6:30pm. Introducing clearways during the AM and PM peak periods, allied to a limited number of additional banned turns at intersections, would provide additional capacity to more than meet the demand from the 20 per cent diverted traffic.

Table 5-13 Intersection performance - AM peak 2021 construction project (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.22	9 (bike)	20
	La Trobe Street (E)	0.92	38	21
	Swanston Street (S)	0.24	2 (bike)	23
	La Trobe Street (W)	0.67	12	8
	Overall	**0.92**	**38**	**17**
Swanston Street / Franklin Street	Swanston Street (N)	0.85	13	30
	Franklin Street (E)	Closed		
	Swanston Street (S)	0.20	3	34
	Franklin Street (W)	0.20	2	6
	Overall	**0.85**	**13**	**30**
Swanston Street / Victoria Street	Swanston Street (N)	0.89	12	37
	Victoria Street (E)	0.84	21	23
	Swanston Street (S)	1.01	9	50
	Victoria Street (W)	0.94	37	44
	Overall	**1.01**	**37**	**34**

Source: Sidra model outputs

Table 5-14 Intersection performance - PM peak assessment project (60% traffic via Swanston Street, 20% via La Trobe Street)

Intersection	Approach	Degree of saturation / level of service	Maximum queue length (veh)	Average delay (s)
Swanston Street / La Trobe Street	Swanston Street (N)	0.21	5 (bike)	20
	La Trobe Street (E)	0.64	11	8
	Swanston Street (S)	0.24	4 (bike)	22
	La Trobe Street (W)	0.89	32	17
	Overall	**0.89**	**32**	**15**
Swanston Street / Franklin Street	Swanston Street (N)	0.69	11	38
	Franklin Street (E)		Closed	
	Swanston Street (S)	0.45	10 (Bike)	37
	Franklin Street (W)	0.69	6	6
	Overall	**0.69**	**11**	**24**
Swanston Street / Victoria Street	Swanston Street (N)	0.81	7	55
	Victoria Street (E)	0.75	14	8
	Swanston Street (S)	0.75	12	30
	Victoria Street (W)	0.71	19	16
	Overall	**0.81**	**19**	**18**

Source: Sidra model outputs

5.7 Precinct 6: CBD South Station

5.7.1 Overview of Construction Activities

Construction of the CBD South station would be via mined shafts from work sites off the public road adjacent to Swanston Street, Collins Street and Flinders Street. While construction traffic would require access to and from these areas, vehicle numbers are expected to be low compared to existing traffic volumes and would principally occur outside of peak periods, and not materially affect the current operation of the road network.

However, there would be short periods where some roads or traffic lanes may need to be closed for periods.

5.7.2 Future conditions – 2021 No Project Case

5.7.2.1 Intersection Analysis

For the 2021 Base, the traffic volumes within the CBD are expected to remain at 2015 levels, based on the zero growth within the CBD over the last 10 -15 years. Intersection performance is therefore expected to be as shown in Table 3-12.

Table 5-15 Intersection performance - 2021 no project and 2021 construction (both as per 2015 operation)

Intersection	Approach	AM Peak			PM Peak		
		Degree of saturation	Max Queue (veh)	Avenue delay (sec)	Degree of saturation	Max Queue (veh)	Avenue delay (sec)
Swanston Street / Flinders Street	Swanston Street (N)	0.22	8	28	0.34	13	20
	Flinders Street (E)	1.0	37	34	0.96	21	26
	Swanston Street (S)	1.0	25	45	0.90	13	26
	Flinders Street (W)	0.83	14	22	0.62	10	22
	Overall	**1.0**	**37**	**35**	**0.96**	**21**	**25**
Swanston Street / Collins Street	Swanston Street (N)	0.15	4 (Bike)	7	0.16	4 (Bike)	7
	Collins Street (E)	0.65	10	10	0.51	6	9
	Swanston Street (S)	0.27	7 (Bike)	10	0.16	4 (Bike)	9
	Collins Street (W)	0.63	8	9	0.76	14	11
	Overall	**0.65**	**10**	**9**	**0.76**	**14**	**9**
Elizabeth Street / Flinders Street	Elizabeth Street (N)	0.82	5	51	0.61	6	42
	Flinders Street (E)	0.75	9	4	0.70	3	7
	Flinders Street (W)	0.64	10	14	0.68	12	18
	Overall	**0.82**	**10**	**12**	**0.70**	**12**	**14**

Source: Sidra model outputs

5.8 Precinct 7: Domain Station

5.8.1 Overview of Construction Activities

The construction of Domain station would require the closure of Domain Road. This would result in the current route 8 tram being rerouted via Toorak Road to connect with existing tram tracks along St Kilda Road. This scenario has been modelled to assess construction impacts, with new segregated tram tracks and stops along Toorak Road west, which reduces to one running lane of traffic (plus parking) between Park Street and Domain Street.

Rerouting of the route 8 tram also requires a new phase at the St Kilda Road intersection to enable trams to turn into and out of Toorak Road west. To facilitate this a third tram track is proposed for southbound trams turning east into Toorak Road and stops are relocated in St Kilda Road, south of Toorak Road.

The temporary road layout for St Kilda Road would provide one tram lane, one traffic lane and a cycle lane in each direction between Kings Way and Park Street with a temporary DDA-compliant tram stop to be provided opposite Albert Road.

While there are expected to be several stages of construction for Domain Station, modelling has been undertaken for this main stage, as outlined above, as this is expected to have the most significant traffic impacts and would be likely to be in place for the longest duration.

5.8.2 Future Conditions – 2021 Construction

5.8.2.1 VITM Demand Summary

As described in Section 5.8.1, it is proposed to reduce St Kilda Road to a single traffic lane in each direction adjacent to the construction works. This significantly reduces existing capacity along St Kilda Road. The impact of this is that a significant proportion of traffic diverts from St Kilda Road to parallel routes in the wider network, as described in Section 5.1.

A cordon screenline around the Domain precinct has been used to compare growth of VITM traffic volumes through Domain between the 2015 Base Case and the 2021 No Project Case and indicates the differences are small. Comparison of the 2021 Base Case and the 2021 Construction Case indicates a reduction in trips through the Vissim modelled area of approximately 25 per cent associated with the reduction in capacity of St Kilda Road. However, some specific movements through the area indicate a greater or lesser increase or decrease. These changes in OD trips have been used as inputs into the Vissim 2021 Construction model.

5.8.2.2 VISSIM Network Volumes

Table 5-16 and

Table 5-17 summarise the changes in the volumes on key links within the VISSIM model network. Note that these are modelled through movements, not demand and may be impacted by broader network delays associated with the St Kilda Road and Domain Road construction activity.

Table 5-16 VISSIM network volumes summary – AM Peak 2021 construction project

Period	Road	Section	Direction	2015 Base	2021 Base	2021 Construction scenario
7:30-9:30AM	St Kilda Road	South of Dorcas Street	northbound	3120	3120	1340
			southbound	1530	1860	1090
	Park Street	East of Kings Way	eastbound	710	740	710
			westbound	790	790	560
	St Kilda Road	North of Toorak Road	northbound	4100	4130	2190
			southbound	1490	1820	1610
	Kings Way	West of Queens Lane	eastbound	1500	1400	1410
			westbound	1380	1380	1740
	Toorak Road	Wast of Park Street	eastbound	1090	1110	1480
			westbound	1750	1760	1390
	St Kilda Road	South of Arthur Street	northbound	4520	4520	3210
			southbound	2700	2890	2230

Table 5-17 VISSIM network volumes summary – PM peak 2021 construction project

Period	Road	Section	Direction	2015 Base	2021 Base	2021 Construction Scenario
4:30-6:30PM	St Kilda Road	South of Dorcas Street	northbound	2110	2260	900
			southbound	2720	2720	1390
	Park Street	East of Kings Way	eastbound	890	890	670
			westbound	1050	1040	860
	St Kilda Road	North of Toorak Road	northbound	2560	2700	1690
			southbound	2940	2960	2060
	Kings Way	West of Queens Lane	eastbound	2140	2140	2040
			westbound	1610	1610	1390
	Toorak Road	East of Park Street	eastbound	2080	2070	1670
			westbound	1390	1390	1320
	St Kilda Road	South of Arthur Street	northbound	2980	3110	2340
			southbound	3720	3720	3010

The results indicate that there is a slight increase in vehicles along St Kilda Road travelling in both directions during the 2021 Base for both peak periods.

However, during construction, there is a decrease of approximately 1000 vehicles in the northbound direction (north of Toorak Road) and 400 vehicles southbound along St Kilda Road (south of Dorcas Street) during the morning peak hour. In the evening peak, reductions of approximately 700 vehicles in each direction are seen along St Kilda Road, south of Dorcas Street. These reductions are primarily due to the change in capacity along St Kilda Road resulting from the reduction to one traffic lane in each direction.

5.8.2.3 Network Performance

Table 5-18 indicates that the 2021 Base operates similarly to that of the existing conditions models, whilst there is a slight decline in all network performance parameters in the construction scenario, even with the reduced number of trips, due to the reduced number of lanes along St Kilda Road.

Table 5-18 Network performance summary - 2021 construction project

Peak	Parameters	2015 Base	2021 No Project	Difference	Per cent	2021 Construction	Difference	Percent
AM Peak	Average Travel Time (min)	3:23	3:19	-0:04	-2%	3:39	-0:20	10%
	Average delay per vehicle (s)	80	80	0	0%	80	0	0%
	Average Speed (km/h)	20	20	0	0%	20	0	0%
	Total Distance Travelled (km)	20,690	21,020	330	2%	15,620	-5,400	-26%
	Total Travel Time (h)	1,030	1,010	-20	-2%	790	-220	-22%
	Total Completed Trips	18,240	18,190	-50	0%	13,030	-5,160	-28%
PM	Average Travel Time	3:33	3:29	-0:04	-2%	3:35	0:06	3%

Peak	Parameters	2015 Base	2021 No Project	Difference	Per cent	2021 Construction	Difference	Percent
Peak	(min)							
	Average delay per vehicle (s)	90	90	0	0%	90	0	0%
	Average Speed (km/h)	20	20	0	0%	20	0	0%
	Total Distance Travelled (km)	21,620	21,900	280	1%	15,630	-6,270	-29%
	Total Travel Time (h)	1,070	1,060	-10	-1%	840	-220	-21%
	Total Completed Trips	18,090	18,200	110	1%	14,010	-4,190	-23%

Source: Vissim outputs

Travel times increase in the 2021 Construction when compared to the 2021 Base in all travel routes in both directions during both peaks. The AM peak results indicate an increase of approximately 50 seconds in the peak direction, with less delay in the opposing direction. The PM peak results illustrate a slightly higher increase in travel times, with an approximate increase between 35 to 45 seconds in both routes, in both peak hours. These increases are primarily due to traffic weaving on the approaches to the one lane sections of St Kilda Road and reduced speed through the one lane section.

5.8.2.4 Intersection Analysis

Movement delays have been extracted from Vissim using travel time sections for the key intersections of the study area. Table 5-19 and Table 5-20 show the maximum queue, movement delay and LOS for each approach based on the HCM 2000 criteria for the 2021 Construction Case. The results are compared to the 2021 No Project Case.

Table 5-19 Intersection analysis – 2021 construction – AM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2021 no project
7:30-8:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	300	30	0
		Domain Road	0	-	-
		St Kilda Road South	490	20	0
		Park Street	290	100	10
		Albert Road	70	120	0
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	90	30	-10
		Toorak Road	330	90	10
		St Kilda Road South	330	40	10
		Kings Way	200	70	20
8:30-9:30AM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	360	30	10
		Domain Road	0	-	-
		St Kilda Road South	450	20	-10
		Park Street	440	120	20
		Albert Road	110	110	10

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2021 no project
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	90	30	-10
		Toorak Road	510	80	0
		St Kilda Road South	510	50	0
		Kings Way	320	80	20

Table 5-20 Intersection analysis – 2021 construction – PM peak

Period	Intersection	Approach	Max queue (m)	Avg delay (s)	Diff to 2021 base (s)
4:30-5:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	30	20	0
		Domain Road	0	-	-
		St Kilda Road South	250	30	0
		Park Street	380	110	-60
		Albert Road	40	110	30
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	500	60	20
		Toorak Road	130	70	-50
		St Kilda Road South	460	40	0
		Kings Way	180	70	10
5:30-6:30PM	St Kilda Road/ Park Street/ Domain Road/ Albert Road	St Kilda Road North	40	20	0
		Domain Road	0	-	-
		St Kilda Road South	380	30	0
		Park Street	120	60	-20
		Albert Road	60	140	70
	St Kilda Road/ Toorak Road/ Kings Way	St Kilda Road North	500	60	20
		Toorak Road	260	100	-40
		St Kilda Road South	180	40	0
		Kings Way	140	60	0

The 2021 Construction AM peak results indicate that there is an increase in queues on St Kilda Road (south of Albert Road) by up to 150 m and St Kilda Road (north of Toorak Road) by up to 100 m, due to the reduced capacity along St Kilda Road. All other approaches indicate a similar result to the 2021 Base, with a few decreases in queues on St Kilda Road (north of Domain Road) and Toorak Road, due to the decreased number of total trips and the introduction of the new tram phase at the intersection of St Kilda Road/ Toorak Road/ Kings Way.

In the PM Peak, the decrease in capacity on St Kilda Road during construction results in vehicles travelling southbound on St Kilda Road, on the approach Toorak Road, to queue back by up to 300m.

The 2021 Construction results indicate that delays on the approaches to intersections are broadly similar in the AM Peak to the 2021 Base, with the exception being the Kings Way approach to St Kilda Road.

In the PM Peak, the 2021 Construction Case is expected to have a similar average delay to the 2021 Base with the exception of Park Street and Toorak Road with a decrease in delay of up to 65 seconds and 50 seconds, respectively. This is due to the decrease in number of vehicles travelling from these approaches through to St Kilda Road section with the decreased capacity, as well as the additional time given to Toorak

Road, which runs simultaneously with the additional tram phase at the intersection of St Kilda Road/ Toorak Road/ Kings Way. Results also indicate that there is an expected increase in delay along St Kilda Road, north of Kings Way, of up to 19 seconds, due to the decrease in capacity along this section of road, and up to 69 seconds along Albert Road due to changes in signal priority.

5.8.2.5 Conclusion

By comparing the 2021 Base to the Existing Conditions model and the 2021 Construction Scenario to the 2021 Base, the results indicate the following:

- Network performance parameters incur a moderate decrease for the 2021 Construction Scenario, and comparable results with a slight improvement in the 2021 Base in comparison to the Existing Conditions models.
- The 2021 Construction Scenario indicates an increase in travel times in the both directions for both the AM and PM peaks, with increases of up to 50 seconds in the AM peak and 45 seconds in the PM peak.
- Queues for the 2021 Construction Scenario indicate comparable results to the 2021 Base with the exception of St Kilda Road (south of Albert Road) with an increase of up to 150 m and St Kilda Road (north of Toorak Road) by up to 100 m, in the AM Peak, and St Kilda Road (north of Toorak Road) by up to 300 m in the PM Peak.
- The average speed plots indicate a reduction in the 2021 Construction scenario along St Kilda Road in both directions, particularly south of Toorak Road, for both peak periods when compared with the 2021 Base.
- With respect to movement delay, on average, there is a similar trend between the 2021 Base and the Existing Conditions models, as well as the 2021 Construction Scenario to the 2021 Base. Results indicate that there are expected improvements along Park Street, as well as Toorak Road, in the PM peak within the 2021 Construction model. Slight increases in delay are expected along Kings Way, during the AM Peak, and along St Kilda Road during the PM Peak.
- Comparison of traffic volumes indicates that there is a significant decrease along St Kilda Road for the 2021 Construction Scenario due to reduction in traffic lanes. This reduction is up to 1000 vehicles per hour in the northerly direction during the AM peak, and approximately 700 vehicles per hour in both directions in the PM peak. 2021 Base volumes are comparable to the Existing Conditions models.
- While Vissim models indicates that the modelled network continues to operate within acceptable standards, this is based on up to 25 per cent of traffic reassigning to the wider network as a result of the reduction of St Kilda Road to one through lane in each direction during construction. It is recommended that measures are taken to improve capacity along potential diversion routes along with a Demand Management Strategy to encourage people to consider alternative modes or patterns of travel to avoid driving through the Domain area during construction.

5.9 Precinct 8: Eastern Portal (South Yarra)

Modelling has not been undertaken for the eastern portal in relation to Melbourne Metro Construction impacts as there is no material change in traffic demand or supply in the local network resulting from the 2021 Construction when compared with the 2021 Base (No Project) Case.

5.10 Precinct 9: Western Turnback

Modelling has not been undertaken for the Western Turnback in relation to Melbourne Metro Construction impacts as there is no material change in traffic demand or supply in the local network resulting from the 2021 Construction when compared with the 2021 Base (No Project) Case.

Appendices

Appendix A

Outline of Modelling Tools

VITM

VITM is the State's in-house strategic demand model. It is a multi-modal analytical tool which forecasts travel and can be used to look at alternate travel by private vehicles and public transport in response to various transport infrastructure and land use planning scenarios. Melbourne Metro patronage at stations for a number of scenarios. This can be used to inform the pedestrian demand and traffic demand (at a strategic level) used in the various pedestrian and traffic modelling described below.

For pedestrian modelling, VITM is being used to assess passenger distribution from the stations to the surrounding areas and interchange with other public transport. For traffic modelling, VITM is being used to inform the wider traffic impacts of key phases of construction (for example closure of a road) and operational impacts of the project. In particular, VITM is used to compare changes in traffic flow and distribution between the base case and scenarios, rather than provide absolute traffic volumes.

ClicSim

ClicSim is a passenger simulation model of the Melbourne rail system originally developed to assess the capacity of the City Loop and Inner Core (CLIC) stations. The model was used for work on Melbourne Metro in 2010 to assess capacity requirements at CBD North and CBD South. The model was subsequently recalibrated in 2014 as part of the former Melbourne Rail Link (MRL) project, and has now been updated to include all of the proposed Melbourne Metro stations.

The ClicSim model is a dynamic passenger simulation that models the location of trains and passengers on a second-by-second basis across the entire metropolitan rail network.

The inputs to the model are:

- A representation of the rail network and walking networks in each station
- Station-to-station origin-destination matrices of passenger demand during the AM and PM peaks
- The proposed train timetable.

The primary outputs from the model are:

- Pedestrian volumes in each part of the modelled stations (e.g. gate lines, platforms, concourses, vertical transport)
- Pedestrian levels of service in each station on a minute-by-minute basis
- Train loads
- Boarding, alighting and transfer volumes.

The main application of the model is in providing forecasts of future passenger volumes to assist in the design of each station element and providing level of service evaluations for each station.

VISSIM/Aimsun

VISSIM is a micro-simulation traffic model that models individual vehicles through a small/medium network. Aimsun is a mesoscopic/micro-simulation hybrid model, which can model different areas as either micro-simulation or mesoscopic areas within the same model. Both VISSIM and Aimsun can be used to simulate SCATS signal operation at individual sites or across a network.

For Melbourne Metro Reference Design, VISSIM and Aimsun are being used at key locations where impacts due to construction or operations are expected to be significant and potentially lead to some redistribution of traffic. The models are used to inform local network design and area assessment. The VITM model is used to identify wider strategic impacts and potential changes in localised traffic as an input into the micro/meso models.

Sidra

Sidra is an industry standard traffic model used to assess the performance of individual intersections or small networks. The model is a micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive models. It can be used to compare alternative treatments of individual intersections or small networks. Sidra allows modelling of separate modes (light vehicles, trucks, buses, cycles, trams etc.) which can be allocated to different lanes, lane segments and signal phases.

Sidra is a relatively cost effective model to assess local impacts of transport projects. For Melbourne Metro Concept Design, Sidra is being used to inform the local intersection design and undertake initial traffic analysis of changes in functionality of intersections as a result of station precinct designs or road restrictions resulting from the proposed construction methodology, and to identify potential mitigation measures.

Appendix B

Traffic Signal Timing Changes

Parkville Traffic Signal Timing Changes

Key
× - no change
✓ - change to the model or optimised by the program

Intersection	2021 Construction			2031 Melbourne Metro Project Case		
	Cycle Time	Green Splits	Phases	Cycle Time	Green Splits	Phases
Royal Parade/ Grattan Street/ Elizabeth Street	×	✓[1]	×	×	✓[1]	×
Flemington Road/ Grattan Street/ Wreckyn Street	×	✓[1]	×	×	✓[1]	×
Haymarket Roundabout	×	✓[1]	×	×	✓[1]	×
Flemington Road/ Elliott Avenue/ Racecourse Road	×	×	×	×	×	×
Flemington Road/ Abbotsford Street	×	✓	×	×	×	×
Flemington Road/ Royal Children's Hospital Melbourne Access	×	×	×	×	×	×
Flemington Road/ Royal Children's Hospital Melbourne Access	×	×	×	×	×	×
Flemington Road/ Gatehouse Street/ Harker Street	×	×	×	×	×	×
Flemington Road/ Royal Melbourne Hospital Access	×	×	×	×	×	×
Royal Parade/ Macarthur Road/ Cemetery Road West	×	×	×	×	×	×
Royal Parade/ Gatehouse Street/ College Crescent	×	✓	×	×	×	×
Royal Parade/ Royal Melbourne Hospital Access	×	✓	×	×	×	×
College Crescent/ Cemetery Road West/ Princes Park Drive	×	✓	×	×	×	×
Cemetery Road East/ Swanston Street/ College Crescent	×	✓	×	×	×	×
Swanston Street/ Elgin Street	×	✓	×	×	×	×
Swanston Street/ Monash Road	×	×	×	×	×	×
Swanston Street/ Grattan Street	×	×	×	×	×	×
Harker Street/ Haines Street	×	✓	×	×	✓	×
Curzon Street/ Arden Street	×	×	×	×	×	×
Curzon Street/ Queensberry Street	×	×	×	×	×	×
Curzon Street/ Victoria Street/ King Street	×	×	×	×	✓	×
Victoria Street/ King Street	×	×	×	×	×	×
Victoria Street/ Errol Street	✓	✓	×	×	×	×
Victoria Street/ Leveson Street	✓	✓	×	×	✓	×
Victoria Street/ Chetwynd Street	×	×	×	×	×	×
Victoria Street/ Howard Street	×	×	×	×	✓	×
Victoria Street/ Peel Street	✓	✓	×	×	✓	×
Victoria Street/ Elizabeth Street	×	×	×	×	✓	×
Queensberry Street/ Errol Street	×	×	×	×	×	×
Queensberry Street/ Chetwynd Street	×	×	×	×	×	×
Queensberry Street/ Peel Street	✓	✓	×	×	✓	×
Queensberry Street/ Elizabeth Street	✓	✓	×	×	×	×
Queensberry Street/ Leicester Street	✓	✓	×	×	×	×
Arden Street/ Errol Street	×	×	×	×	×	×
Grattan Street/ University of Melbourne Access	✓[2]	✓[2]	✓[2]	×	×	×
Grattan Street/ Bouverie Street	×	×	×	×	×	×

Notes
1. Dynamic SCATS signals were implemented at these intersections and therefore the green time splits would have differed based on demand.
2. Intersection was removed due to construction works.

CBD North Traffic Signal Timing Changes

Key
× - no change
✓ - change to the model or optimised by the program

Intersection	2021 Construction			2031 Melbourne Metro Project Case		
	Cycle Time	Green Splits	Phases	Cycle Time	Green Splits	Phases
Swanston Street/La Trobe Street	×	✓	×	×	✓	×
Elizabeth Street/Victoria Street	Not modelled			×	×	×
Swanston Street/Franklin Street	×	✓	✓[1]	×	✓	✓[1]
Swanston Street/Victoria Street/	×	✓	×	×	✓	×
Victoria Street/Therry Street	Not modelled			×	×	×
Elizabeth Street/Therry Street				×	×	×

Note
1. Closure of Franklin Street east of Swanston Street results in the removal of the eastern approach signal groups.

Domain Traffic Signal Timing Changes

Key
× - no change
✓ - change to the model or optimised by the program

Intersection	2021 Construction			2031 Reference Case			2031 Melbourne Metro Project Case (Tram Diversion via Toorak Rd)		
	Cycle Time	Green Splits	Phases	Cycle Time	Green Splits	Phases	Cycle Time	Green Splits	Phases
St Kilda Road/ Domain Road/ Park Street[4]	×	✓[1 & 2]	✓[1 & 2]	×	×	✓[1]	×	✓[1 & 2]	✓[1 & 2]
St Kilda Road/ Toorak Road/ Kings Way[4]	×	✓[3]	✓[3]	×	×	×	×	✓[3]	✓[3]
Kings Way/ Queen Street	×	×	×	×	×	×	×	×	×
St Kilda Road/ Dorcas Street	×	×	×	×	×	×	×	×	×
St Kilda Road/ Arthur Street	×	×	×	×	×	×	×	×	×
Kings Way/ Park Street	×	×	×	×	×	×	×	×	×

Notes
1. Pedestrian crossings were removed at St Kilda Road/ Domain Road/ Park Street at the old tram stop location and tram stop relocated south of Albert Road.
2. Tram Route 58 Signal Group (trams turning in and out of Domain Road) were removed. i
3. Additional tram phase was included at the intersection of St Kilda Road/ Toorak Road/ Kings Way to accommodate the tram diversion via Toorak Road.
4. Vehicle Actuated Programming (VAP) was used in the VISSIM modelling for this intersection. An × indicates no change was made to the VAP file. Due to the nature of microsimulation modelling each would run may result in variations in the signal green times.

AJM Joint Venture

121 Exhibition Street

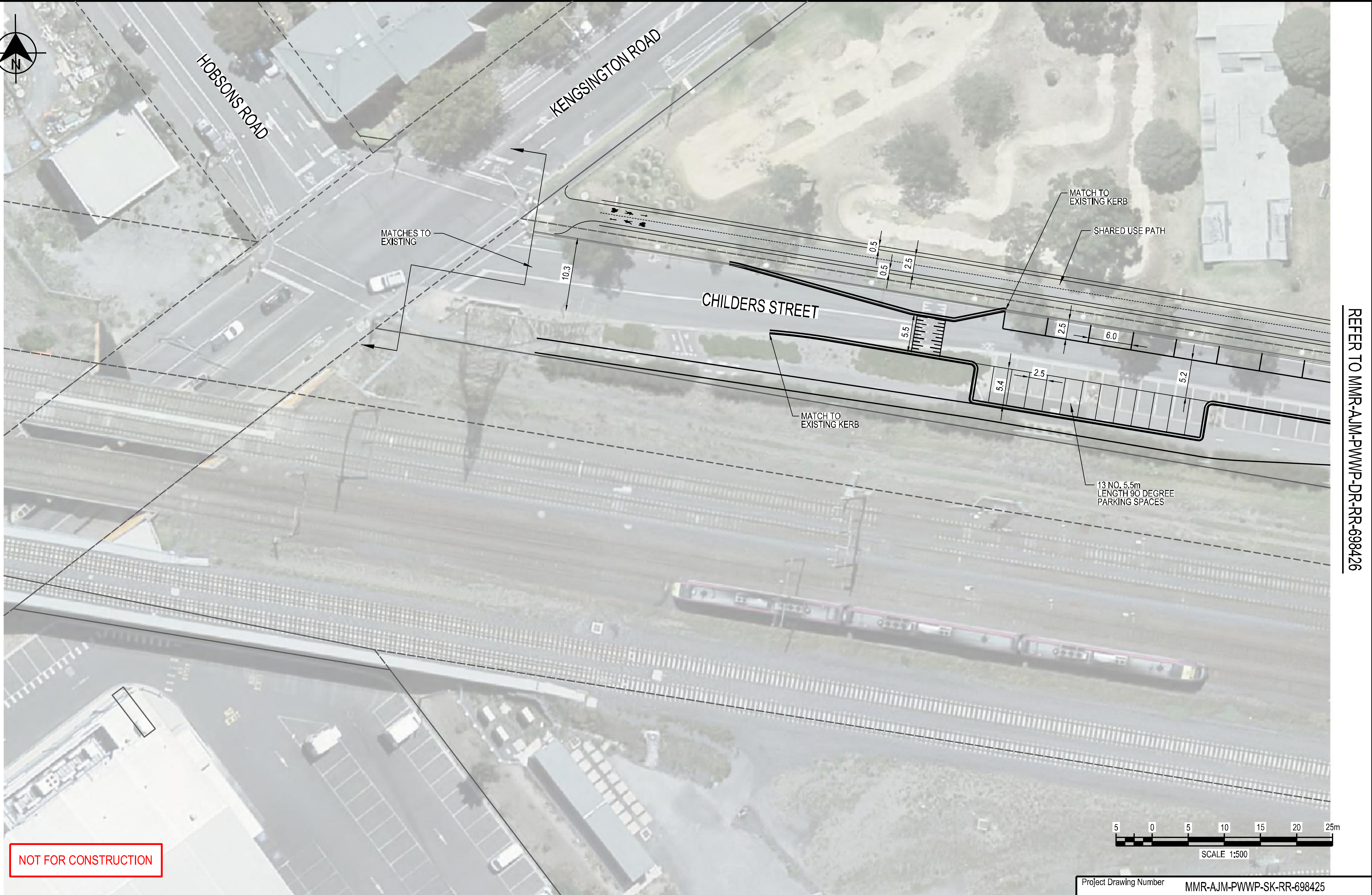
Melbourne VIC 3000

PO Box 23061 Docklands VIC 8012 Australia

Appendix E

2031 Road Functional Layouts

Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)



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AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

18/11/2015 8:00:29 PM

Consultant

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MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL
ROAD FUNCTIONAL LAYOUT
SHEET 1

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWWP-SK-RR-698425

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

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Sheet No. 01 of 01

Drawing Number

Revision: P2

Scale: 1:500

Sheet Size: A3

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Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)

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AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW; MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO
WESTERN PORTAL
ROAD FUNCTIONAL LAYOUT
SHEET 2

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWWP-SK-RR-698426

Drawn By	Designed By
E WISNIEWSKI	E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWWP-SK-RR-698426.dgn

Sheet No. 01 of 01

Scale 1:500 | Sheet Size A3

Drawing Number | Revision P2

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REFER TO MMR-AJM-PWWP-DR-RR-698426

REFER TO MMR-AJM-PWWP-DR-RR-698428

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Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
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AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant

AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

All written dimensions take precedence over scaled dimensions.

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL
ROAD FUNCTIONAL LAYOUT
SHEET 3

Up Location: East. North. ID#
Down Location: East. North. ID#
Datum: MGA Z55

Project Drawing Number: MMR-AJM-PWWP-SK-RR-698427

VicTrack ACCESS

File Name: MMR-AJM-PWWP-SK-RR-698427.dgn

Sheet No. 01 of 01

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E WISNIEWSKI	S BRANFORD
Checked By: T LAU	Ind. Review
Approved	Approval Date

Drawing Number

Revision P2

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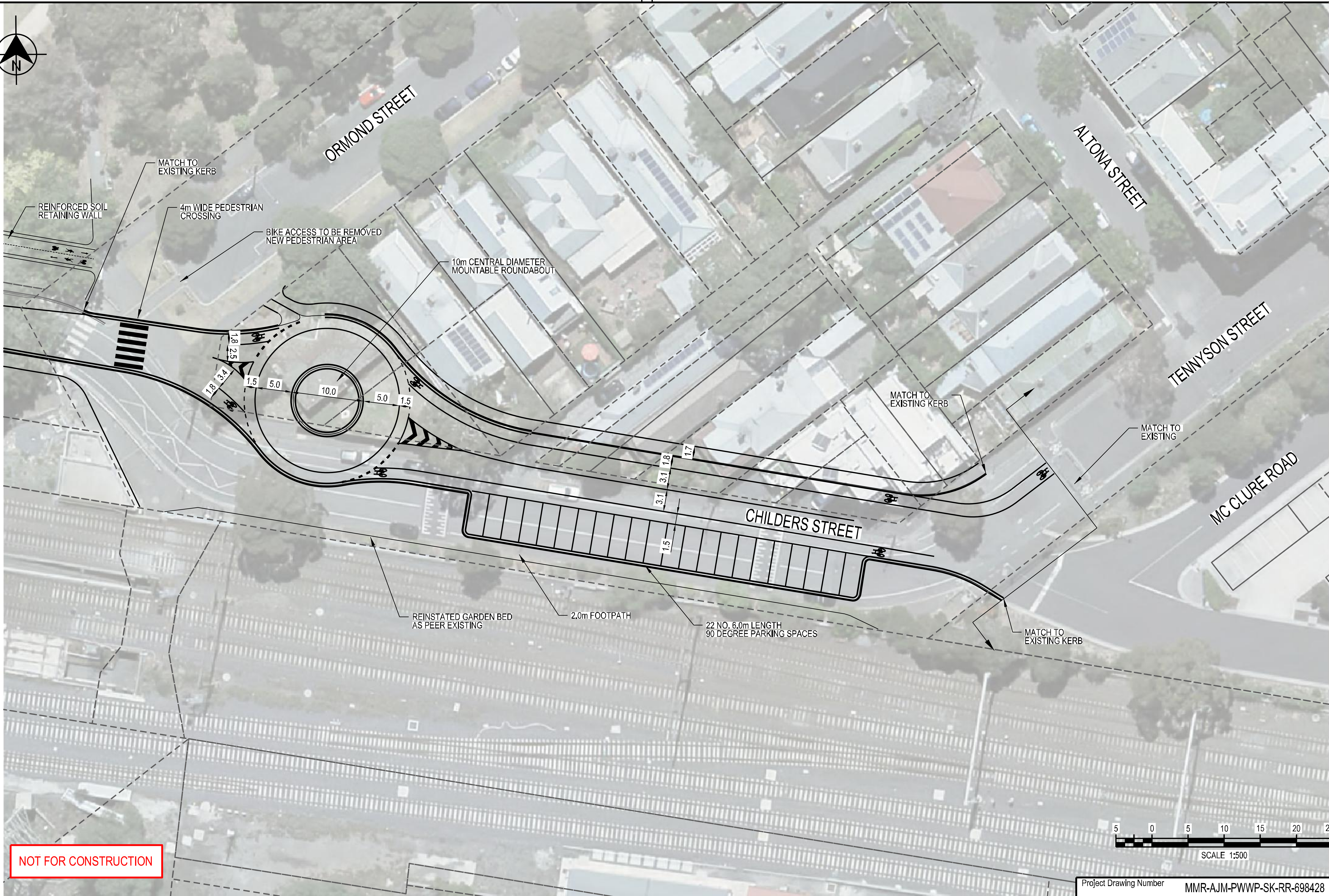
Certified By:

REFER TO MMR-AJM-PWWP-DR-RR-698427



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18/11/2015

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MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL
ROAD FUNCTIONAL LAYOUT
SHEET 4

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWWP-SK-RR-698428

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Drawn By: E WISNIEWSKI	Designed By: S BRANFORD
Checked By: T LAU	Ind. Review
Approved	Approval Date

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Sheet No. 01 of 01

Drawing Number

Revision: P2

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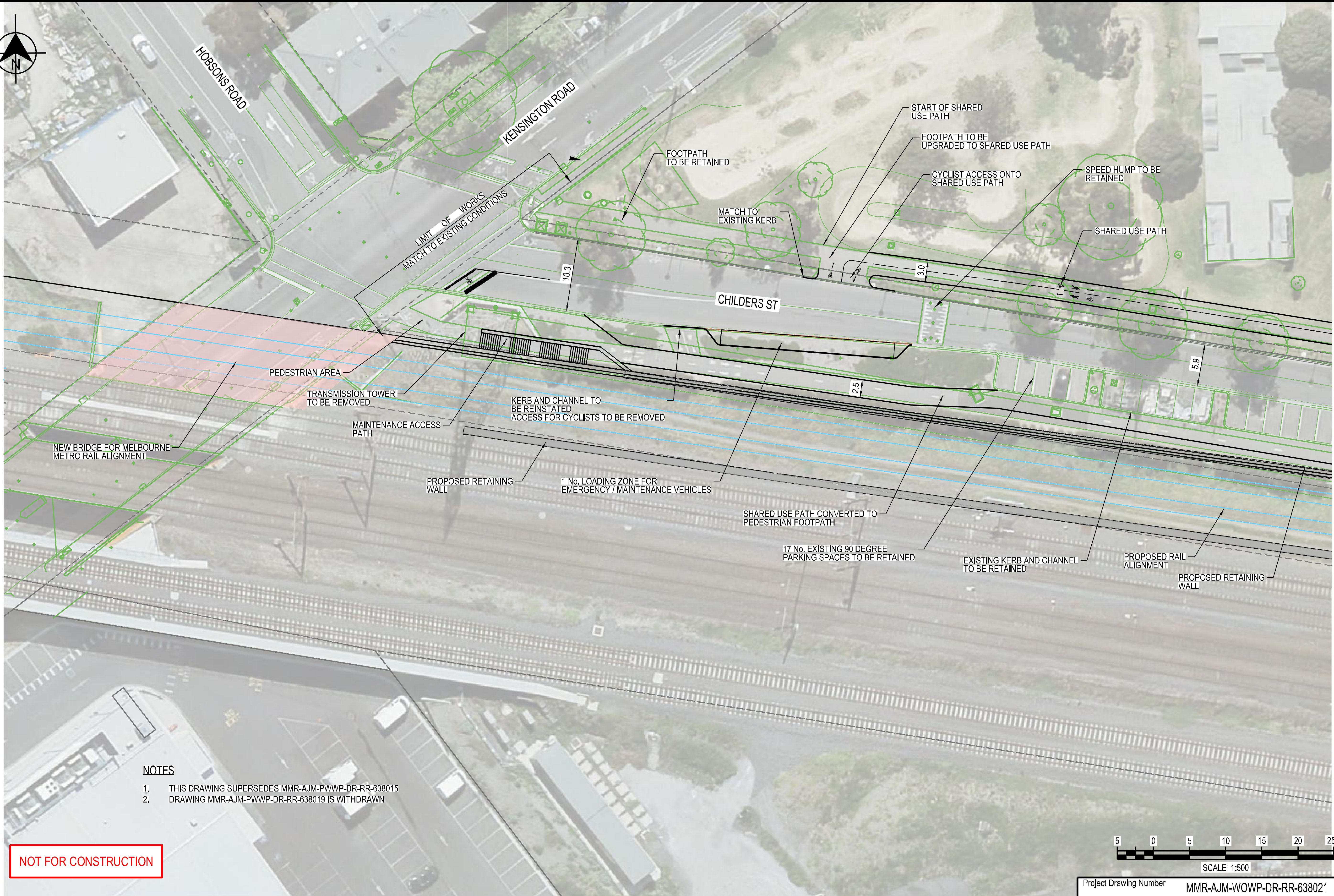

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1. THIS DRAWING SUPERSEDES MMR-AJM-PWWP-DR-RR-638015
2. DRAWING MMR-AJM-PWWP-DR-RR-638019 IS WITHDRAWN

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MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL PRECINCT
ROAD FUNCTIONAL LAYOUT
PROJECT VARIATION SHEET 1

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-WOWP-DR-RR-638021

VicTrack ACCESS

File Name: MMR-AJM-WOWP-DR-RR-638021.dgn

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N DHAVALA	N DHAVALA
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Approved	Approval Date
Drawing Number	Revision: P1

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REFER TO MMR-AJM-WOWP-DR-RR-638021

REFER TO MMR-AJM-WOWP-DR-RR-638023

NOTES
1. THIS DRAWING SUPERSEDES MMR-AJM-PWWP-DR-RR-638016

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RAILWAY TRACK AND CIVIL
MELBOURNE METRO
WESTERN PORTAL PRECINCT
ROAD FUNCTIONAL LAYOUT
PROJECT VARIATION SHEET 2

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

VicTrack ACCESS

Project Drawing Number	MMR-AJM-WOWP-DR-RR-638022
Drawn By	N DHAVALA
Designed By	N DHAVALA
Checked By	T LAU
Ind. Review	
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Approval Date	
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Drawing Number	
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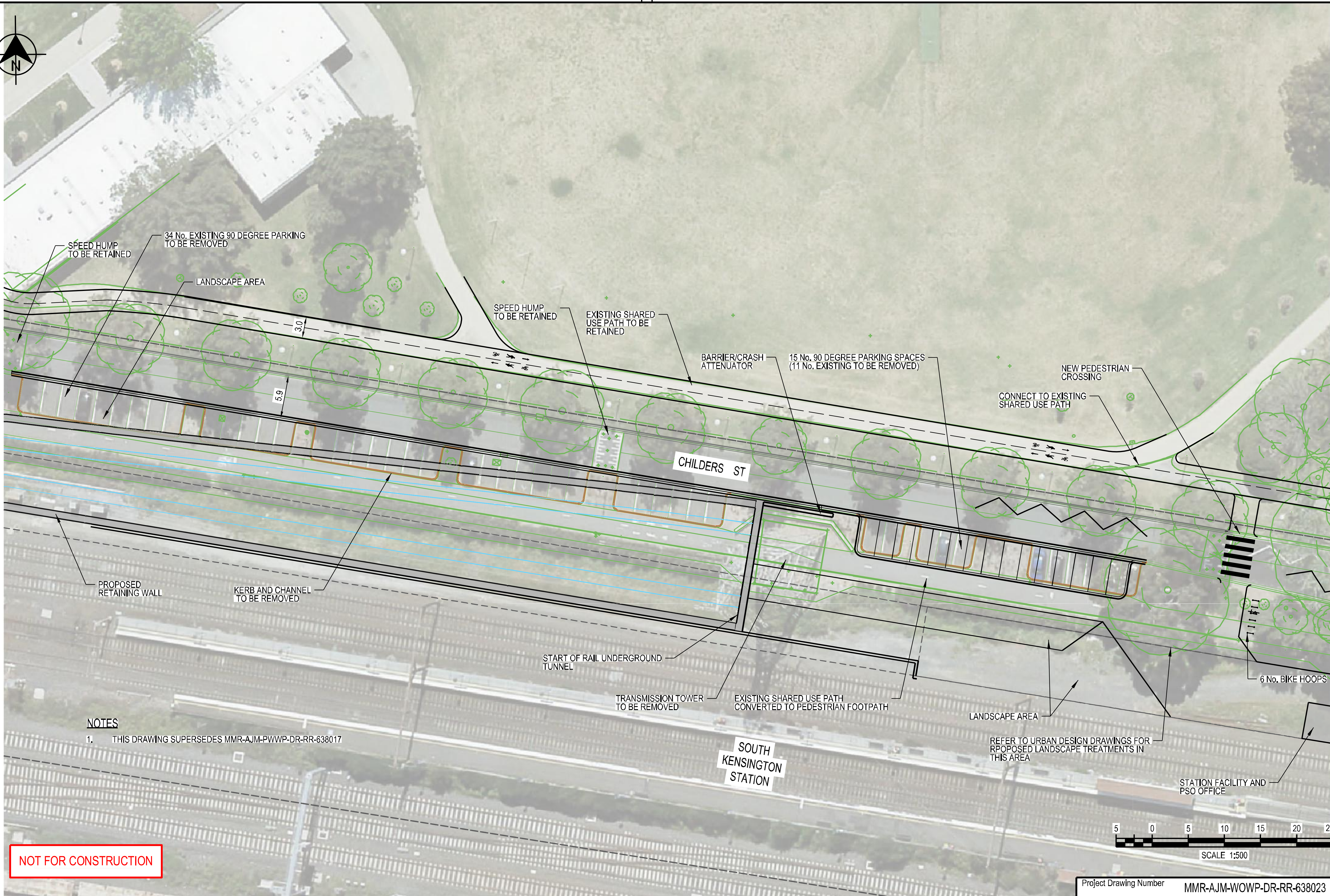

REFER TO MMR-AJM-WOWP-DR-RR-638022

REFER TO MMR-AJM-WOWP-DR-RR-638024

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1. THIS DRAWING SUPERSEDES MMR-AJM-PWWP-DR-RR-638017

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL PRECINCT
ROAD FUNCTIONAL LAYOUT
PROJECT VARIATION SHEET 3

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-WOWP-DR-RR-638023

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Sheet No. 01 of 01

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N DHAVALA	N DHAVALA
Checked By: T LAU	Ind. Review
Approved	Approval Date

Drawing Number | Revision P1

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1. THIS DRAWING SUPERSEDES MMR-AJM-PWWP-DR-RR-638018

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

WESTERN PORTAL PRECINCT
ROAD FUNCTIONAL LAYOUT
PROJECT VARIATION SHEET 4

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-WOWP-DR-RR-638024

VicTrack ACCESS

File Name: MMR-AJM-WOWP-DR-RR-638024.dgn

Sheet No. 01 of 01

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Scale 1:500 | Sheet Size A3

Drawn By	Designed By
N DHAVALA	N DHAVALA
Checked By: T LAU	Ind. Review
Approved	Approval Date

Drawing Number | Revision: P1

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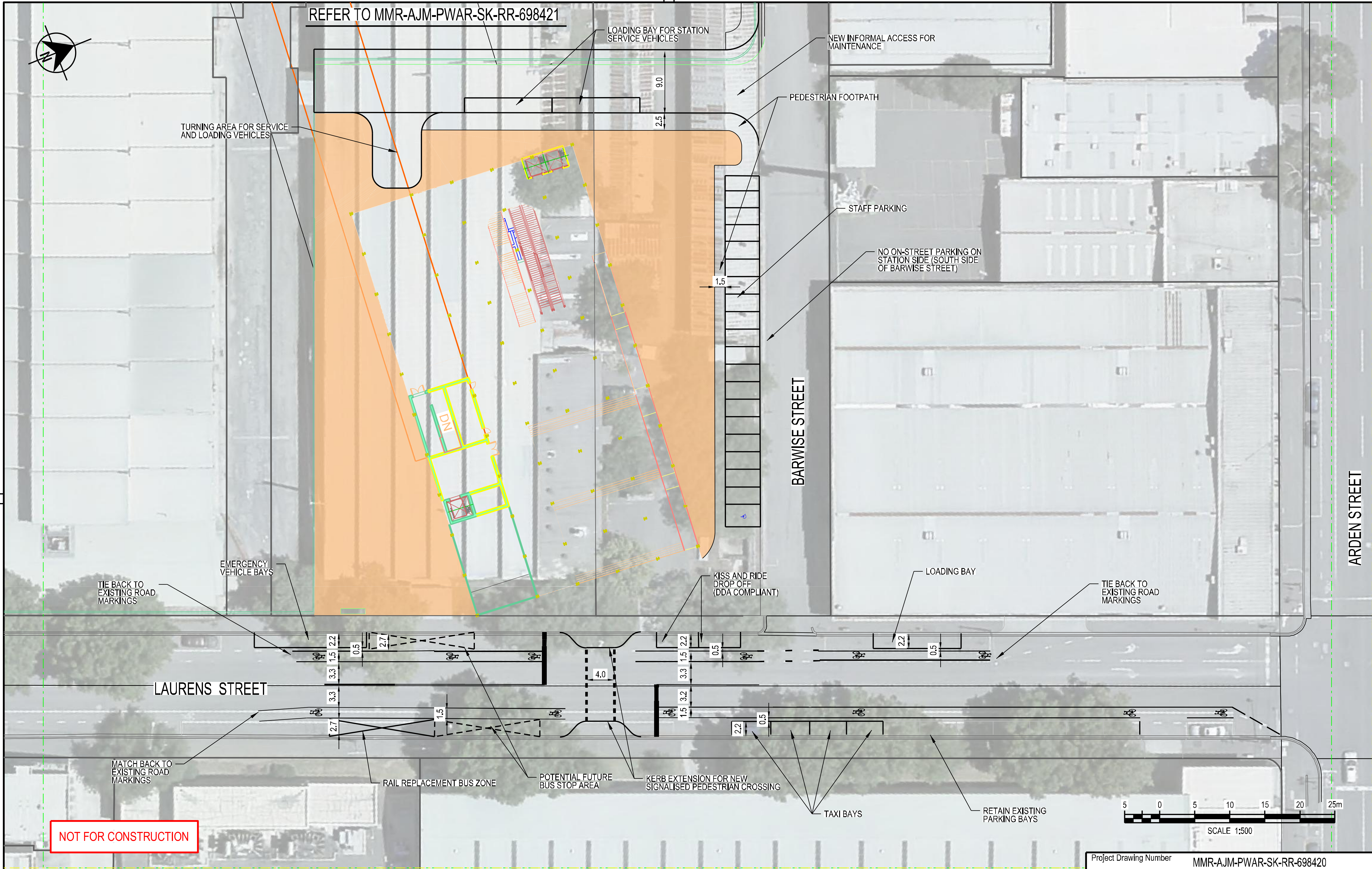

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Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)

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AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW; MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL
MELBOURNE METRO
ARDEN STREET
ROAD FUNCTIONAL LAYOUT
SHEET 1

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWAR-SK-RR-698420

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
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Approved	Approval Date

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Drawing Number
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Revision P2

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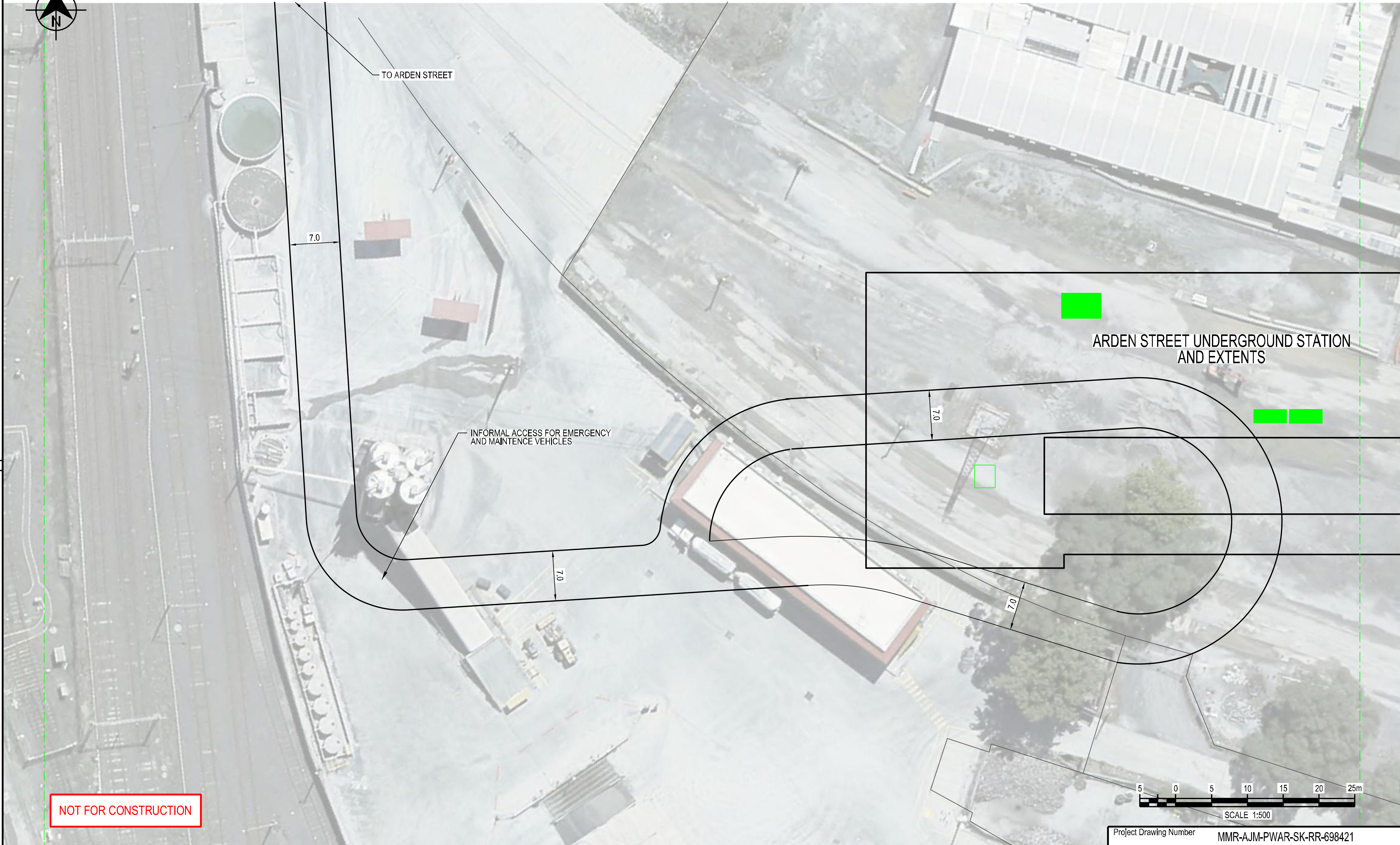

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

ARDEN STREET
ROAD FUNCTIONAL LAYOUT
SHEET 2

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWAR-SK-RR-698421

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWAR-SK-RR-698421.dgn

Sheet No. 01 of 01

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Drawing Number | Revision P1

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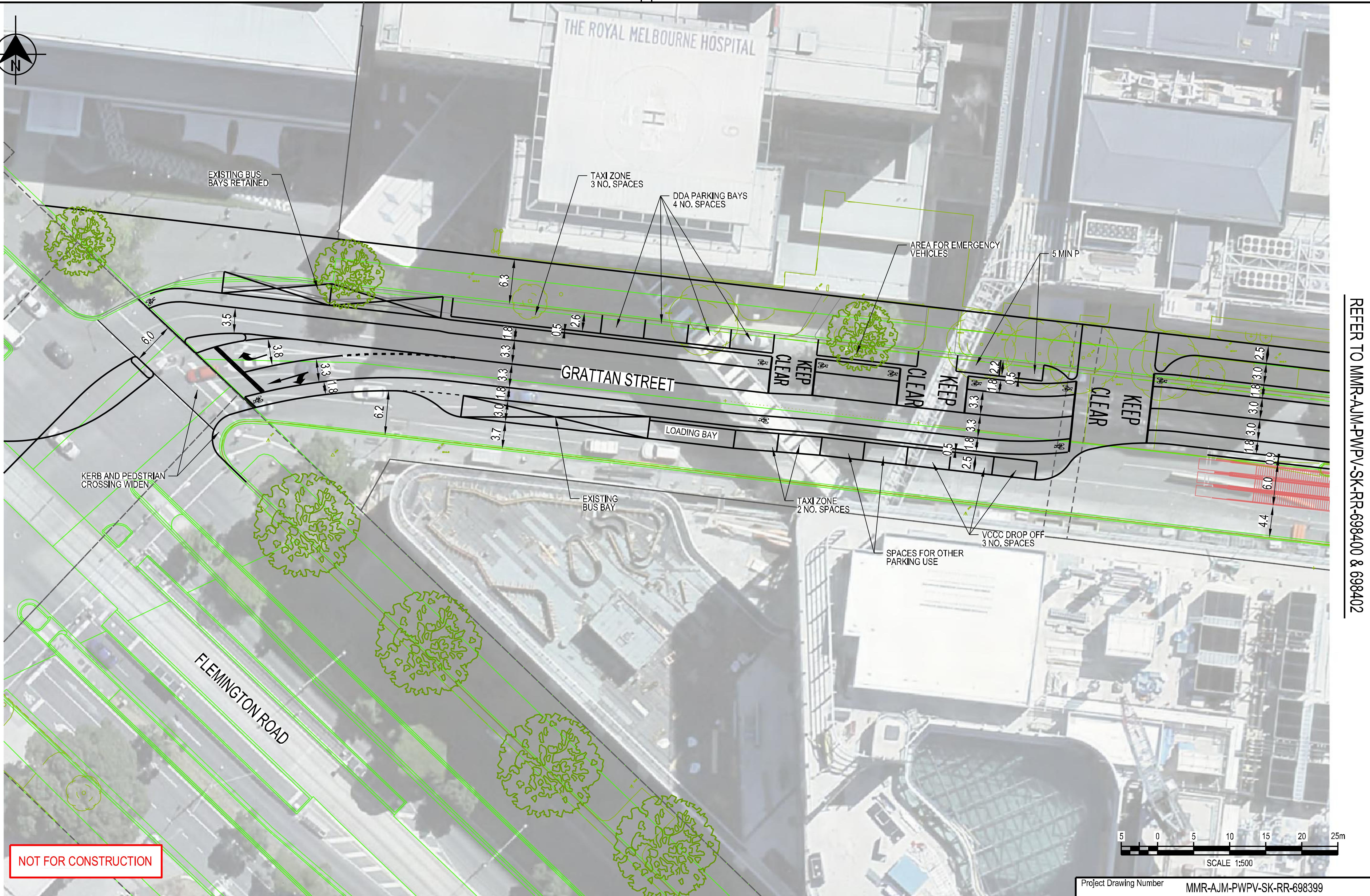

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE
ROAD FUNCTIONAL LAYOUT
SHEET 1

Up Location	Down Location	Datum
East. North. ID# <Enter the up tra	East. North. ID#PASS ID #>	MGA Z55

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698399

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Checked By: T LAU	Ind. Review
Approved	Approval Date

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Drawing Number
Revision P1

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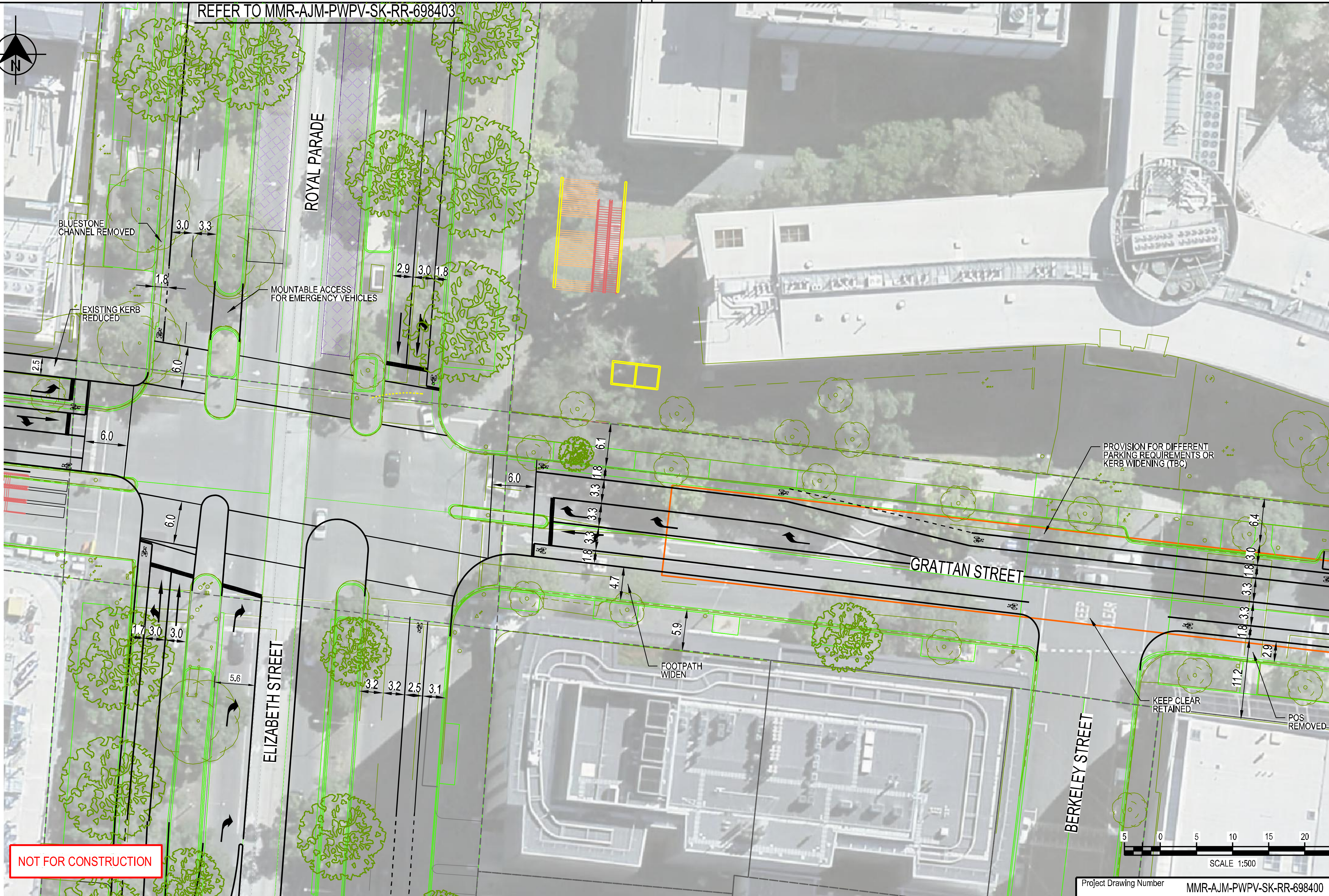

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17/11/2015

Consultant

AJM Joint Venture

aurecon JACOBS Mott MacDonald GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE

ROAD FUNCTIONAL LAYOUT

SHEET 2

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up tra	ID#PASS ID #>	

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698400

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWPV-SK-RR-698400.dgn

Sheet No. 01 of 01

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Drawing Number

Revision: P1

Scale 1:500

Sheet Size A3

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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

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Consultant

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE

ROAD FUNCTIONAL LAYOUT

SHEET 3

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up tra	ID#PASS ID #>	

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698401

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Checked By: T LAU	Ind. Review
Approved	Approval Date

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Sheet No. 01 of 01

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Scale 1:500

Sheet Size A3

Drawing Number

Revision P1

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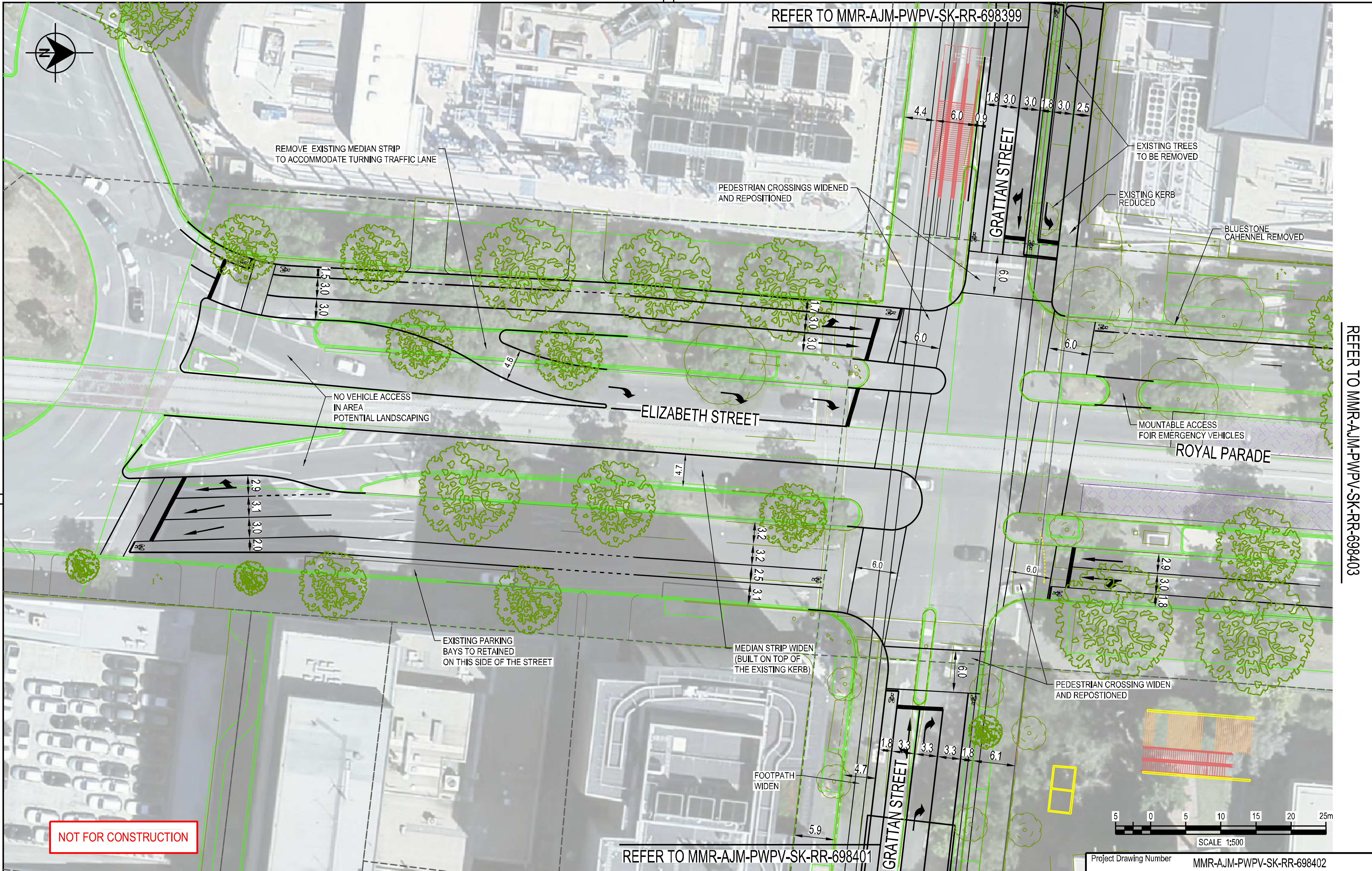

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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE
ROAD RUNCTIONAL LAYOUT
SHEET 4

Up Location	Down Location	Datum
East. North. ID# <Enter the up tra…	East. North. ID# <PASS ID #>	MGA Z55

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698402

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWPV-SK-RR-698402.dgn

Sheet No. 01 of 01

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Scale 1:500 | Sheet Size A3

Drawing Number

Revision P1

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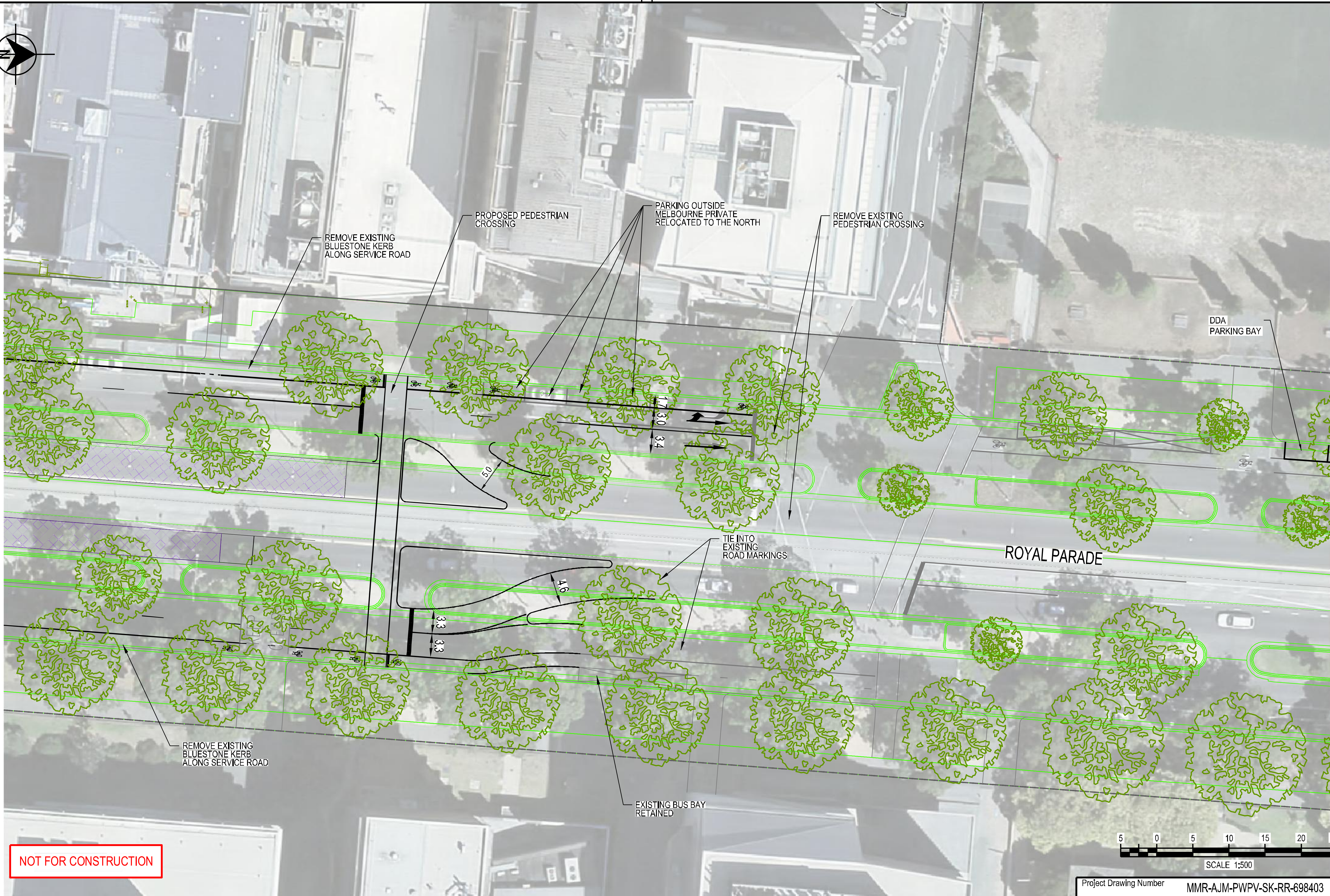
(DATE)

(SIGNATURE)

(BLOCK LETTERS)

Certified By:

REFER TO MMR-AJM-PWPV-SK-RR-698402



REFER TO MMR-AJM-PWPV-SK-RR-698404

NOT FOR CONSTRUCTION

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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

17/11/2015 2:25:38 PM

Consultant

AJM Joint Venture
aurecon
JACOBS
Mott MacDonald
GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE

ROAD FUNCTIONAL LAYOUT

SHEET 5

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up tra	ID#PASS ID #>	

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698403

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWPV-SK-RR-698403.dgn

Sheet No. 01 of 01

In Serv.

Drawing Number

Revision: P1

Scale 1:500 | Sheet Size A3

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Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald, in association with GRIMSHAW; MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

PARKVILLE
ROAD FUNCTIONAL LAYOUT
SHEET 6

Up Location	Down Location	Datum
East. North. ID# <Enter the up tra	East. North. ID#PASS ID #>	MGA Z55

Project Drawing Number: MMR-AJM-PWPV-SK-RR-698404

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWPV-SK-RR-698404.dgn

Sheet No. 01 of 01

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Drawing Number | Revision P1

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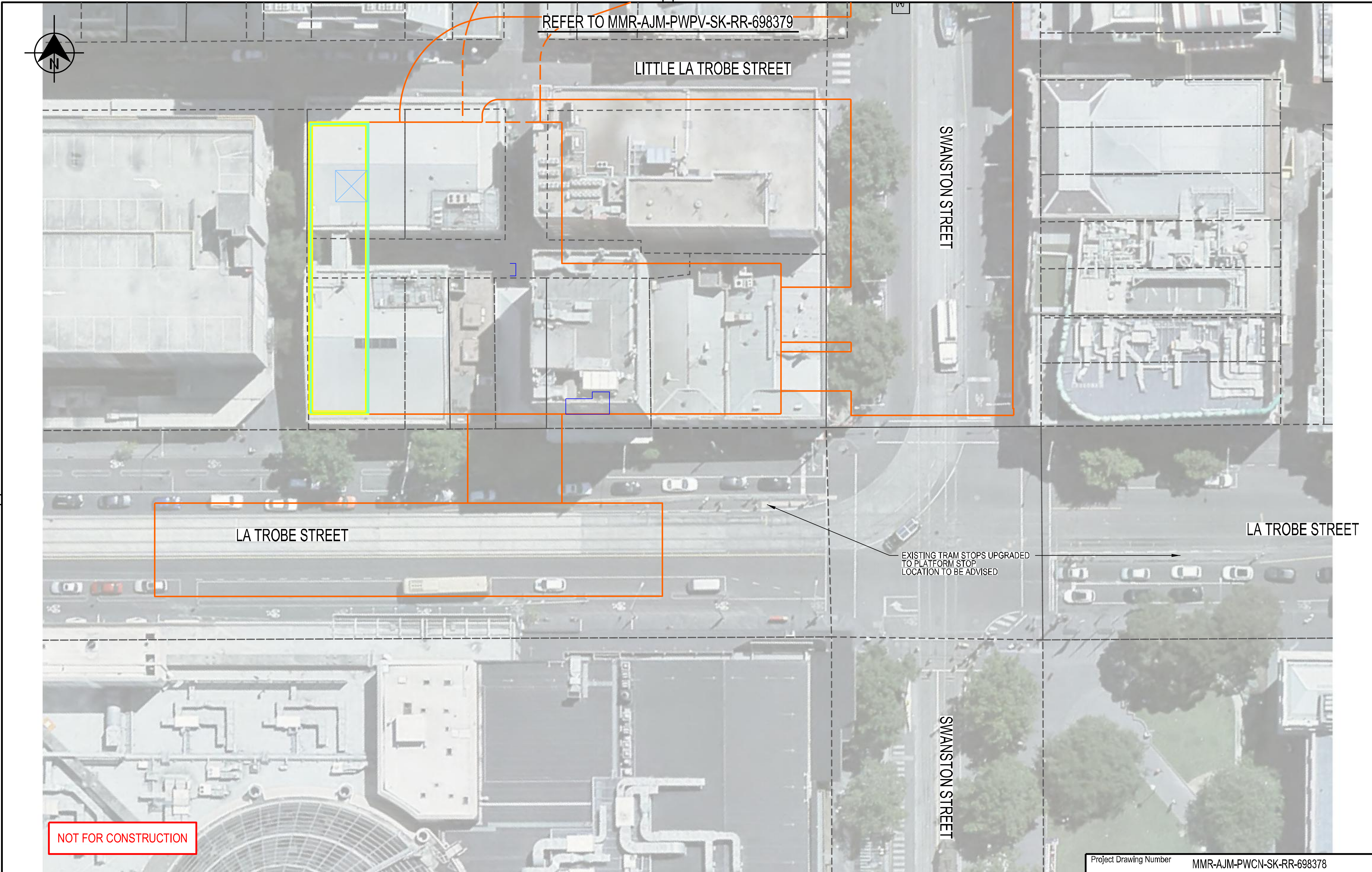
Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)



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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant

AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD NORTH
ROAD FUNCTIONAL LAYOUT
SHEET 1

Up Location
East.
North.
ID# <Enter the up tra

Down Location
East.
North.
ID# <PASS ID #>

Datum
MGA Z55

Project Drawing Number: MMR-AJM-PWCN-SK-RR-698378

VicTrack ACCESS

File Name: MMR-AJM-PWCN-SK-RR-698378.dgn

Sheet No. 01 of 01

In Serv.

Scale 1:500 | Sheet Size A3

Drawn By: E WISNIEWSKI
Designed By: E WISNIEWSKI
Checked By: T LAU
Ind. Review
Approved
Approval Date
Drawing Number
Revision: P1

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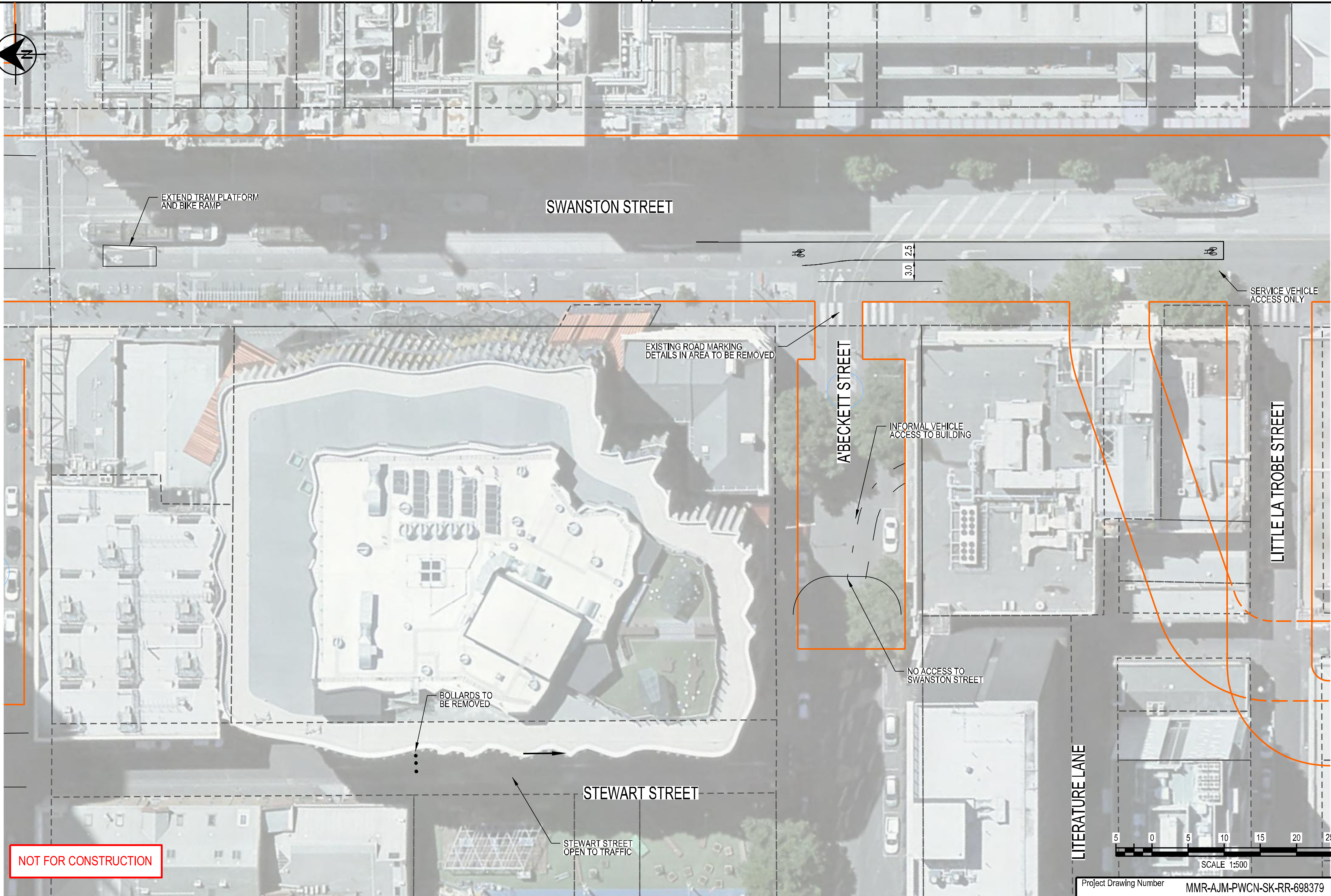

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REFER TO MMR-AJM-PWCN-SK-RR-698380

REFER TO MMR-AJM-PWCN-SK-RR-698378

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Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
AJM		P1	17/11/15	NOT FOR CONSTRUCTION	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW; MELBOURNE METRO RAIL AUTHORITY

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD NORTH

ROAD FUNCTIONAL LAYOUT

SHEET 2

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up tra	ID# <PASS ID #>	

Project Drawing Number: MMR-AJM-PWCN-SK-RR-698379

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWCN-SK-RR-698379.dgn

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Drawing Number — Revision P1

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AJM		P1	17/11/15	NOT FOR CONSTRUCTION	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald (in association with) GRIMSHAW

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RAILWAY TRACK AND CIVIL
MELBOURNE METRO
CBD NORTH
ROAD FUNCTIONAL LAYOUT
SHEET 3

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWCN-SK-RR-698380

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWCN-SK-RR-698380.dgn

Sheet No. 01 of 01

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Scale 1:500 | Sheet Size A3

Drawing Number | Revision P1

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AJM		P1	17/11/15	NOT FOR CONSTRUCTION	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald, in association with GRIMSHAW

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD NORTH
ROAD FUNCTIONAL LAYOUT
SHEET 4

Up Location	Down Location	Datum
East. North. ID# <Enter the up trail ID#PASS ID #>	East. North.	MGA Z55

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWCN-SK-RR-698381

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWCN-SK-RR-698381.dgn
Sheet No. 01 of 01
In Serv.
Scale 1:500
Sheet Size A3
Drawing Number
Revision P1

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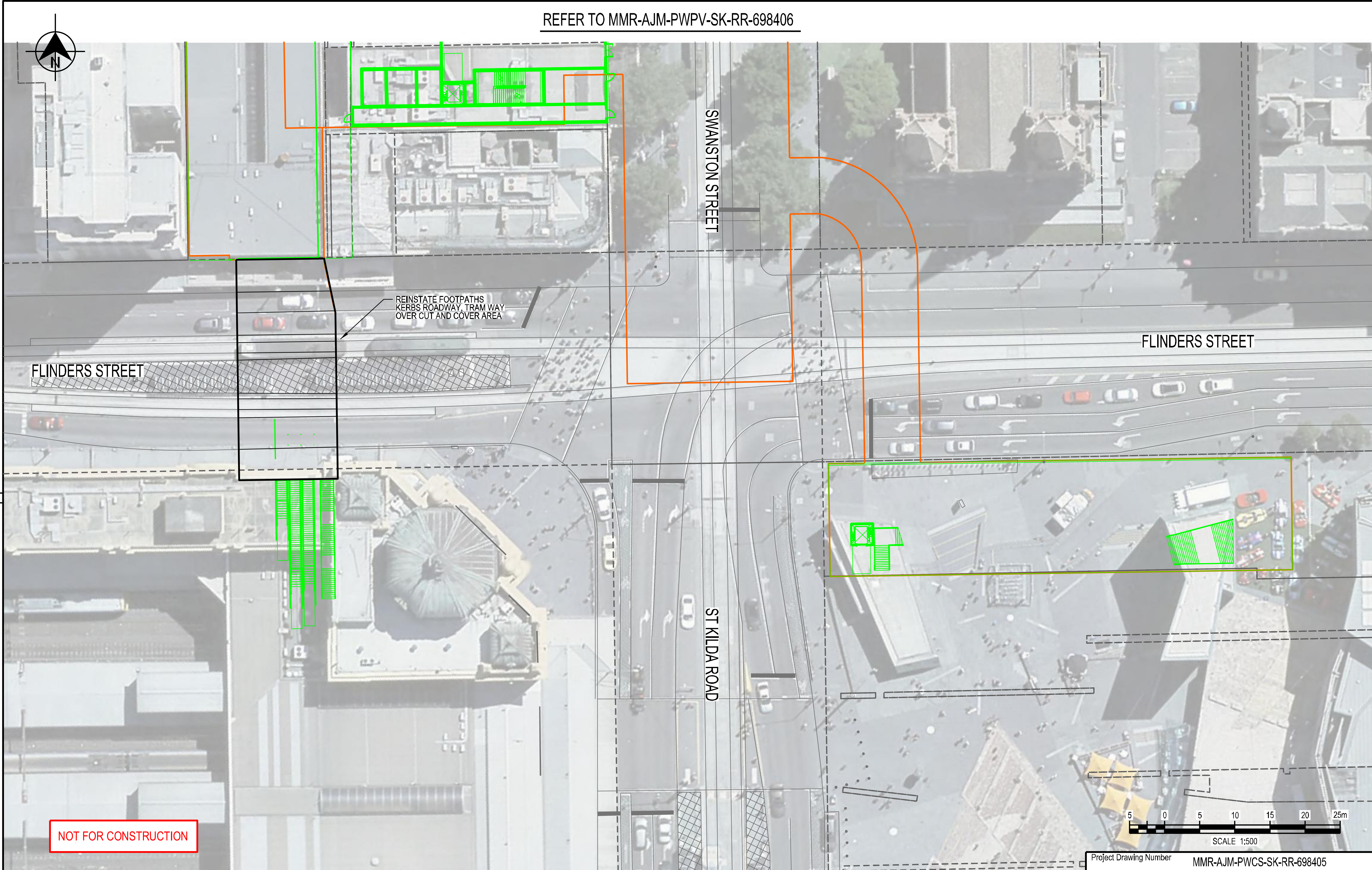

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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

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17/11/2015

Consultant

AJM Joint Venture

aurecon

JACOBS

Mott MacDonald in association with GRIMSHAW

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD SOUTH

ROAD FUNCTIONAL LAYOUT

SHEET 1

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up tra	ID# <PASS ID #>	

Project Drawing Number: MMR-AJM-PWCS-SK-RR-698405

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date
Drawing Number	Revision: P1

File Name: MMR-AJM-PWCS-SK-RR-698405.dgn

Sheet No. 01 of 01

In Serv.

Scale 1:500

Sheet Size A3

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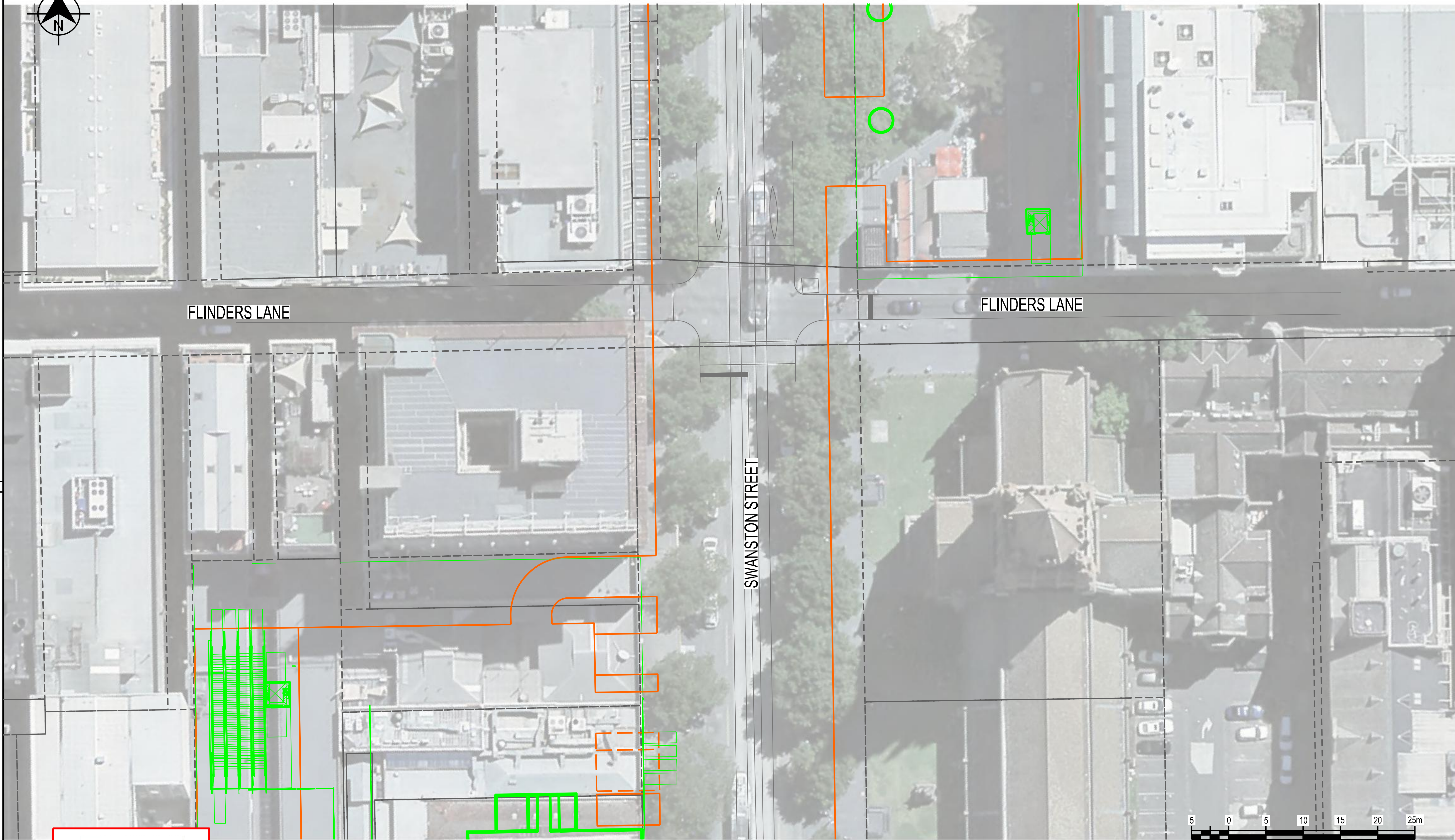
REFER TO MMR-AJM-PWPV-SK-RR-698407



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REFER TO MMR-AJM-PWPV-SK-RR-698405

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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald, in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD SOUTH
ROAD FUNCTIONAL LAYOUT
SHEET 2

Up Location	Down Location	Datum
East.	East.	MGA Z55
North.	North.	
ID# <Enter the up trail ID#	PASS ID #>	

Project Drawing Number: MMR-AJM-PWCS-SK-RR-698406

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI	
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File Name: MMR-AJM-PWCS-SK-RR-698406.dgn	Approved	Approval Date
Sheet No. 01 of 01	Drawing Number	Revision P1
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Scale 1:500	Sheet Size A3	

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SCALE 1:500

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AJM		P1	17/11/15	NOT FOR CONSTRUCTION	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant

AJM Joint Venture

aurecon JACOBS Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

CBD SOUTH

ROAD FUNCTIONAL LAYOUT

SHEET 3

Up Location	Down Location	Datum
East. North. ID# <Enter the up track	East. North. ID#PASS ID #>	MGA Z55

Project Drawing Number MMR-AJM-PWCS-SK-RR-698407

VicTrack ACCESS

File Name MMR-AJM-PWCS-SK-RR-698407.dgn	
Sheet No. 01 of 01	
In Serv.	
Scale 1:500	Sheet Size A3

Drawn By E WISNIEWSKI	Designed By E WISNIEWSKI
Checked By T LAU	Ind. Review
Approved	Approval Date
Drawing Number	Revision P1

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NOTES
1. ST KILDA ROAD
FROM PARK STREET TO DORCAS STREET
REINSTATED TO EXISTING ARRANGEMENT

Certified By: (BLOCK LETTERS) (SIGNATURE) (DATE)

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
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AJM		P2.1	19/11/15	WORK IN PROGRESS	EW	TL		
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AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

20/11/2015 4:50:02 PM

Consultant: AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN
TWO LANE ROAD FUNCTIONAL LAYOUT
SHEET 1

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698371

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWDM-SK-RR-698371.dgn
Sheet No. 01 of 01
In Serv.
Scale 1:500
Sheet Size A3
Drawing Number
Revision P2

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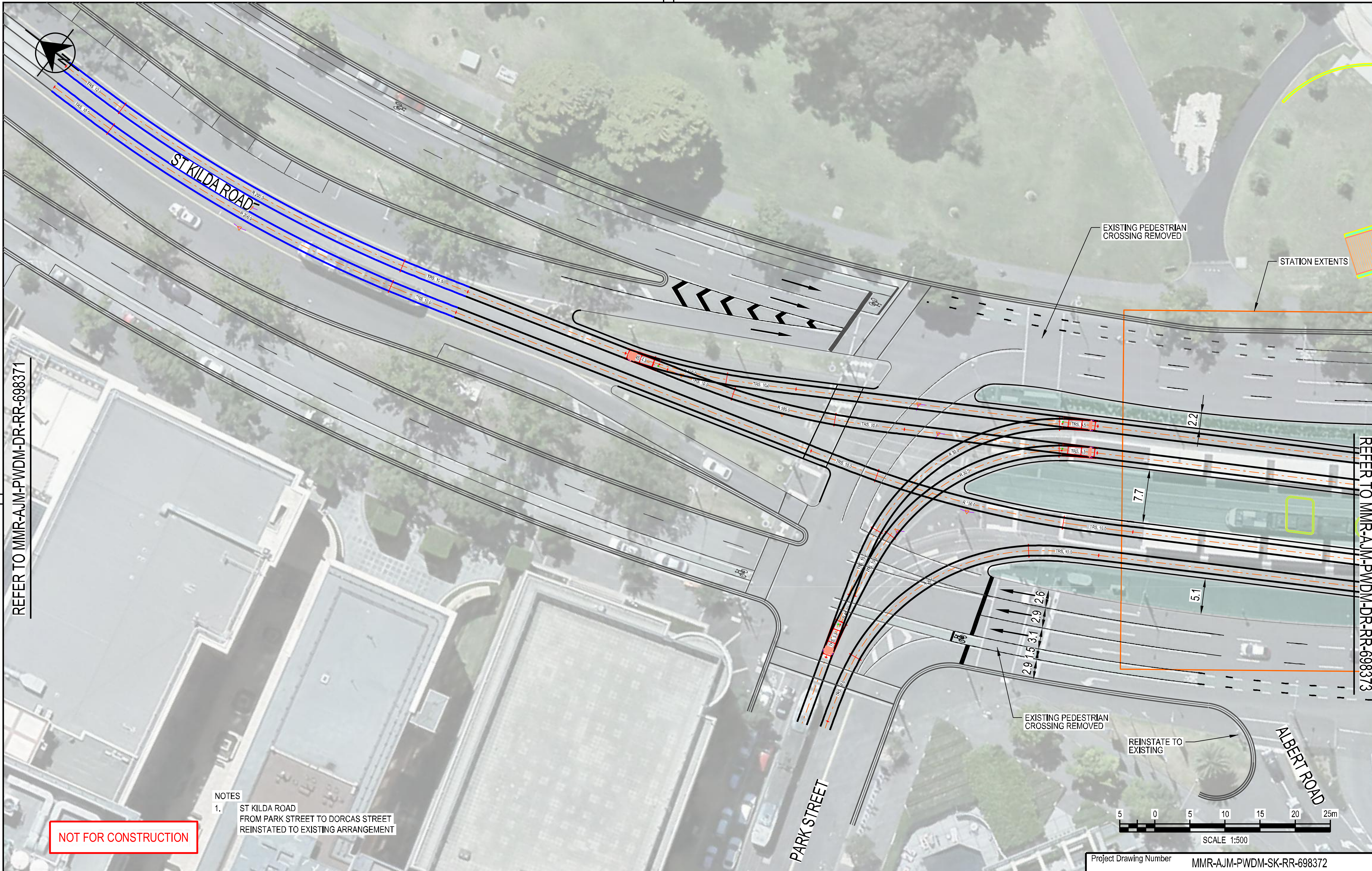
(SIGNATURE)

(DATE)



NOTES

1. ST KILDA ROAD FROM PARK STREET TO DORCAS STREET REINSTATED TO EXISTING ARRANGEMENT

NOT FOR CONSTRUCTION

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
AJM		P2	20/11/15	NOT FOR CONSTRUCTION	EW	TL		
AJM		P2.1	19/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

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Consultant

AJM Joint Venture — aurecon JACOBS Mott MacDonald GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN

TWO LANE ROAD FUNCTIONAL LAYOUT

SHEET 2

Up Location East. North. ID#

Down Location East. North. ID#

Datum MGA Z55

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698372

Drawn By: E WISNIEWSKI

Designed By: E WISNIEWSKI

Checked By: T LAU

Ind. Review

Approved

Approval Date

File Name: MMR-AJM-PWDM-SK-RR-698372.dgn

Sheet No. 01 of 01

In Serv.

Drawing Number

Revision: P2

Scale 1:500

Sheet Size A3

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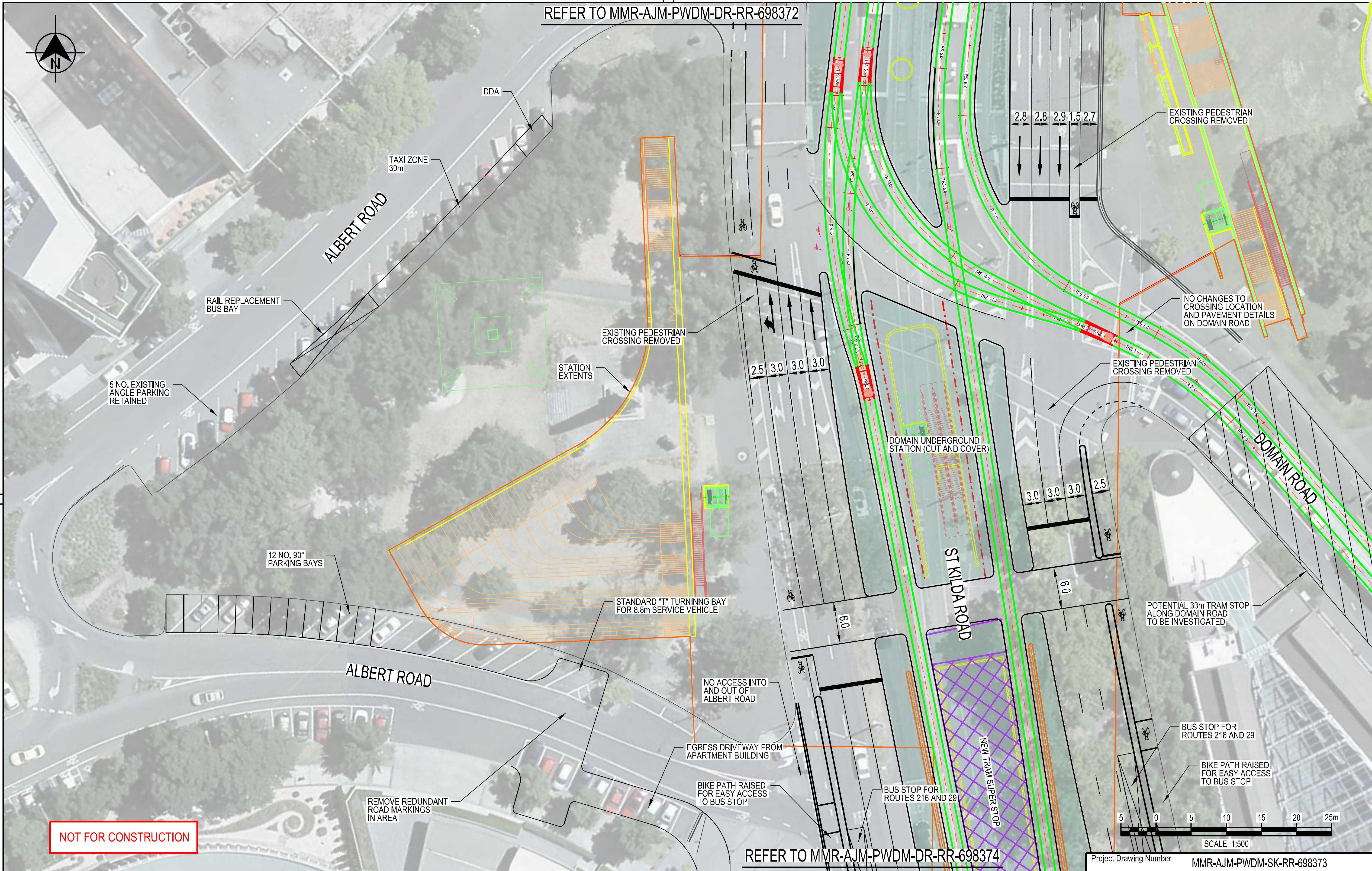

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AJM		P2.1	19/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant

AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN

TWO LANE ROAD FUNCTIONAL LAYOUT

SHEET 3

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698373

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date
File Name: MMR-AJM-PWDM-SK-RR-698373.dgn	
Sheet No.: 01 of 01	Drawing Number
In Serv.	Revision: P2
Scale: 1:500	Sheet Size: A3

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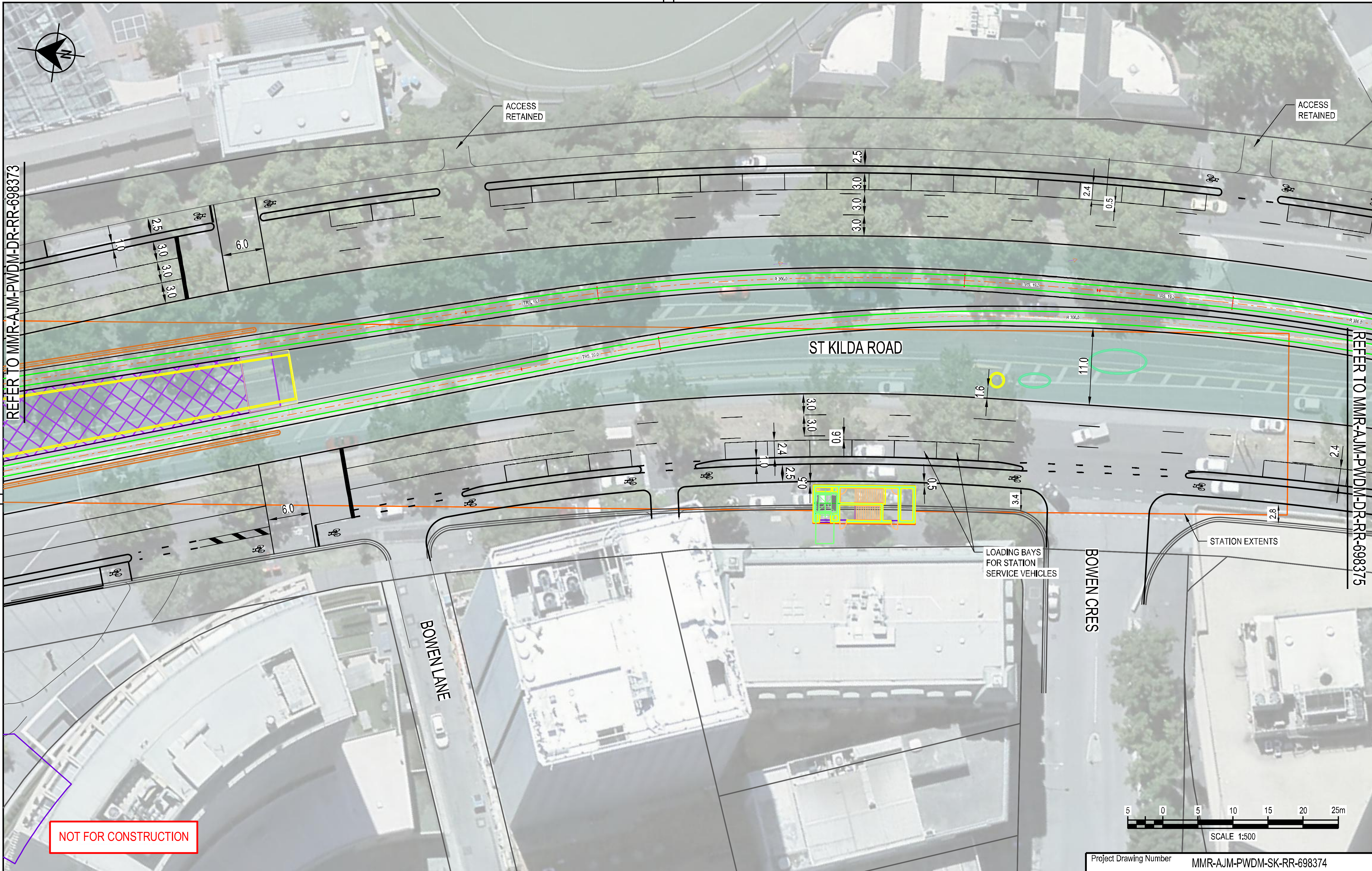

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(SIGNATURE)

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Certified By:

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
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AJM		P2.1	19/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1	17/11/15	WORK IN PROGRESS	EW	TL		
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		

Consultant

AJM Joint Venture — aurecon, JACOBS, Mott MacDonald, GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN
TWO LANE ROAD FUNCTIONAL LAYOUT
SHEET 4

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698374

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWDM-SK-RR-698374.dgn

Sheet No. 01 of 01

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Scale 1:500 | Sheet Size A3

Drawing Number

Revision P2

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Certified By:

Revised By	In Serv	Rev.	Date	Description	Designed	Checked	Ind. Rev.	Approv.
AJM		P1.1	13/11/15	WORK IN PROGRESS	EW	TL		
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AJM		P2.1	19/11/15	WORK IN PROGRESS	EW	TL		
AJM		P2	20/11/15	NOT FOR CONSTRUCTION	EW	TL		

Consultant

AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN
TWO LANE ROAD FUNCTIONAL LAYOUT
SHEET 5

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698375

VicTrack ACCESS

File Name: MMR-AJM-PWDM-SK-RR-698375.dgn	Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
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Consultant

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MELBOURNE METRO RAIL AUTHORITY

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RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN

TWO LANE ROAD FUNCTIONAL LAYOUT

SHEET 6

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698376

VicTrack ACCESS

Drawn By: E WISNIEWSKI	Designed By: E WISNIEWSKI
Checked By: T LAU	Ind. Review
Approved	Approval Date

File Name: MMR-AJM-PWDM-SK-RR-698376.dgn

Sheet No. 01 of 01

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Drawing Number

Revision P2

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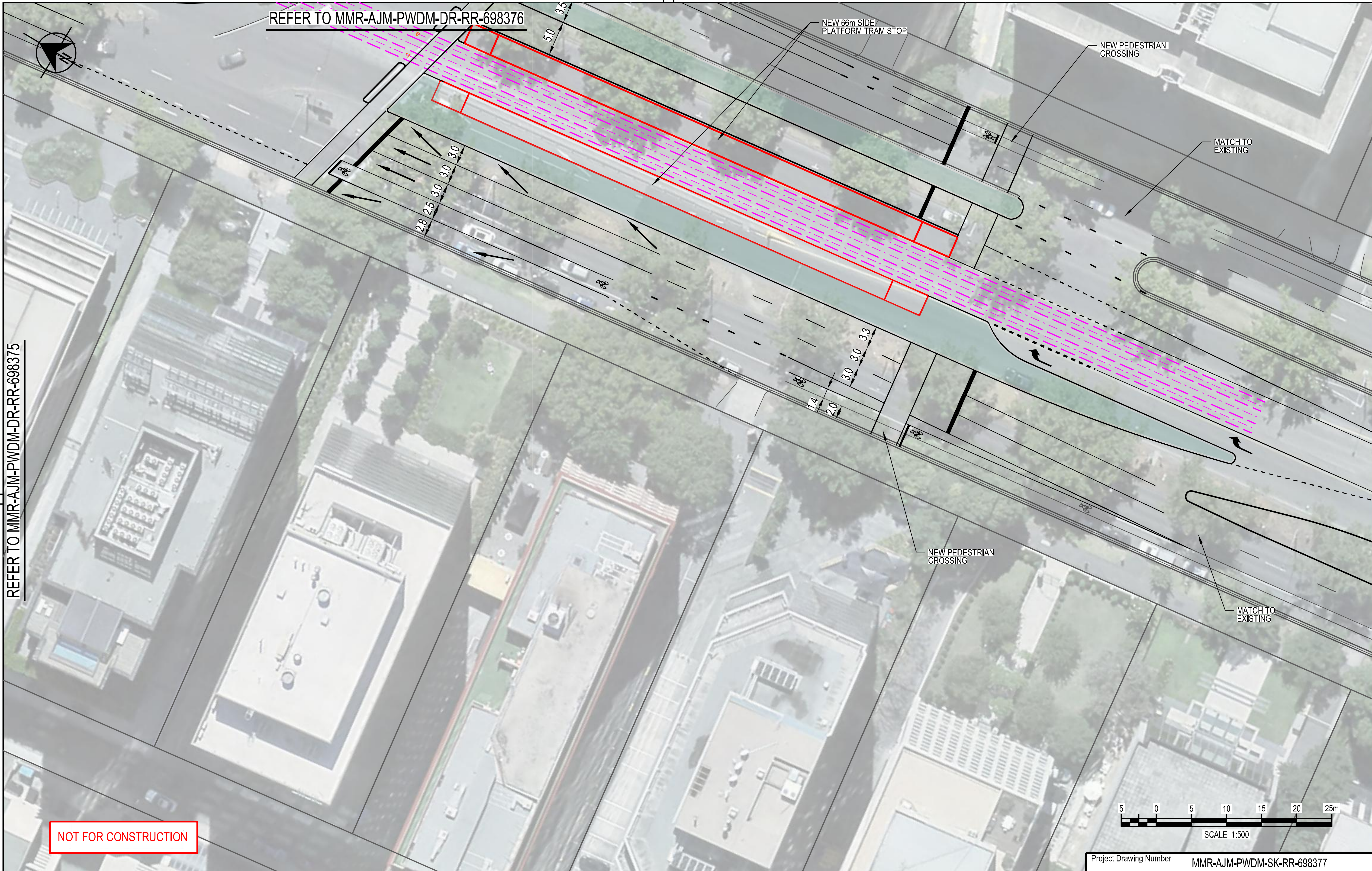

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Consultant

AJM Joint Venture
aurecon
JACOBS
Mott MacDonald
GRIMSHAW

MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

DOMAIN
TWO LANE ROAD FUNCTIONAL LAYOUT
SHEET 7

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

Project Drawing Number: MMR-AJM-PWDM-SK-RR-698377

VicTrack ACCESS

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Checked By: T LAU	Ind. Review
Approved	Approval Date

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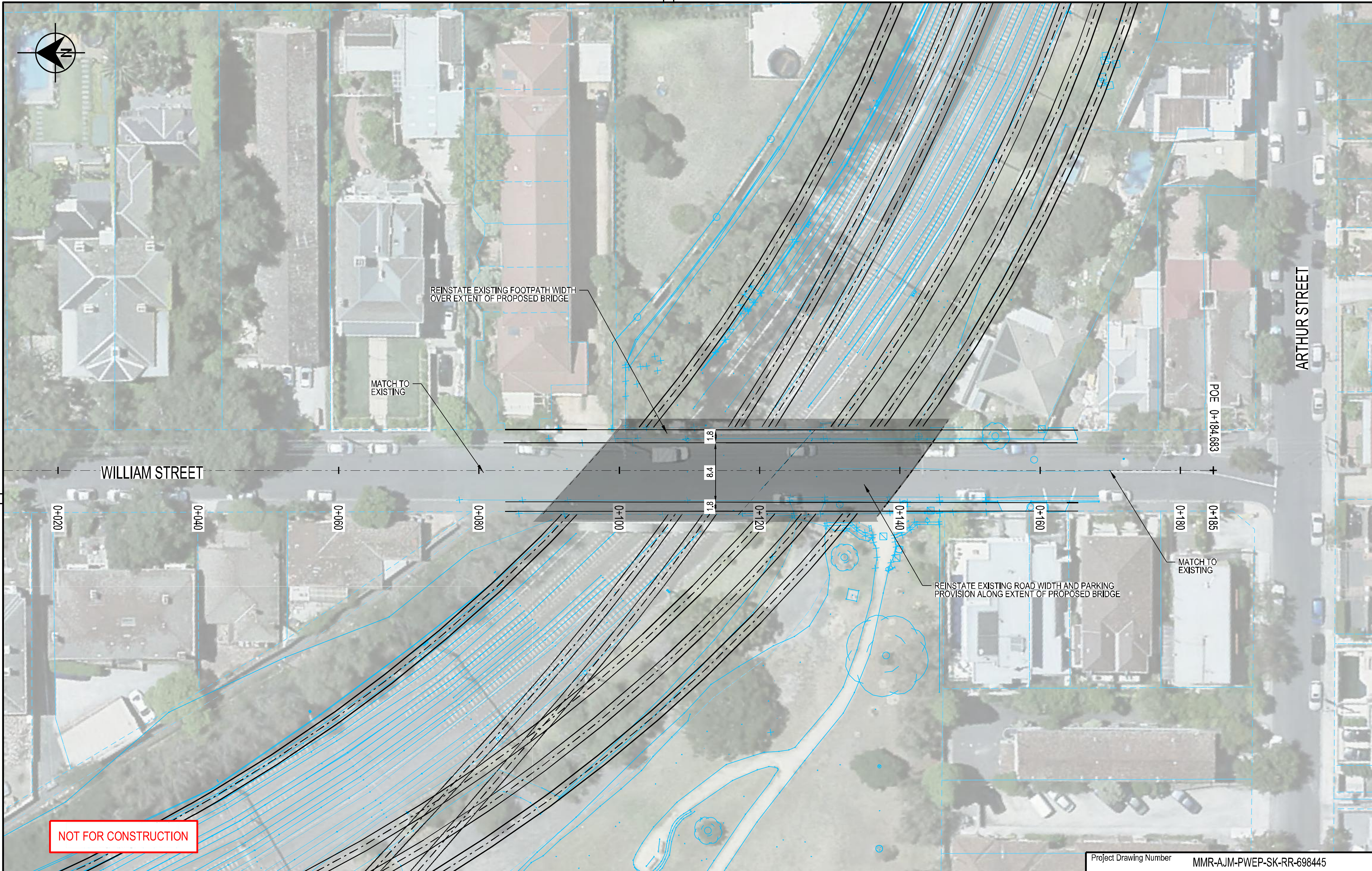

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Consultant: AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW; MELBOURNE METRO RAIL AUTHORITY

RAILWAY TRACK AND CIVIL

MELBOURNE METRO

EASTERN PORTAL
ROAD FUNCTIONAL LAYOUT
ALIGNMENT SHEET 1

Up Location	Down Location	Datum
East. North. ID#	East. North. ID#	MGA Z55

VicTrack ACCESS

Project Drawing Number: MMR-AJM-PWEP-SK-RR-698445

File Name: MMR-AJM-PWEP-SK-RR-698445.dgn

Sheet No. 01 of 01

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Checked By: T LAU	Ind. Review
Approved	Approval Date
Drawing Number	Revision: P1

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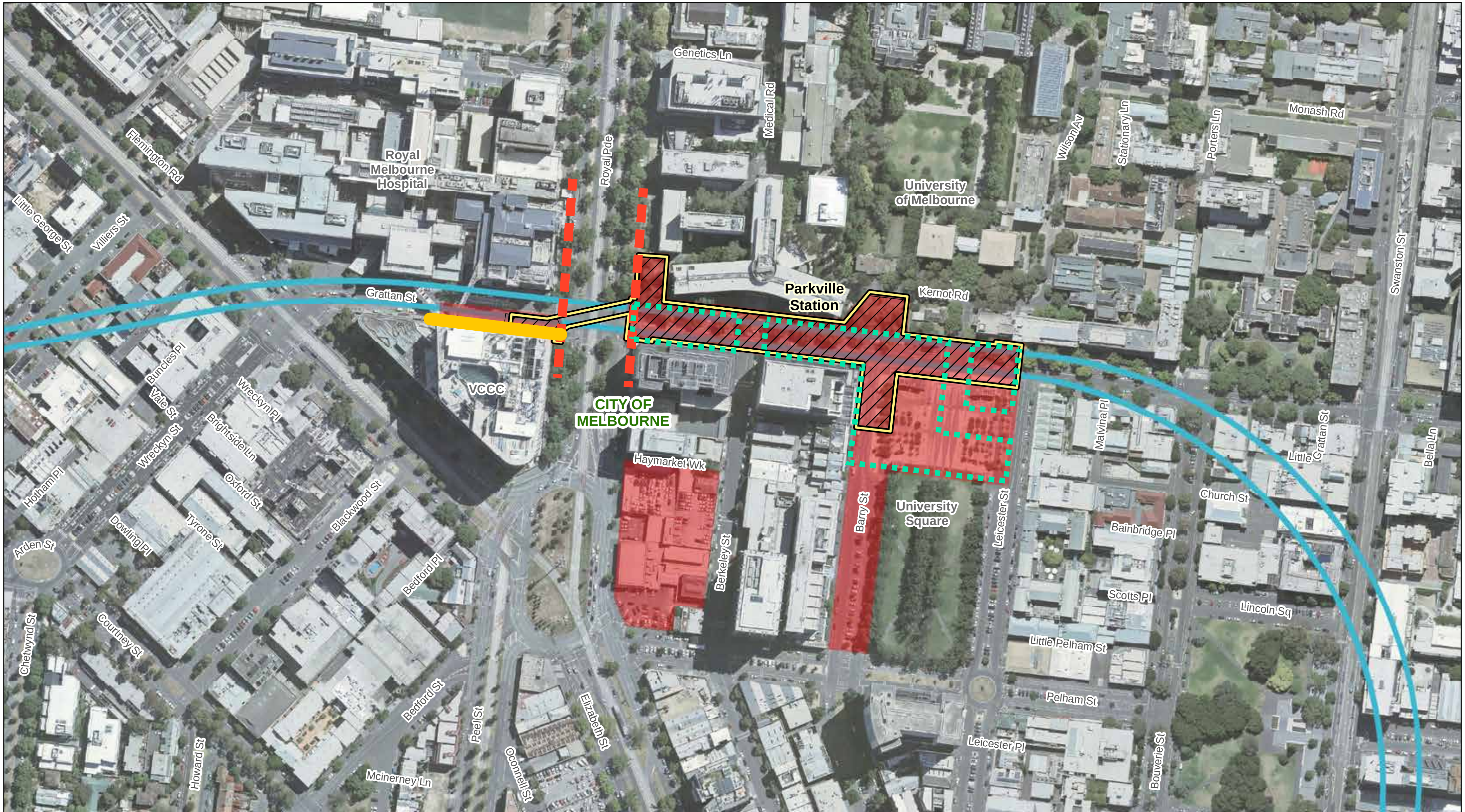
Appendix F

Construction footpath closures and diversions



Legend

Pedestrian Routes

- Footpath Closure
- Footpath Diversion
- Construction Hoarding
- Proposed Station Footprint
- Proposed Alignment
- Proposed Construction Area
- Proposed Excavation Area
- Local Government Area (LGA)

Data Sources:
Proposed Infrastructure: AJM 2016
Contains Vicmap Information
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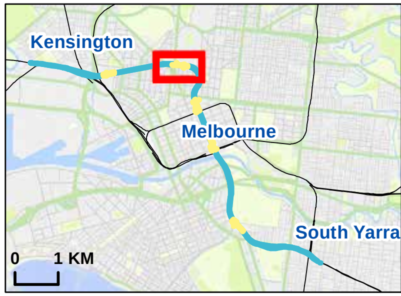
Aerial photo (DELWP, February 2015)

Map 1 of 5



Melbourne Metro Rail Project

Title:
Pedestrian routes impacted by construction phase

Drawing Number:		Revision:
MMR-AJM-UGAA-MP-NB-500422		P1

Drawn By:	Approved By:	Date:	Map Size:
A. Davy	K. Blaylock	17/03/2016	A4

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Metres

MELBOURNE METRO RAIL AUTHORITY

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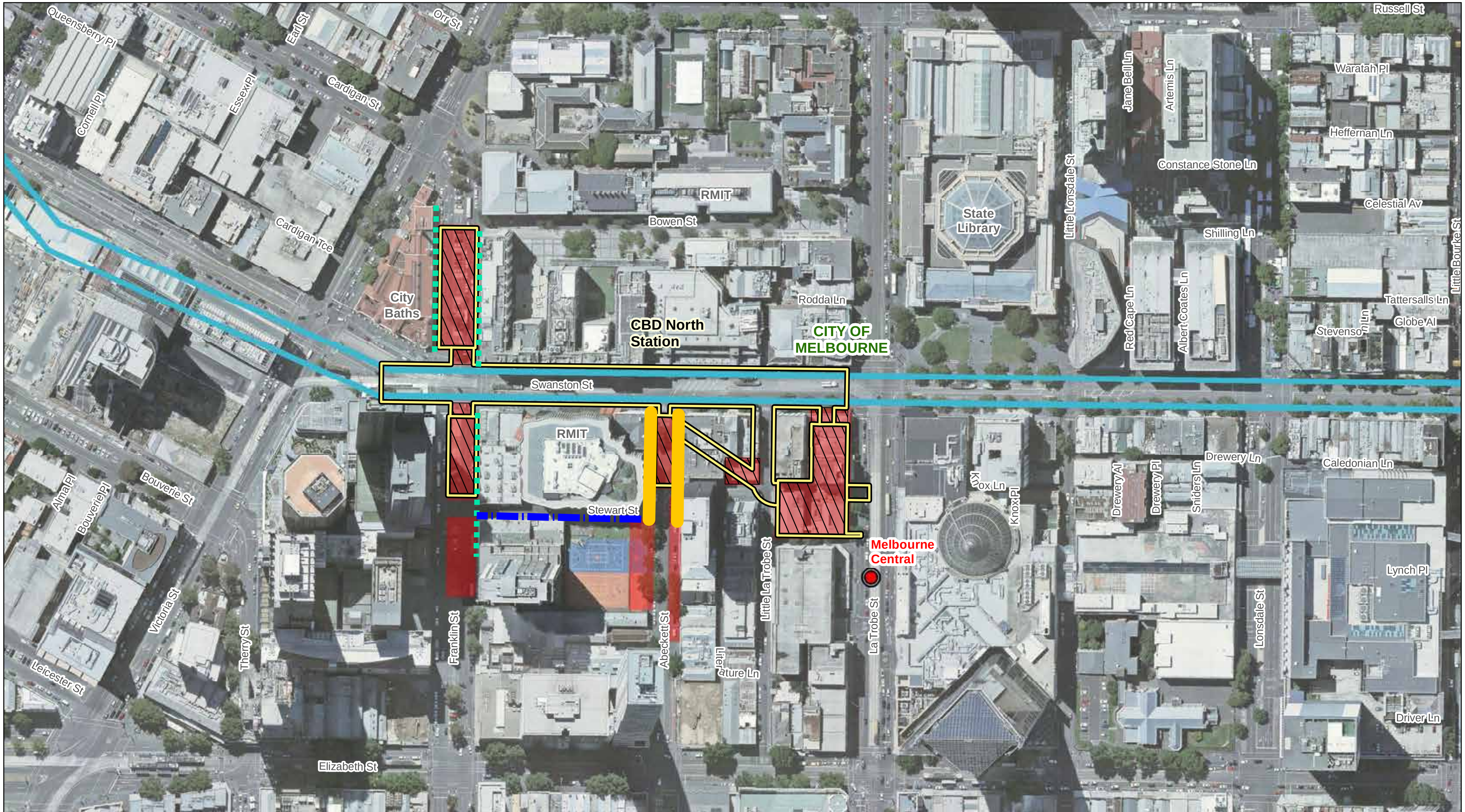

Legend

- Existing Rail Station

Pedestrian Routes

- Footpath Closure
- Construction Hoarding
- Re-opens to Pedestrians
- Proposed Station Footprint
- Proposed Alignment
- Proposed Construction Area
- Proposed Excavation Area
- Local Government Area (LGA)

Map 2 of 5

Data Sources:
Proposed Infrastructure: AJM 2016
Contains Vicmap Information

Aerial photo (DELWP, February 2015)

MELBOURNE METRO RAIL AUTHORITY

aurecon JACOBS AJM Mott MacDonald in association with Joint Venture GRIMSHAW

Melbourne Metro Rail Project

Title:
Pedestrian routes impacted by construction phase

Drawing Number:		Revision:
MMR-AJM-UGAA-MP-NB-500422		P1

Drawn By:	Approved By:	Date:	Map Size:
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Metres

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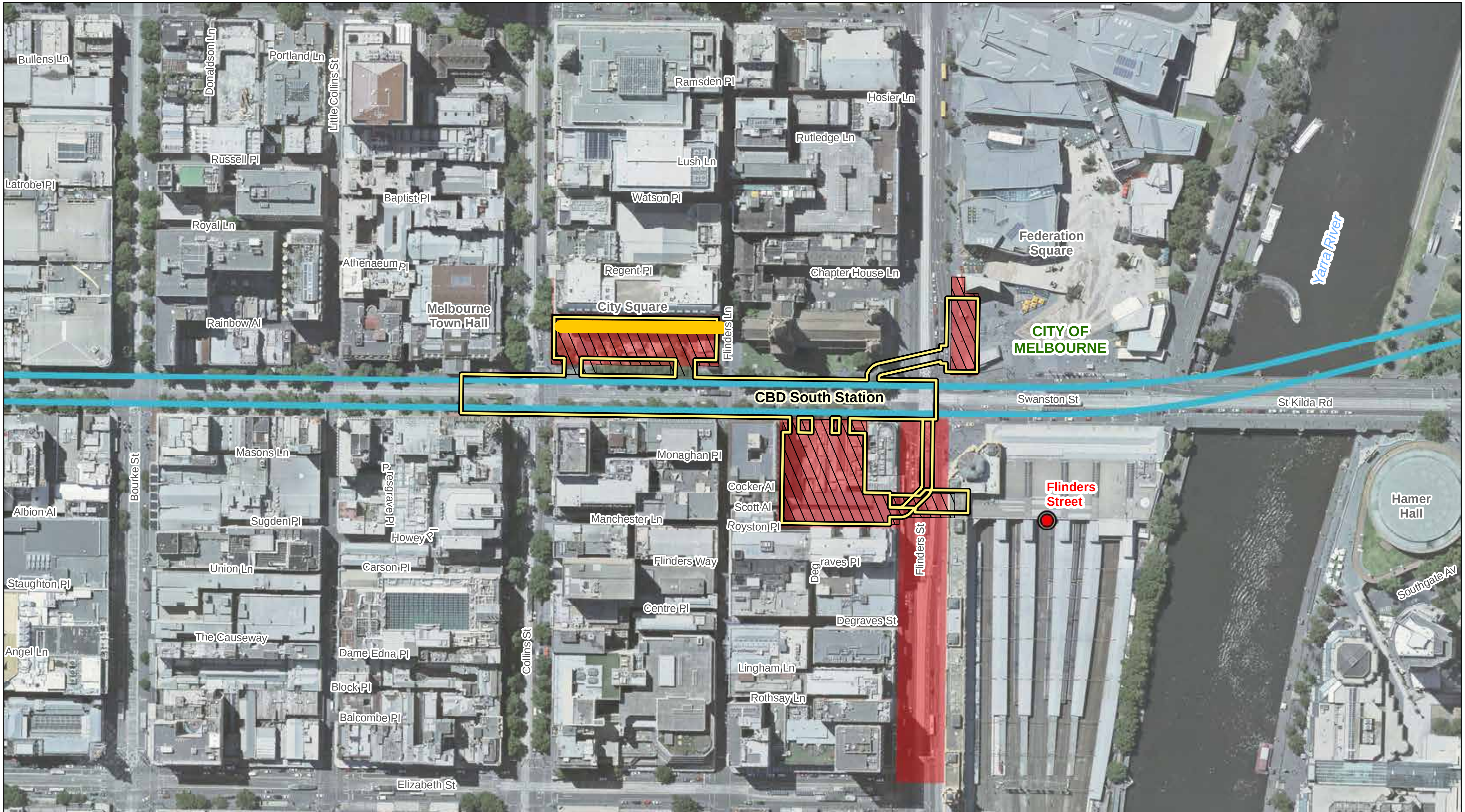

Legend

Existing Rail Station

Pedestrian Routes

Footpath Closure

Proposed Station Footprint

Proposed Alignment

Proposed Construction Area

Proposed Excavation Area

Local Government Area (LGA)

Map 3 of 5

Data Sources:
Proposed Infrastructure: AJM 2016
Contains Vicmap Information
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Aerial photo (DELWP, February 2015)

MELBOURNE METRO RAIL AUTHORITY

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Melbourne Metro Rail Project

Title:
Pedestrian routes impacted by construction phase

Drawing Number:			Revision:
MMR-AJM-UGAA-MP-NB-500422			P1
Drawn By: A. Davy	Approved By: K. Blaylock	Date: 17/03/2016	Map Size: A4

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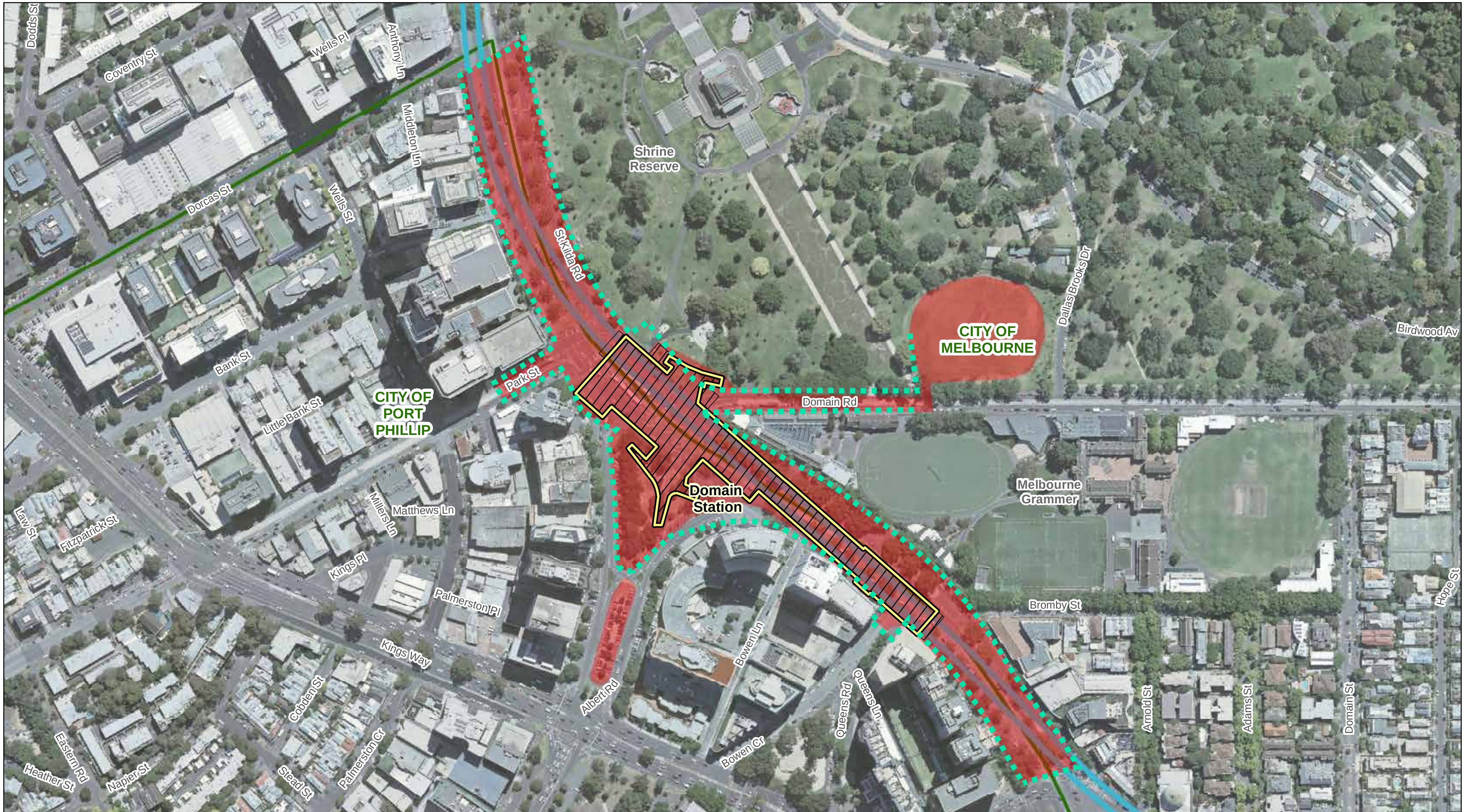

Legend

Pedestrian Routes

- Construction Hoarding
- Proposed Station Footprint
- Proposed Alignment
- Proposed Construction Area
- Proposed Excavation Area
- Local Government Area (LGA)

Map 4 of 5

Data Sources:
Proposed Infrastructure: AJM 2016
Contains Vicmap Information
© State of Victoria 2015
Aerial photo (DELWP, February 2015)

Melbourne Metro Rail Project

Title:
Pedestrian routes impacted by construction phase

Drawing Number:			Revision:
MMR-AJM-UGAA-MP-NB-500422			P1
Drawn By:	Approved By:	Date:	Map Size:
A. Davy	K. Blaylock	17/03/2016	A4

0 50 100
Metres

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture: aurecon JACOBS Mott MacDonald in association with GRIMSHAW

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Legend

- Existing Rail Station

Pedestrian Routes

- Footpath Closure
- Proposed Alignment
- Proposed Construction Area
- Proposed Excavation Area
- Local Government Area (LGA)

Data Sources:
Proposed Infrastructure: AJM 2016
Contains Vicmap Information

Aerial photo (DELWP, February 2015)

Map 5 of 5

MELBOURNE METRO RAIL AUTHORITY

aurecon JACOBS Mott MacDonald AJM Joint Venture GRIMSHAW

Melbourne Metro Rail Project

Title:
Pedestrian routes impacted by construction phase

Drawing Number: MMR-AJM-UGAA-MP-NB-500422			Revision: P1
Drawn By: A. Davy	Approved By: K. Blaylock	Date: 17/03/2016	Map Size: A4

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Metres

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Appendix G

Peer Review Report

Review

To	Tim Power		
Copy to	Fiona Curl		
From	Shaun Smedley (Smedley Technical & Strategic)	Date	15/04/2016
Subject	Melbourne Metro Rail Project EES TIA Peer Review	Job no.	P0009

1 Scope of Review

1.1 Introduction

Smedley Technical and Strategic was engaged by Herbert Smith Freehills (HSF), on behalf of the Melbourne Metro Rail Authority (MMRA), to undertake a technical peer review of the Melbourne Metro Rail Project (MMRP) Environment Effects Statement (EES) Transport Impact Assessment (TIA).

This peer review focussed on the process, methodology and assessment undertaken to validate that the TIA addressed the requirements of the EES and so was suitable to represent the impacts of the project. This was a high-level review only, not a detailed 'forensic' review of the analysis.

The peer review focused on the appropriateness of the transport models chosen and how they were used to inform the assessment. The review did not undertake a detailed assessment of the traffic modelling itself, as noted in the reports, these models have been reviewed by numerous parties including VicRoads, PTV and independent reviewers appointed by MMRA.

1.2 Experience

The review was undertaken by myself, Shaun Smedley. I am the Director *of Smedley Technical and Strategic*, a consultancy business specialising in providing advice, assistance and direction in the transport sector, related to both transport infrastructure and transport related services.

Prior to this I was the Executive Director, Technical Advisory Group with the Linking Melbourne Authority (LMA). Before joining LMA, I spent 11 years in the transport consulting business having worked for two high profile international firms. At GHD, I was the Leader for Traffic Engineering, Transport Planning and Transport Modelling across the organisation globally.

A copy of my curriculum vitae is attached.

1.3 Documents Reviewed

The following document was provided by HSF for review, herein referred to as the TIA:

- Melbourne Metro Rail Project, MMR-AJM-PWAA-RP-NN-000815, Transport Impact Assessment, Melbourne Metro Rail Authority, Revision P4, March 24 2016 prepared by the AJM Joint Venture.

In addition to the TIA, the following supporting documents were provided for information:

- MM-MMRA-TD-0001, DRAFT Project Description for EES Specialists, Version 5, October 20 2015, (including Addendum 1, Addendum 2 and Addendum 3);
- Scoping Requirements for Melbourne Metro Rail Project, November 2015 (Scoping Requirements);
- Various Victoria Government Gazettes, notably No S 253 Thursday 3 September 2015 and No S 361 Tuesday 24 November 2015; and
- Melbourne Metro Rail Project, MMR-AJM-PWAA-RP-NN-000803, Environmental Management Framework, Melbourne Metro Rail Authority, Revision 5.4, April 11 2016 prepared by the AJM Joint Venture.

2 Adherence to the EES Scoping Requirements

In the two sections below, I have extracted the relevant transport related aspects of the Scoping Requirements set down by the Minister for Planning. I believe these to be the critical items which this TIA should address.

Minister's procedures and requirements under section 3(3) of the Environment Effects Act 1978

> The following procedures and requirements under the guidelines are to apply to the Environment Effects Statement (EES) for the works.
>
> i. The EES is to document investigations of potential environmental effects of the proposed works, including the feasibility of associated environmental mitigation and management measures, in particular for:
>
>   f. potential temporary and permanent effects on transport systems and services, both for residents and businesses located in the vicinity of the project and related works and for the broader community;

Parts a to g of the above section were not repeated here as the do not relate to the TIA.

Section 4.2 of the Scoping Requirements for Melbourne Metro Rail Project, November 2015.

4.2 Transport connectivity

Draft evaluation objective - To enable a significant increase in the capacity of the metropolitan rail network and provide multimodal connections, while adequately managing effects of the works on the broader transport network, both during and after the construction of the project.

Key Issues

- Need to manage permanent changes to the public transport, road, cycling and pedestrian transport system.
- Need to manage disruptions and delays for residents, businesses and travellers during the construction of the project.

Priorities for characterising the existing environment

- Describe the elements of the transport system including public transport, road, cycling and pedestrian networks which might be affected by the project, in particular during the construction phase.

Design and mitigation measures

- Describe the design approach to integrating the project with the existing or modified transport network.
- Describe the network changes proposed to maintain transport system function during the construction of the project, including the proposed nature and duration of diversions, route changes and changes in car parking availability and management.
- Identify potential options and actions which could further mitigate adverse effects or optimise the transport system benefits of the project.

Assessment of likely effects

- Describe and as far as practicable quantify predicted travel time differences (relative to a 'no project' scenario) during and after the construction of the project.

Approach to manage performance

- Describe any monitoring or other program for managing disruption or delays relative to predicted effects and for identifying unexpected effects which may require remedial action.

I consider that overall the AJM TIA has adequately addressed all items required in the Scoping Requirements. The assessment has documented the relevant legislation and policies which apply, detailed the existing conditions in each of the affected areas, detailed the likely temporary or permanent effects of the project in each of the identified areas and recommended a range of mitigations or performance requirements.

The transport modelling undertaken was appropriate for the task, the methodology and analysis appears sounds and was suitable to inform an assessment of transport impacts.

While I believe that the TIA has adequately addressed the Scoping Requirements, there are several areas which I believe may warrant further analysis or that could be further detailed to provide a more complete representation of the likely effects of the project. These areas for further consideration are only related to the construction phase assessment.

3 Areas for Further Consideration

3.1 Construction Phase

Section 8 of the TIA provides an assessment of the transport related impacts that may occur during the construction phase in the various precincts.

3.1.1 Parkville Station Precinct

The TIA provides significant detail around the temporary issues likely to be encountered during the construction period of the Parkville Station, particularly with the closure of Grattan Street between Royal Parade and Leicester Street. Detail is provided on likely changes to traffic volumes and intersection delays. However, the broader impacts on the network are not as well quantified. The following statement is made on page 97, but there is no further supporting analysis or quantification of this issue.

"In the AM peak period, the closure of Grattan Street is predicted to cause the majority of the vehicles to reroute via Swanston Street and Queensberry Street. Swanston Street currently does not have the capacity to accommodate this increase in traffic, and thus would likely be a key congestion point. The congestion on Swanston Street may cause further congestion along College Crescent towards Royal Parade."

In my opinion, this statement is valid and supported by the forecasted doubling of traffic on Swanston Street as documented in Tables 8-14 and 8-15. However, there is no further quantification of this congestion and likely delays or travel time increases. As Swanston Street is a Local Primary Access Route and College Crescent is a Preferred Traffic Route (Table 8-12) the likely congestion on these roads should warrant further analysis or documentation of the expected impacts. It appears that the AimSum model developed for the Parkville Precinct and documented in Appendix D would be suitable to quantify these impacts.

Related to this issue is the likely effect on Public Transport through this area, Section 8.7.4 indicates that the bus travel times are predicted to increase by up to 4 minutes for Routes 401 and 402.

In my opinion this increase in travel time needs to be further explored. Route 401 currently has an average travel time of 12 minutes with service frequencies as low as three minutes during the peak periods. An increase in travel time of 4 minutes in this context is significant and likely to require additional buses to meet the service requirements. It is also likely to divert some passengers away from this service potentially impacting other transport services that access the Parkville Precinct.

I believe that the Environmental Performance Requirements that relate to this issue should provide a stricter requirement that will ensure appropriate measures are taken to reduce this impact on the Route 401 and 402 bus services.

3.1.2 CBD South Station Precinct

The TIA adequately addresses the main construction transport impacts for this station. However, there are several references in the document to the requirement to utilise cut and cover construction methods on Flinders Street for the construction of the underground connection between the CBD South Station and Flinders Street Station. Section 8.9.3 mentions this requirement and states that it expects this to last for 2-3 months. There is no further detail, analysis or discussion on the likely impacts of this construction method.

In my opinion, the expected impacts of this construction should be further through the EES process. I believe that this method of construction can be appropriately managed and staged to minimise the impacts on the travelling public, yet these have not been explored. I would recommend that an Environmental Performance Requirement is included that requires this construction to be appropriately staged to ensure that at least one lane in each direction and the current tram services along Flinders Street are maintained during peak or other appropriate times.

3.1.3 Domain Station Precinct

During one of the construction stages for the Domain Station, it is proposed that St Kilda Road is narrowed to provide one lane in either direction (down from three currently) in addition to the tram line. This phase is expected to last for around 18 months. This is a significant reduction in capacity to a major thoroughfare for the city. The analysis in the TIA has been informed by model runs using the Victorian Integrated Transport Model (VITM) for the year 2021. This assessment has assumed that the capacity is reduced to one lane and has allowed the model to run through the assignment stage of the modelling process to redistribute (or reroute) trips across the network.

Strategic models run in what is considered a ‘steady state’ condition of the transport network. This means that the physical network is not changing and that all users are familiar with the likely traffic conditions, travel times and transport mode options. To utilise the traffic redistribution from a strategic model for a significant capacity constraint during a construction phase would provide an overly optimistic outcome, in my opinion.

The outcome of this modelling is a reduction in traffic volumes north bound on St Kilda Road in the AM peak of 1000 vehicles per hour. This is a significant reduction in traffic. This is acknowledged in the TIA and recommendations are made to develop a travel demand management strategy to assist in this redistribution, while investigations are recommended to assist Kings Way in accommodating some of the redistributed traffic. I support these recommendations.

In my opinion the EES process should document a range of sensitivity tests for travel time and delays on St Kilda Road if less than 1000 vehicles per hour redistribute in 2021. These tests should be undertaken using the VISSIM model developed for this area with a range of traffic volumes passing through the site. This assessment would inform of the potential impacts of the construction phase if the full diversion was not realised and it would assist to understand the likely impacts early in the construction phase before all drivers became aware of the issues.

4 Appropriateness of Environmental Performance Requirements

I have reviewed the proposed Environmental Performance Requirements and have found them to be appropriate for the nature and scale of the project.

I believe that some additional requirements could be provided as outlined above related to the bus travel times for the Parkville Precinct and the cut and cover construction on Flinders Street for the CBD South Station Precinct.

In my opinion, a further requirement should be mandated that St Kilda Road is made a Clearway during peak periods around the Domain Station, post construction, to reflect the assumptions and analysis that supports this operation in the TIA.

5 Conclusion

Based on my review and subject to the areas for further consideration outlined above, I believe that this TIA is appropriate to enable an informed assessment of the likely temporary and permanent effects on transport systems and services as a result of the Project.

Sincerely

Shaun Smedley

Director, Smedley Technical & Strategic

Shaun Smedley
Director
Bachelor of Civil Engineering

Responsibilities and expertise

Shaun is the Director of Smedley Technical & Strategic, a consultancy business specialising in providing advice, support and direction, related to both transport infrastructure and transport related services. Smedley Technical & Strategic prides itself on its capability in providing advice on major transport infrastructure projects.

Prior to this Shaun was the Executive Director, Technical Advisory Group with the Linking Melbourne Authority (LMA). In that role, Shaun was the technical lead for the East West Link project, including development, planning, technical oversight and technical contract negotiations which led to the contract award of $5.3 billion AUD.

Before joining LMA, Shaun spent 12 years in the transport consulting business having worked for two high profile international firms. At GHD, Shaun was the Leader for Traffic Engineering, Transport Planning and Transport Modelling across the organisation globally.

In Shaun's time in consultancy he has worked on a wide variety of projects ranging from basic traffic engineering impact assessments to corridor planning for multi-billion dollar projects and state transport plan strategic advice. Shaun has managed or overseen over 80 transport modelling projects in his career.

Relevant experience

Western Distributor Proposal

Since mid-2015 Shaun has assisted the State Government by consulting into the role of Technical Director for the State team on the Western Distributor Proposal. This has involved review of the market-led proposal, ongoing negotiations and development of a State Concept and tolling structure.

The Western Distributor is a $5.5 billion project which involves widening the West Gate Freeway from 8 to 12 lanes between the M80 and Williamstown Road, a tunnel under Yarraville and a second river crossing over the Maribyrnong River. The project then extends through an elevated road along Footscray Road with direct links to the Port of Melbourne, CityLink and links to bypass traffic around the CBD.

Shaun has provided technical direction into the development of the Government reference business case, the development of an initial State Concept Design, the proposed tolling structure and the ongoing review and evaluation of the Market Led Proposal from Transurban.

East West Link, Linking Melbourne Authority

Shaun was the Executive Director of the Technical Advisory Group at the Linking Melbourne Authority; a Public Private Partnership focused government authority responsible for delivering some of Australia's largest transport infrastructure projects.

For the East West Link, Shaun led the development of the Reference Design for the project, oversaw the development of the technical requirements, led the transport modelling, led the technical workshops with the bidding consortia and chaired the technical evaluation panels.

Shaun oversaw the development of the Transport Impact Assessment for the Comprehensive Impact Statement for East West Link and was responsible for coordinating and developing the appropriate response to issues raised through the planning panels process.

Shaun was LMA's lead for establishing tolling pricing structures and was LMA's appointment on the Department's Melbourne Tolling Strategy Steering Group and subsequent working group.

Prior to joining LMA, Shaun was seconded to act as technical advisor providing advice on traffic modelling, traffic impacts, reference design and innovation workshops. Shaun was also heavily involved in the technical aspects of the East West Link business case. During this time, the modelling used for the patronage forecasts, the VLC Zenith Model, was independently reviewed. Shaun coordinated and managed this review process.

WestLink Planning and Consultation Study, Linking Melbourne Authority

Shaun was the leader for the traffic component of this project for the AGA joint venture team. Shaun was responsible for transport planning, interchange concept development and overseeing the Transport Impact Assessment and operational analysis aspects of the study. This included developing microsimulation models for key interchanges of the project.

Victorian Transport Plan Strategic Advice, Department of Premier and Cabinet

Shaun was the Project Manager for this undertaking in which he lead a team to prepare several reports to assist in developing the $38 billion Victorian Transport Plan (VTP). Shaun and his team provided key technical advice to the Department of Premier and Cabinet through scoping up potential alignments and options for several projects; North East Link, East West Link and Hoddle Street improvements

The East West Link aspect focussed on the western section of the project, WestLink.

Microsimulation Modelling Guidelines, Calibration and Validation, Roads and Maritime Services (RMS)

Shaun managed the development of the microsimulation modelling guidelines for the RMS in NSW. In developing the guidelines, the team undertook literature reviews and various workshops to develop the most appropriate set of inputs and criteria for the calibration and validation of transport models.

South Morang Rail Extension, Department of Transport

As part of this study, Shaun undertook strategic modelling using the Melbourne Integrated Transport Model (MITM), a multi-modal four-step model, to test alternative scenarios and produce bus and train patronage forecasts for the South

Morang Rail extension. This involved testing a range of scenarios including a potential further extension. As part of this project, passenger diversion from adjacent rail lines was also considered as well as the boarding and alighting patterns of buses at the new interchanges.

Microsimulation models were then undertaken of key precincts to determine impacts and to optimise operations.

Victorian School Bus Strategy, Department of Transport/Department of Education and Early Childhood Learning

Shaun was the project lead in a study jointly engaged by DOT and DEECD. The purpose of the project was to investigate current utilisation of the existing school bus system and consider broad opportunities to use these services to benefit rural and regional communities

This project involved consultation workshops with each of the regions, issues analysis based on the findings of the workshops, desktop research and appraisal of national and international examples of school bus systems, demand analysis using a GIS mapping and statistical data. This provided a solid foundation upon which initiatives and options could be developed to address specific issues, incorporate learnings from other jurisdictions, and meet community needs. The Transport Integration Act heavily influenced the options.

Southland Station Planning Study, Department of Transport

Shaun was the Project Director for this study to develop concept plans and cost estimates for Southland Station. The investigations included identifying appropriate supporting land use and transport solutions to ensure effective integration with the surrounding urban fabric.

Geelong Bus Interchange, Public Transport Victoria

Shaun was the project director for this project in which microsimulation models of the on-road bus interchange in the City Centre were developed. This modelling took into account issues with occupancy of bus stands, access to the stops and associated traffic congestion. The modelling incorporated the broader road network from Ryrie Street through to the Rail station to understand and find solutions for the bus delays that were occurring on Mooroobool Street.

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