Fishermans Bend Public Transport and Active Mode Link

VicRoads

Background / Feasibility Report

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Document history and status

Revision	Date	Description	By	Review	Approved
A	12 July 2016	Draft Report	Melissa Merlo	Katie Mitchell	Katie Mitchell
B	29 July 2016	Final Report	Melissa Merlo	Katie Mitchell	Katie Mitchell
C	1 Sep 2016	Final Report including Hartley Street Option	Melissa Merlo	Katie Mitchell	Katie Mitchell

Contents

Executive Summary

Jacobs has been engaged by VicRoads to undertake a Feasibility Study and Options Development for a Fishermans Bend Public Transport and Active Transport (PTAT) Link. This study will be used by VicRoads, Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and Public Transport Victoria (PTV) to provide advice regarding the Fishermans Bend Urban Renewal Area. This will assist the Fishermans Bend Taskforce who are tasked with developing a recast Strategic Framework Plan to support the development in Fishermans Bend.

The scope of this study has been split into three main stages:

- Stage 1 - undertake a background review and existing conditions assessment to determine whether a PTAT link across Charles Grimes Bridge or crossing further west along the North Wharf is feasible. This report assesses the feasibility of a number of options that the project team have requested be assessed. The feasibility of the Collins Street Extension has been assessed in a number of previous studies and is deemed feasible.
- Stage 2 - Options Development. Concept designs will be developed for options the project team deem feasible following the outcomes of Stage 1; and
- Stage 3 – Option Assessment. An option assessment will be undertaken on the concept designs developed, including assessment against options developed for the Collins Street Extension (both fixed bridge and opening bridge).

The options that have been considered for the PTAT corridor can be split into four alignment options and are detailed below and shown in Figure 1.1.

- Charles Grimes Bridge
  - Option 1 – at grade PT corridor, utilising Charles Grimes Bridge Slip Road to incorporate a PT only corridor. This corridor will remain on the west side of Charles Grimes Bridge and then proceed west along Lorimer Street;
  - Option 2 – An elevated PT corridor, utilising a similar alignment to Option 1. This corridor will remain on the west side of Charles Grimes Bridge but potentially cross to the south side of Lorimer Street before proceeding west; and
  - Option 3 – a tidal flow (bi-directional bus / tram traffic on bridge utilising tidal flow signalling).
- Collins Street Extension
  - Fixed Bridge – previously assessed as part of a number of studies; and
  - Opening Structure – previously assessed as part of a number of studies.
- North Wharf
  - Western alignment – not assessed previously;
  - Central alignment – previously assessed as part of Aurecon Alignment Report in 2013; and
  - Eastern alignment – previously assessed as part of Aurecon Alignment Report in 2013.
- Hartley Street Option – connection across from Yarra's Edge opposite Hartley Street connecting through to Collins Street / Bourke Street intersection.

This study is only assessing above ground river crossing options. Underground river crossing options have previously been assessed by the Department of Transport and are not included in this assessment as they are likely to be very expensive due to ground conditions in the area and are not deemed to provide a good active transport solution.

Following review of the existing conditions and background information it is recommended that the following options continue through to Stage 2 – Concept Design Development:

1

- Charles Grimes Bridge Option 1 - At grade PT corridor, utilising Charles Grimes Bridge slip road to incorporate a PT only corridor. A sub option to this would be to consider widening Charles Grimes Bridge in the median so that traffic lanes could potentially be shifted towards the east to create more room for a tram corridor on the west, thereby reducing the traffic impacts of an at-grade solution;
- Charles Grimes Bridge Option 2 – An elevated PT corridor, utilising a similar alignment to Option 1. The recommended corridor for Lorimer Street is to proceed along the centre of Lorimer Street rather than the option to proceed along the south side of Lorimer Street due to the significant impacts this would have on properties west of the exit ramp, however this option will be considered further throughout the study; and
- Collins Street Extension – Fixed Bridge Option – this has previously been assessed in a number of other previous studies and deemed feasible; and
- Collins Street Extension - Opening Structure – this has previously been assessed in a number of other previous studies and deemed feasible.

It is not recommended to undertake any concept design work on the following options:

- Charles Grimes Bridge Option 3 – Tidal Flow. This option is not considered feasible unless approval can be gained from Yarra Trams to introduce a tidal flow arrangement onto the network. The operational impacts and potential safety impacts of this solution are considered significant;
- Charles Grimes Bridge Alternative Option – use of centre of Charles Grimes Bridge and connection to either Collins Street or Flinders Street tram network. This is not considered feasible due to significant structural constraints at the northern end of Charles Grimes Bridge (and the considerable costs associated with any work in this area) and expected impacts on through traffic movements;
- North Wharf – all alignments - significant changes would be required to the proposed layout for the Collins Wharf Development Plan (north side of the river) along with significant additional wharf strengthening works required to cater for a tram along the proposed Collins Street extension road. Also the impacts on the Yarra's Edge Development (south side of the river) would be significant with this area either now fully developed or under construction (Yarra's Edge Bolte Precinct Development Plan). The road connections through Yarra's Edge are narrow and would struggle to fit a tram connection plus active mode facilities. Also a new bridge in this area would have similar constraints on river traffic with an opening structure required to allow for tall masted boats to access Yarra's Edge Marina; and
- Hartley Street Option – due to the impact the tram tracking path has on existing and proposed building developments adjacent to the intersection of Bourke Street and Collins Street intersection i.e. a tram cannot turn the tight corner within the road corridor available.

1. Background

1.1 Introduction

Jacobs has been engaged by VicRoads to undertake a Feasibility Study and Options Development for a Fishermans Bend Public Transport and Active Transport (PTAT) Link. This study will be used by VicRoads, Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and Public Transport Victoria (PTV) to provide advice regarding the Fishermans Bend Urban Renewal Area. This will assist the Fishermans Bend Taskforce who are tasked with developing a recast Strategic Framework Plan to support the development in Fishermans Bend. The client side project team for this study includes VicRoads, DEDJTR, PTV and Department of Environment, Land, Water and Planning (DELWP).

1.2 Background

Fishermans Bend is an area of Melbourne which has gone through many and varied changes since Melbourne was first established. Since first being a swampy dividing area between the City of Melbourne and development at Williamston and Port Melbourne, Fishermans Bend developed to include an airfield and Melbourne's first modern production line industries. The area was reshaped again by the construction of the West Gate Freeway and the Charles Grimes Bridge in the 1970s and City Link tollway developments in the late 1990s.

Today, Fishermans Bend is home to a range of businesses that vary significantly in type and scale from large, heavy manufacturing such as Holden's engine plant and defence and aerospace operations through to newer, innovation based businesses such as camera equipment manufactures that occupy smaller land footprints. Looking forward, the Fishermans Bend Taskforce is progressing work to plan for the likely next evolution of Fishermans Bend towards further growth of Innovation and knowledge based employment, with larger scale manufacturing expected to reduce in size – the most significant example being Holden ceasing manufacturing engines in Fishermans Bend in 2017.

The Fishermans Bend precinct is a very important growth area, close to the Melbourne CBD and attractive to new residents and workers, due to its close proximity to the CBD and Port Philip Bay. The provision of an effective and efficient transport system, both public and active, for the expected 80,000+ new residents and 60,000 workers is imperative for the success of this new city-shaping neighbourhood.

The importance of the getting the right solution along the harbour-side of the Yarra River cannot be underestimated. Significant strategic planning and urban development have been undertaken over the past 10-15 years, to promote the transition of the previous industrial docks and wharfs to attractive waterfront places that will facilitate activity. Each development has an influence on the decision making process for active and public transport and how they affect the options being investigated in this project. These include amongst others, Victoria Harbour Collins Street Development Plan when considering the North Wharf options; and the existing Yarra's Edge and future Bolte/Riverside precinct on the south of the river.

A number of government organisations have undertaken recent option studies to determine how to improve transport access between the Fishermans Bend development area south of the Yarra River and the Melbourne CBD. These include:

- Department of Transport, Planning and Local Infrastructure (DTPLI) – 'Fishermans Bend Light Rail Tram Final Report Alignment Options', prepared by Aurecon in May 2013. This study considered five options for providing a light rail tram connection to Fishermans Bend. Three of these options crossed over the Yarra River west of Charles Grimes Bridge and connected to an extension of Collins Street, one utilised Charles Grimes Bridge and one did not cross the Yarra River but spurred off the existing light rail tram route 109;
- City of Port Phillip – 'Fishermans Bend Collins Street Tram Extension', prepared by AECOM in December 2014. This study investigated a tram extension from Collins Street and across the Yarra River and Westgate Freeway. It considered what type of bridge was feasible for the Yarra River crossing i.e. fixed versus an opening structure. An economic assessment was undertaken to compare a crossing over the Yarra River and Westgate Freeway with the base case of a shuttle tram along Montague Street connecting with Tram Route 109;

- City of Melbourne – 'Improving Access to Fishermans Bend', prepared by SGS in September 2015. This assessment investigated the benefits and disbenefits of providing improved accessibility to Fishermans Bend through an extension of Collins Street over the Yarra River and Westgate Freeway. It built on previous work investigating the feasibility of light rail route alignment options. It analysed the agglomeration benefits of various alignments, and assessed some of their impacts on the road and tram network; and
- Department of Transport – 'Fishermans Bend Development Area – Light Rails Concept Designs Report' prepared by AECOM in November 2011. This study assessed six light rail route options to provide improved public transport links to the Fishermans Bend area, which included two options that provided new links across the Yarra River. The route options were assessed in an unweighted multi-criteria assessment framework.

Some of the key issues identified in these studies for providing a PTAT link included:

- Access across the Yarra. If a new bridge was to be provided west of the boat harbour how could access be maintained for boats;
- How best to cross over Lorimer Street and the M1. Also consideration of the impacts that the City link Tulla widening may have on a new link;
- Maintaining property access along roads within the area that may be used by a new public transport link;
- Impacts to some complex intersections adjacent to the Yarra River and M1, such as the Lorimer Street / Montague Street / Wurundjeri Way intersection;
- Journey time for the public transport (bus or tram) depending on the route considered; and
- Positioning of stops and impacts on surrounding infrastructure and land use.

Since the completion of these reports the government has formed the Fishermans Bend Taskforce whose responsibility it is to develop a recast Strategic Framework Plan to support the future development of the Fishermans Bend area. This study has been commissioned to support the recast of the Strategic Framework Plan.

1.3 Study Scope

The scope of this study has been split into three main stages:

- Stage 1 - undertake a background review and existing conditions assessment to determine whether a PTAT link across Charles Grimes Bridge, from Wurundjeri Way / Harbour Esplanade intersection in Docklands to Lorimer Street in Yarra's Edge, or crossing further west along the North Wharf is feasible. This report assesses the feasibility of a number of options that the project team have requested be assessed. The feasibility of the Collins Street Extension has been assessed in a number of previous studies and is deemed feasible;
- Stage 2 - Options Development. Concept designs will be developed for options the project team deem feasible following the outcomes of Task 1; and
- Stage 3 – Option Assessment. An option assessment will be undertaken on the concept designs developed, including assessment against options developed for the Collins Street Extension (both fixed bridge and opening bridge). The outcome of this phase of the study will be an Options Assessment Report providing the outcomes of the option assessment undertaken including the pros and cons of the different options using option assessment criteria agreed with the Project Team. The outcome of this will then feed into the Fishermans Bend Urban Renewal area recast.

The options that have been considered for the PTAT corridor can be split into three alignment options and are detailed below and shown in **Figure 1.1.** A closer view of the Charles Grimes Bridge area and North Wharf area are shown in **Figures 1.2** and **1.3:**

- Charles Grimes Bridge

- Option 1 – at grade PT corridor, utilising Charles Grimes Bridge slip road to incorporate a PT only corridor. This corridor will remain on the west side of Charles Grimes Bridge and then proceed west along Lorimer Street. This was previously assessed as part of the Aurecon Alignment Report in 2013;
- Option 2 – An elevated PT corridor, utilising a similar alignment to Option 1. This corridor will remain on the west side of Charles Grimes Bridge but potentially cross to the south side of Lorimer Street before proceeding west; and
- Option 3 – a tidal flow (bi-directional bus / tram traffic on bridge utilising tidal flow signalling).

- Collins Street Extension
  - Fixed Bridge – previously assessed as part of a number of studies (noted in Section 1.2); and
  - Opening Structure – previously assessed as part of a number of studies (noted in Section 1.2).
- North Wharf
  - Western alignment – not assessed previously;
  - Central alignment – previously assessed as part of Aurecon Alignment Report in 2013; and
  - Eastern alignment – previously assessed as part of Aurecon Alignment Report in 2013.
- Hartley Street Option – connection across from Yarra's Edge opposite Hartley Street connecting through to Collins Street / Bourke Street intersection.

This Feasibility Report assesses the Charles Grimes Bridge, North Wharf and Hartley Street options only. The feasibility of the Collins Street Extension has been assessed in a number of previous studies (as noted in Section 1.2). However this report does note some additional aspects to consider for the Collins Street Extension that may not have been noted within the previous reports. The study is also only assessing above ground river crossing options. Underground river crossing options have previously been assessed by the Department of Transport and are not included in this assessment as they are likely to be very expensive due to ground conditions in the area and are not deemed to provide a good active transport solution.

The PTAT works will provide a high frequency public transport link that would deliver efficiency and priority to minimise travel times, and a high capacity active transport link. The public transport link is envisaged to be either a Bus Rapid Transit (BRT) connection, or a light rail connection. Any new river crossing will also include a segregated cycle and pedestrian path.

The extent of the study is focused on the immediate area adjacent to the Yarra River and does not extend further south / west into the Fishermans Bend area i.e. it doesn't consider the route for the BRT or Light Rail past the river crossing. It is expected that future studies will investigate onward route alignments, once the preferred river crossing option has been agreed.

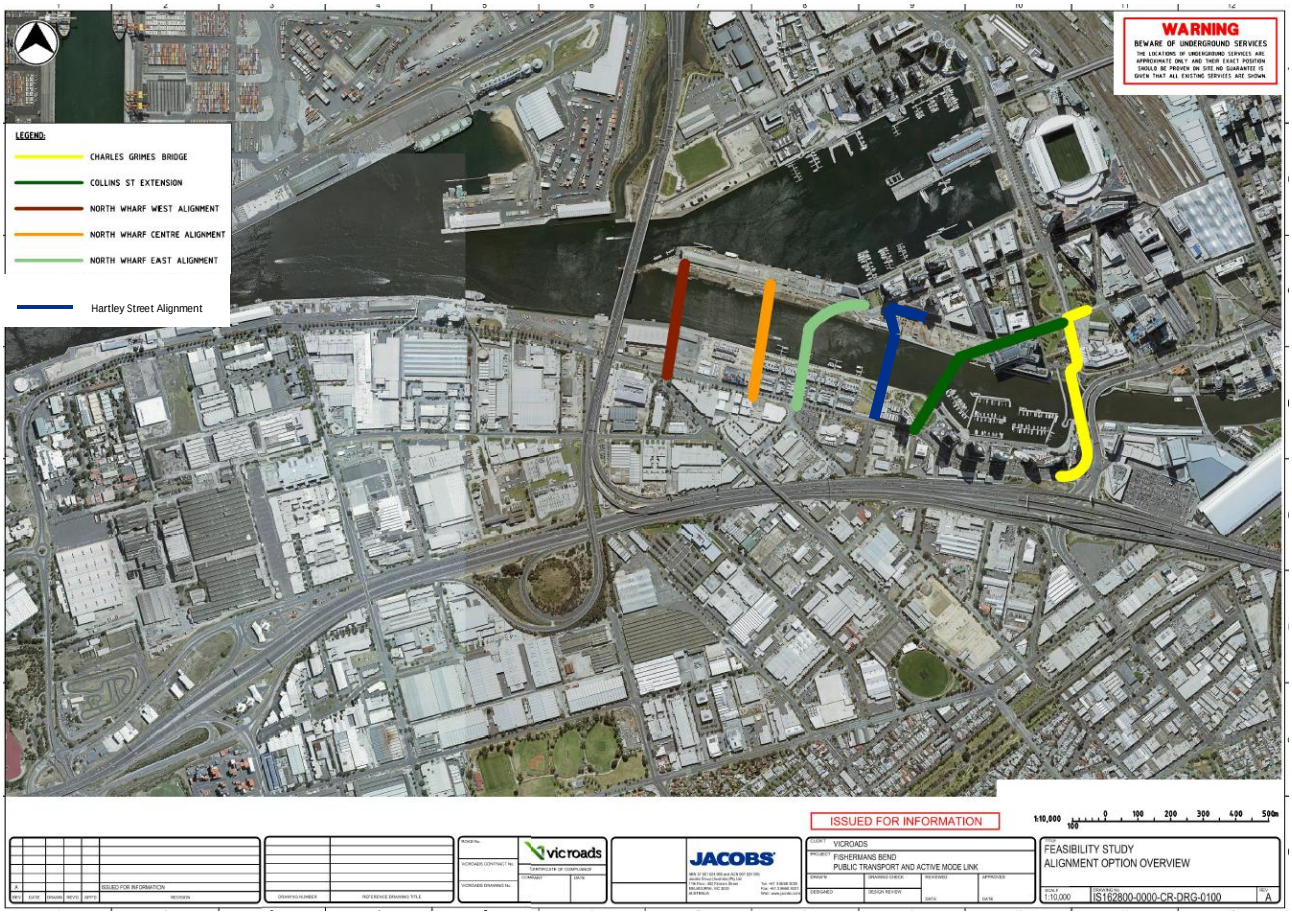


Figure 1.1 – Fishermans Bend PTAT Link – Alignment Options Overview

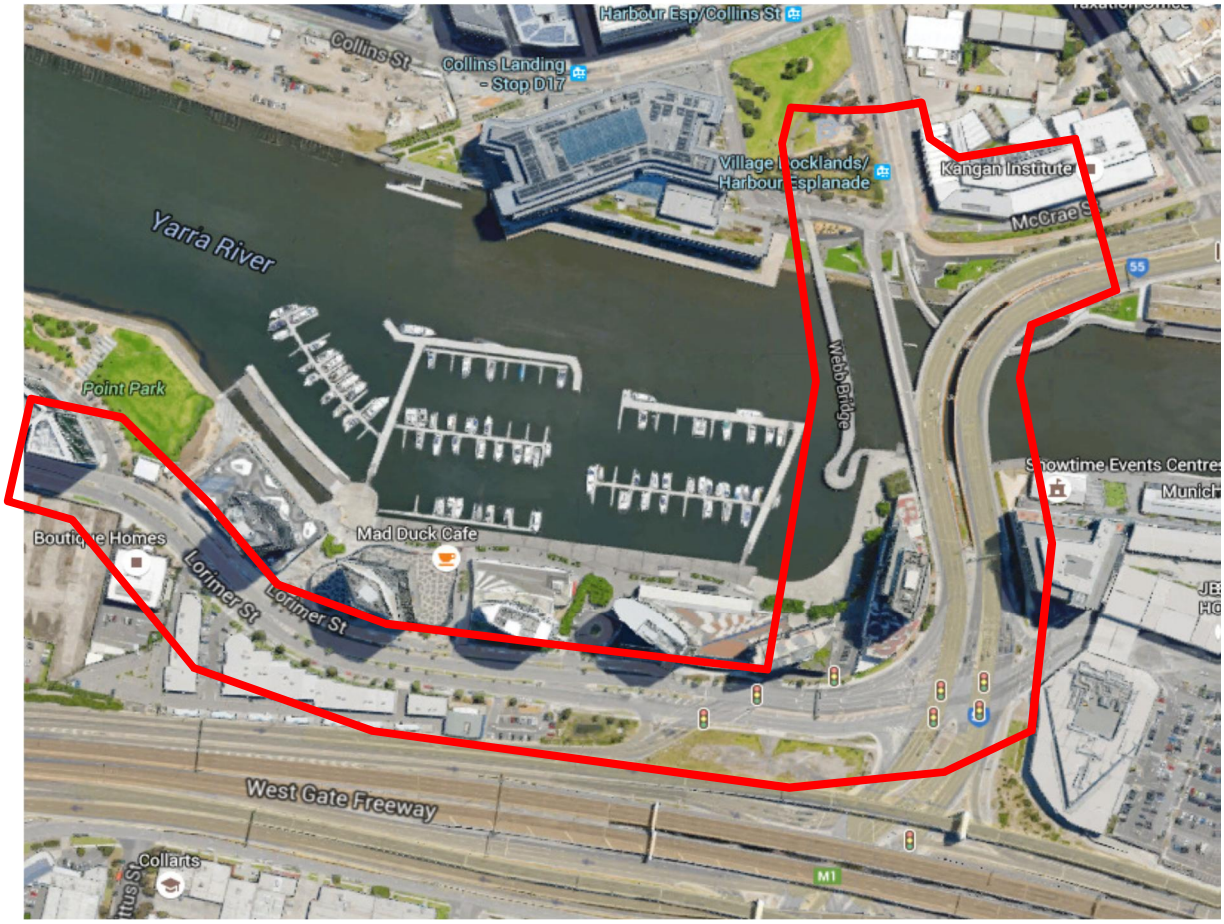


Figure 1.2 – Charles Grimes Bridge Area

Figure 1.3 – North Wharf Area

1.4 Information Supplied by VicRoads

A number of background document have been provided by VicRoads. These have been reviewed as part of undertaking the background review and existing conditions assessment. These documents are listed as follows:

- Charles Grimes Bridge/Harbour Esplanade/Navigation Drive intersection Traffic Signal Plans, Programming Sheets and Yarra Trams Plans;
- City Link Tulla Widening/Lorimer Street intersection Functional Layout Plans;
- Montage Street/M1 Interchange alignment plans, drainage plans, pavement plans, sign and linemarking plans, street lighting plans;
- Charles Grimes Bridge street lighting, layout plans, table of contents of other plans available;
- Lorimer Street alignment and drainage plans;
- Lorimer Street/Montague Street intersection plans;
- West Gate Freeway/Lorimer Street off ramp Traffic Signal Remodel Plans;
- Johnson Street Bridge over the Yarra River deck section and bridge details;
- Charles Grimes Bridge alignment, foundation and bridge plans;
- Charles Grimes Bridge Structures Reports, Condition Report, Maintenance Report;
- Montague Street/Lorimer Street Traffic Signal Controller Reprogram;
- WestGate Freeway/Montague Street Traffic Signal Controller Reprogram;
- WestGate Freeway/Montague Street Wicked Problem Cycle Improvement Works;
- WestGate Freeway/Montague Street Interchange Traffic Signal Plans;
- Spreadsheet of the pedestrian and cycling projections for Fishermans Bend;
- Yarra Trams Collins Street extension report provided by DEDJTR;
- Melbourne Water Final Geotechnical report 'Factual Report on Geological, Geotechnical and Hydrological Investigations (Phases 1 & 2)';
- Site inspection photos from March 2016;
- City of Melbourne Council Reports on the Bolte Precinct Planning Application within the Yarra's Edge development;
- The endorsed 2006 Yarra's Edge Outline Development Plan;
- AECOM – Fishermans Bend Development Area – Light Rails Concept Designs Report for Department of Transport Nov 2011;
- Yarra's Edge Development Plan – September 2006;
- Yarra's Edge Bolte Precinct Development Plan – June 2013;
- Existing Victoria Harbour Development Plan – 2010;
- Proposed Collins Wharf Development Plan Addendum – September 2015;
- Victoria Harbour Collins Wharf Addendum Economic Assessment LLD Report – March 2016;
- Collins Wharf Titling presentation to CoM - 8 March 2016;
- Letter to CoM regarding Collins Wharf Ownership Arrangements - 1 April 2016;
- Robert Bird Group Structural Report – North Wharf Collins Street Remediation Nov 2014;
- DEDJTR Western Distributor Network Impact Assessment Nov 2015; and
- Jim Stynes Bridge / Landscape Works Design Plans.

2. Existing Conditions – Charles Grimes Bridge

2.1 Road Geometry

The existing layout for Charles Grimes Bridge and the adjacent intersections is shown on the Existing Conditions Plan included in **Appendix A**. This plan also includes the existing vertical alignment for the structure along the slip road. As feature survey was not available for the bridge, the vertical alignment has been estimated using the As Built plans for the bridge, Melbourne Water 1m contours and tied into the levels either side of the structure.

The 'estimated' grades for the Charles Grimes Bridge are borderline DDA compliant, with grades in the order of maximum 4.7%. Normally 1 in 33 (3%) is the maximum grade for DDA compliance however this is often relaxed for footpaths adjacent to roads. If landings are provided 1 in 20 (5%) is acceptable. This will need to be considered further when developing options for the pedestrians / cycle connection. These grades are compliant for trams and buses.

2.2 Transport Conditions

2.2.1 Existing Road Network

The Fishermans Bend precinct is well serviced by a number of arterial and local roads. Figure 2-1 provides a locality plan for the area adjacent to Charles Grimes Bridge including the key intersections.

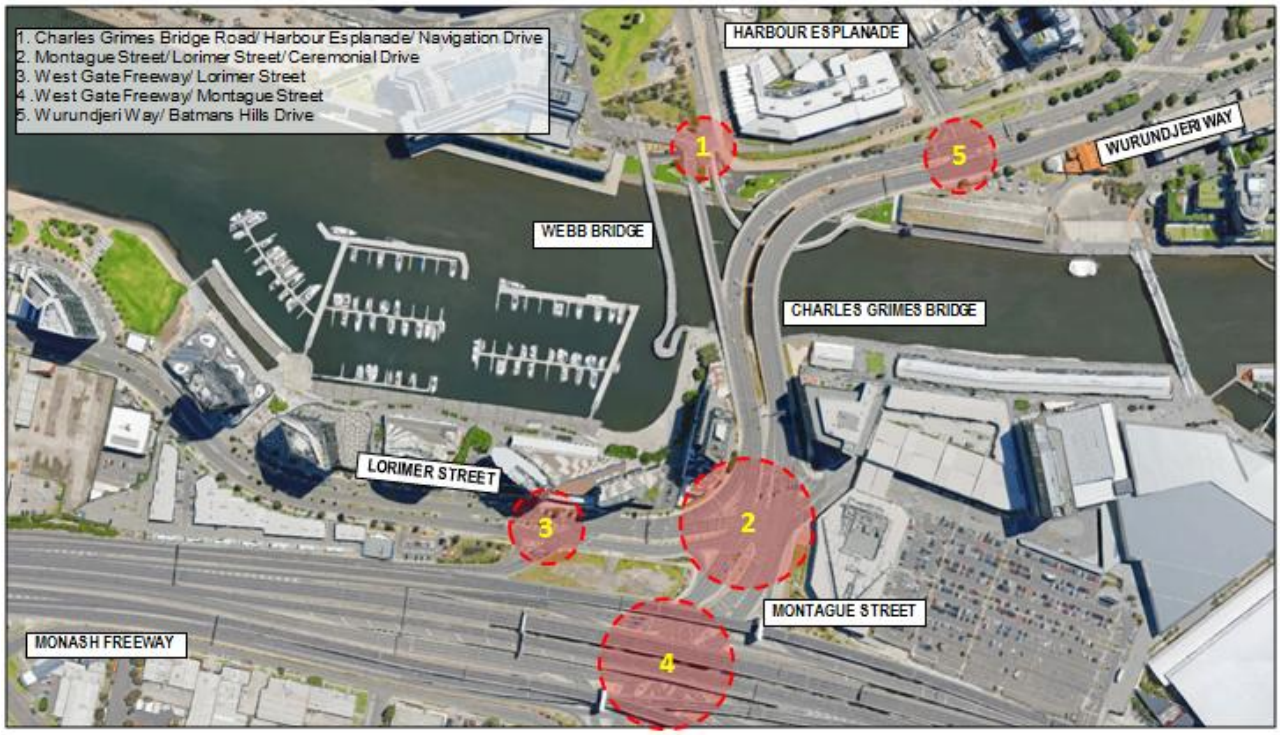


Figure 2-1: Road Network

2.2.2 Road hierarchy

Roads fall into a hierarchy of functional and operational classes ranging from major freeways to local access roads. A typical road hierarchy is described in Table 2-1.

Table 2-1: Road Hierarchy Functions

Road type	Road function
Freeway	Freeways are high capacity roads that have an exclusive function of carrying general traffic and freight around cities. Freeways are designed to accommodate through traffic only and they do not provide for pedestrians or bicycles. Access to adjacent land use is only provided via grade separated interchanges which link to the arterial road network.
Arterial Road	Arterial roads have a predominant function of facilitating the safe and efficient movement of through traffic and at-grade public transport on key public transport routes. Arterial roads form the primary road network and link main traffic generator hubs within an urban area. Vehicle access to adjacent land use is limited and provided through well planned minor local connections between widely spaced priority controlled intersections. High quality pedestrian and bicycle facilities can be provided along these roads, however due to the higher order speeds, fully separated facilities are often required.
Local Access Road	These are roads intended exclusively for localised access, where the safe and efficient movement of through traffic must be balanced with the vehicle access needs of adjacent land uses and pedestrian and bicycle movements. Speeds and traffic volumes are generally low to provide a high level of pedestrian and bicycle facilities.

SmartRoads adopts the following Road Use Hierarchy for the road network in the vicinity of the study area (refer to Table 2-2):

Table 2-2: SmartRoads road user priority classifications - Fishermans Bend Study Area

SmartRoads Classification	Road Transport	Public Transport		Active Transport
	Preferred Traffic Route	Traffic Route	Tram Priority Route	Bicycle Priority Route
Declared Roads				
Monash Freeway (M1)	✓	-	-	-
Montague Street/ Wurundjeri Way	-	✓	-	-
Montague Street south of M1	-	✓	-	-
Lorimer Street	-	✓	-	✓
Local Roads				
Collins Street	-	-	✓	✓
Charles Grimes Bridge Road	-	-	-	-
Webb Bridge	-	-		✓
Harbour Esplanade	-	-	✓	✓
Jim Stynes Bridge	-	-	-	✓
Navigation Drive	-	-	-	-
Macrae Street	-	-	✓	✓

Source: Transmaps, 2015 (http://www.maps.vic.gov.au/TransMaps/ui/DotmapUI.jsp)

Although this modal priority is strictly speaking only applicable to the current road network and land use, it can also be used to inform VicRoads' future position in this regard. This approach will be adopted by Jacobs to

inform the proposed concept designs which will take into account the change in VicRoads policy towards priority for alternative modes of transport other than the car.

Montague Street/ Wurundjeri Way

Montague Street/ Wurundjeri Way provides three (3) traffic lanes in the northbound direction and four (4) traffic lanes in the southbound direction across the Charles Grimes Bridge. Montague Street/ Wurundjeri Way forms a significant connection across the Yarra River and is one of the most fundamental road links contributing towards the movement of traffic to/ from the city from the south. It is also a key link in the future potential development of the Fishermans Bend precinct and South Wharf as a commercial hub.

Montague Street introduces a number of adverse local impacts owing to high traffic demands (i.e. approximately 52,000 daily vehicle trips i.e. 22,000 trips northbound and 30,000 trips southbound) which result in significant vehicle delays and localised traffic congestion. The traffic flow on Montague Street/ Wurundjeri Way is significantly impeded by critical bookend signalised intersections i.e. West Gate Freeway and Batmans Hill Drive intersections which restrict the release and dissipation of traffic flow across the Charles Grimes Bridge.

Lorimer Street

Lorimer Street provides two (2) traffic lanes in each direction. It links the Fishermans Bend precinct to Montague Street/ Wurundjeri Way and South Wharf as well as providing connectivity to the Monash Freeway via Montague Street.

Lorimer Street is characterised by the following traffic related issues:

- Mix of through, commercial, light industrial traffic;
- Uncontrolled median breaks with opposing right turn movements to access adjacent properties;
- Relatively equal flows in the AM peak with significant tidal flows in the PM peak; and
- Significant road connection to Montague Street/ Wurundjeri Way.

Charles Grimes Bridge Road

Charles Grimes Bridge Road provides a single traffic lane and on-road bicycle lane in the northbound direction only, connecting to Navigation Drive to the north. It links general traffic to the Docklands precinct as well as providing pedestrian and bicycle access to the tram route on Harbour Esplanade as well as connectivity to the Jim Stynes Bridge.

Harbour Esplanade and Navigation Drive

Harbour Esplanade and Navigation Drive provides a single traffic lane in each direction, servicing the internal vehicle movements with the Docklands precinct. An on-road single tram track is provided along Harbour Esplanade in each direction. A shared use path is present on the northern side of Navigation Drive and the western side of Harbour Esplanade providing suitable connectivity to/ from the surrounding land use and the Jim Stynes Bridge and Webb Bridge.

2.2.3 Public transport

Public transport is exclusively provided by metropolitan bus services and tram services. The following public transport routes operate within the study area:

Bus routes:

- Route 232: Altona North to Queen Victoria Market (via West Gate Freeway);
- Route 235: City to Fishermans bend via Williamstown Road; and
- Route 237: City to Fishermans Bend via Lorimer Street.

Tram routes on Harbour Esplanade:

- Route 70: Waterfront, City Docklands to Wattle Park; and
- Route 35: City Circle.

Tram routes on Collins Street Docklands

- Route 11: West Preston to Victoria Harbour Docklands; and
- Route 48: North Balwyn to Victoria Harbour Docklands.

2.2.4 Active transport

Pedestrians and bicycles are almost exclusively reliant on a two bridge crossing points of the Yarra River (i.e. Charles Grimes Road Bridge and Webb Bridge). Webb Bridge is pedestrian / bicycle access only and is part of the Capital City Trail Bicycle Corridor. In addition, the recently completed Jim Stynes Bridge provides an east-west link under the Charles Grimes Bridge on the Yarra's north bank.

Alternatively, pedestrians and bicycles travelling to/ from the west of Montague Street can navigate through the Montague Street/ Lorimer Street signalised intersection and travel along South Wharf Promenade, where they can cross the Yarra River via Seafarers Bridge and Spencer Street Bridge further east.

Bicycle Volumes

The City of Melbourne has continued to see an increase in the number of cyclists commuting to work. Super Tuesday Bike Count (Super Tuesday) is the world's biggest and longest running visual bike counts (conducted by Bicycle Network). It measures bicycle commuter flows in the morning peak from 7am to 9am at key locations around Melbourne. The ninth annual Super Tuesday was conducted on Tuesday 3rd March 2015.

Table 2-3 shows that Charles Grimes Bridge has seen a 20% increase between 2014 and 2015 in the number of cyclists during the AM peak period. The bicycle count at Webb Bridge showed a decrease of 48% between 7am – 9am.

Table 2-3: Super Tuesday Bicycle Commuter Count (7am - 9am)

Site Location	Total 2015	Total 2014	% Change
Collins St (E), Harbour Esp (S), Collins St (W), Harbour Esp (N)	1,124	964	17%
Flinders St [E], Spencer St [S], Flinders St [W], Spencer St [N]	227	281	-19%
Path to McCrae St (E), Charles Grime Bridge Rd (S), Path (W), Harbour Esp (N)	1,025	856	20%
Upstream Path [E], Downstream Path [S], Webb Bridge [N]	519	989	-48%
Upstream Path [E], Path besides Polly Woodside [SE], Downstream Path [W], Seafarers Bridge [N]	1,076	1,024	5%
Queens Bridge St (N), City Road (NE), Moray St (S), City Rd (SW)	442	257	72%

Source: Bicycle Network (2015), Super Tuesday Bicycle Commuter Count 2015

Pedestrian Volumes

The City of Melbourne has developed an automated pedestrian counting system to better understand pedestrian activity within the municipality. The information can be used to examine how people use different city locations at different times of day to better inform decision-making and plan for the future.

There is a pedestrian counter located on the north side of Webb Bridge and this data has been analysed for the week commencing 20th June 2016. Figure 2-2 shows the pattern of pedestrian movements over a 24 hour

period for this week. As is typical in the City of Melbourne the busiest pedestrian movements (on a weekday) are from 12pm – 2pm.

The highest number of pedestrian movements (517) was recorded at this location between 12pm-1pm on Tuesday 21st June 2016. The AM and PM peak periods also have over 400 pedestrian movements across Webb Bridge.

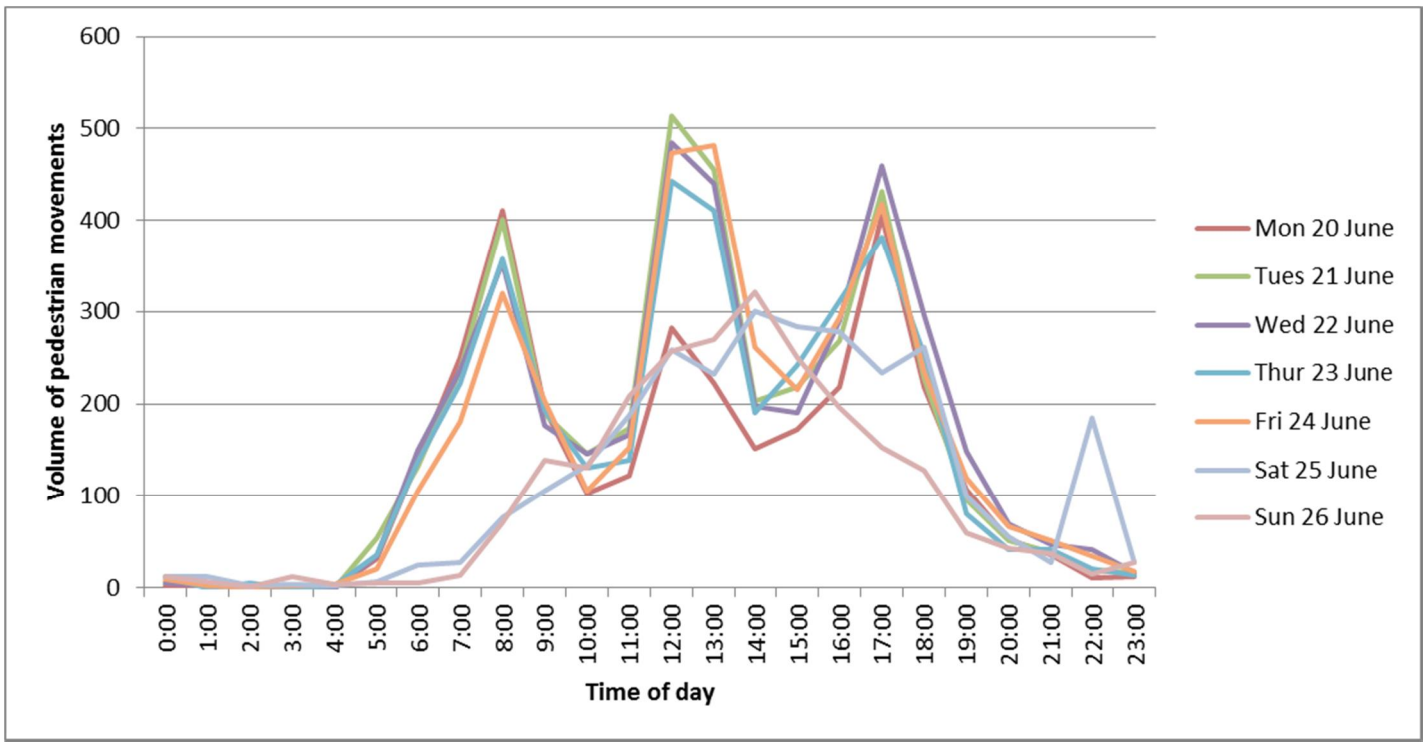


Figure 2-2: Webb Bridge – volume of pedestrian movements (Source: City of Melbourne)[1]

2.2.5 Traffic signals

There are three (3) signalised intersections located within the confluence of the study are. These include:

- Site 1191: Charles Grimes Bridge Road/ Harbour Esplanade/ Navigation Drive;
- Site 2886: West Gate Freeway/ Lorimer Street; and
- Site 4902: Montague Street/ Lorimer Street/ Ceremonial Drive.

In addition to those intersections, there are a two (2) other signalised intersections that bookend the Charles Grimes Bridge, which influence and assist in the release and dissipation of traffic over the bridge. These include:

- Site 4901: West Gate Freeway/ Montague Street; and
- Site 4370: Wurundjeri Way/ Batmans Hills Drive.

All of the signals are connected to the SCATS network and operate under a dynamic signal operation. Due to the closely spaced intersections along Montague Street/ Wurundjeri Way, the traffic signals are coordinated for linking and operate with a common maximum 130 second cycle time.

[1] http://www.pedestrian.melbourne.vic.gov.au/

The intersection of Charles Grimes Bridge Road/ Harbour Esplanade/ Navigation Drive is not linked and therefore adopts a shorter cycle time to minimise delays for pedestrians and bicycles.

The signalised intersections are characterised by the following traffic related issues:

- Closely spaced intersections;
- Localised traffic congestion, especially during peak travel times; and
- Confusing traffic movements and lane configurations, especially on the approach to the West Gate Freeway/ Montague Street intersection.

Site 1191: Charles Grimes Bridge Road/ Harbour Esplanade/ Navigation Drive

The intersection of Charles Grimes Bridge Road/ Harbour Esplanade/ Navigation Drive is a 4-phase site – refer to phasing sequence below:

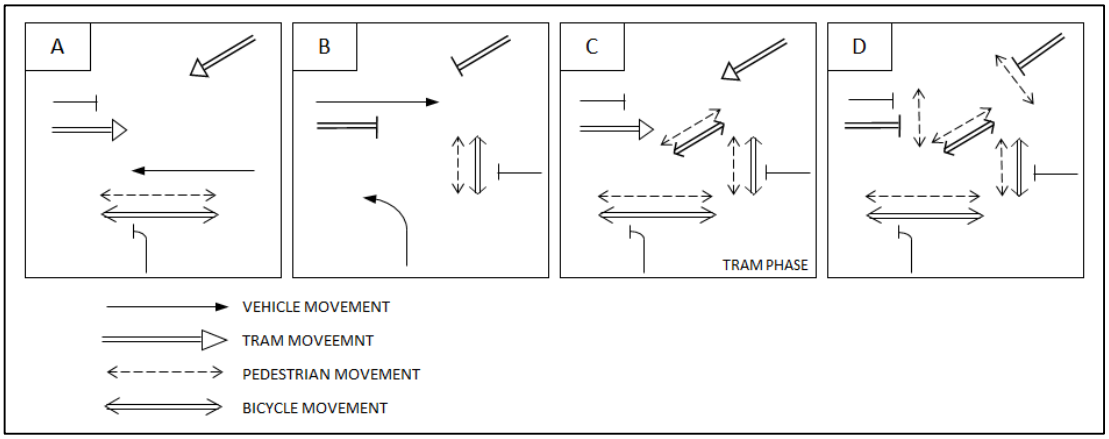


Figure 2.3 – Phasing Diagram for Site 1191 Charles Grimes Bridge Road/ Harbour Esplanade/ Navigation

The intersections provide pedestrian crossings across all legs as well as bicycle lanterns across three (3) crossings to provide connections to the shared use path and the Jim Stynes Bridge. Tram priority is also present servicing the tram route on Harbour Esplanade. A summary of the traffic signal phase frequency and average phase time allocation for a one hour period in the AM and PM peak is provided below:

Table 2.4: Site 1191 phase time summary

Phase	AM Peak		PM Peak	
	Frequency	Average phase time allocation (seconds)	Frequency	Average phase time allocation (seconds)
A	57	36	50	31
B	23	13	38	13
C	16	17	15	17
D	52	18	48	18

AM peak: 08:00 – 09:00
PM peak: 17:00 – 18:00

Site 4902: Montague Street/ Lorimer Street/ Ceremonial Drive

The intersection of Montague Street/ Lorimer Street/ Ceremonial Drive is a 5-phase site – refer to phasing sequence below:

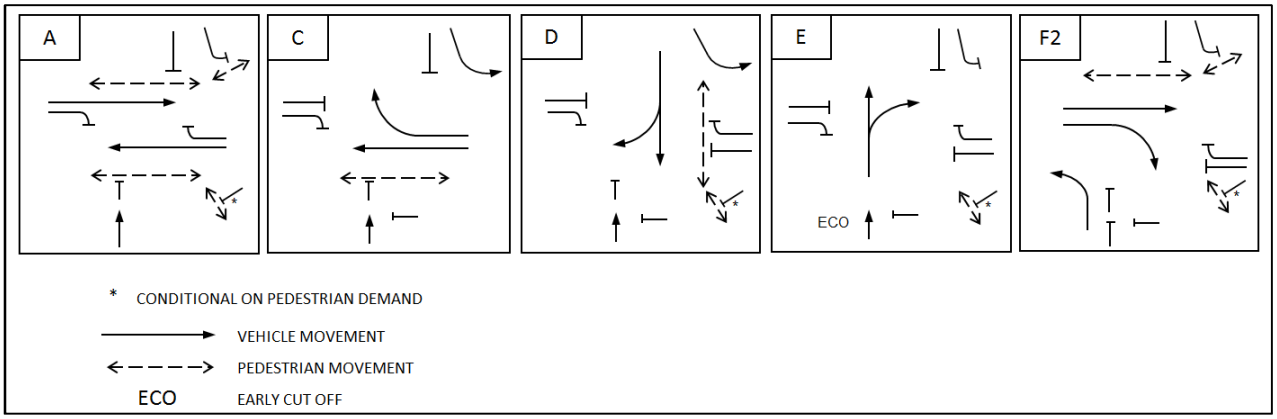


Figure 2.4 – Phasing Diagram Site 4902 Montague Street/ Lorimer Street/ Ceremonial Drive

The intersections provide pedestrian crossings across the northern, eastern and western legs.

A summary of the traffic signal phase frequency and phase time allocation for a one hour period in the AM and PM peak is provided below:

Table 2.5: Site 4902 phase time summary

Phase	AM Peak		PM Peak	
	Frequency	Average phase time allocation (seconds)	Frequency	Average phase time allocation (seconds)
A	31	43	31	35
C	28	25	28	30
D	28	27	28	33
E	15	18	27	18
F2	28	17	26	14

AM peak: 08:00 – 09:00
PM peak: 17:00 – 18:00

Site 2886: West Gate Freeway/ Lorimer Street

The intersection of West Gate Freeway/ Lorimer Street is a 3-phase site – refer to phasing sequence below:

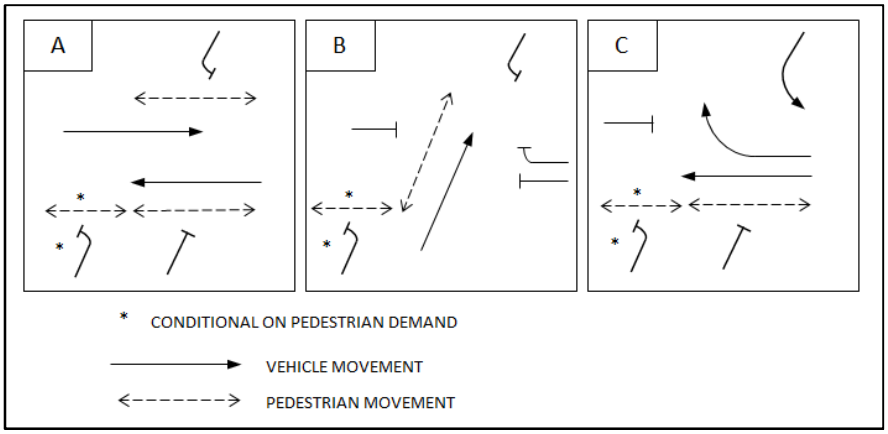


Figure 2.5 – Phasing Diagram Site 2886 West Gate Freeway/ Lorimer Street

The intersections provide pedestrian crossings across the northern, southern and western legs.

A summary of the traffic signal phase frequency and phase time allocation for a one hour period in the AM and PM peak is provided below:

Table 2.6: Site 2886 phase time summary

Phase	AM Peak		PM Peak	
	Frequency	Average phase time allocation (seconds)	Frequency	Average phase time allocation (seconds)
A	30	50	31	80
B	28	55	31	37
C	28	25	25	13

AM peak: 08:00 – 09:00
PM peak: 17:00 – 18:00

Limitations in traffic signal software

Current generation traffic signal controllers operating VC5 software are capable of supporting 24 signal group inputs and 32 detector inputs. The next generation traffic signal controller software VC6 is due to be approved in the next couple of months. VC6 software is capable of supporting 32 signal group inputs and 64 detector inputs.

VC6 will also utilise future updates to SCATS that VC5 is not capable of achieving i.e. manual toggling of vehicle detectors; extra phases; etc. The maximum number of traffic signal phases in SCATS is still limited to seven (7) per intersection, however this will increase to 12 with a VC6 controller and a future update to SCATS.

Based on the current traffic signal inputs and current VC5 software, there is available spare capacity to include additional signal groups, detector inputs and tram priority phases associated with the provision of an at-grade tram along Montague Street and Lorimer Street. The impending implementation of the VC6 software provides further capacity to provide the necessary inputs.

2.2.6 OD routes

To facilitate the efficient movement of freight through Melbourne's arterial and municipal road network, VicRoads have developed heavy vehicle route maps which identify the approved heavy vehicle routes.

Based on the information contained within these maps, Lorimer Street/ Wurundjeri Way are approved for the following:

- Class 2 & Class 3 heavy vehicles;
- Class 2 & Class 3 heavy vehicles at Higher Mass Limits (HML);
- High productivity freight vehicles (HPFV); and
- Oversize and Overmass (OSOM) Annual Scheme Permit vehicle.

One design criteria that will need to be considered when developing an elevated structure option for Charles Grimes Bridge is that the clearance to any structure will need to be higher than the standard 5.4m due to it being an OSOM route. The VicRoads Supplement to Austroads Road Design – Part 3 Geometric Design, Table 8.1 required a clearance of 5.9m for over dimensional routes and where there is no alternative route available the minimum clearance should be 6.5m. Alternatives are available in this situation so a minimum clearance of 5.9m is appropriate in this instance. It should be noted that the Lend Lease Melbourne Quarter development approval over Wurundjeri Way airspace south of Collins Street has a height clearance of 5.9m. The existing Bourke Street pedestrian bridge over Wurundjeri Way has a height clearance of 6m. The Flinders Street railway viaducts have a height clearance of 4.5m and 4.0m.

2.2.7 Traffic volumes

A summary of the average annual daily trips (AADT) and peak hour turning movements are provided below:

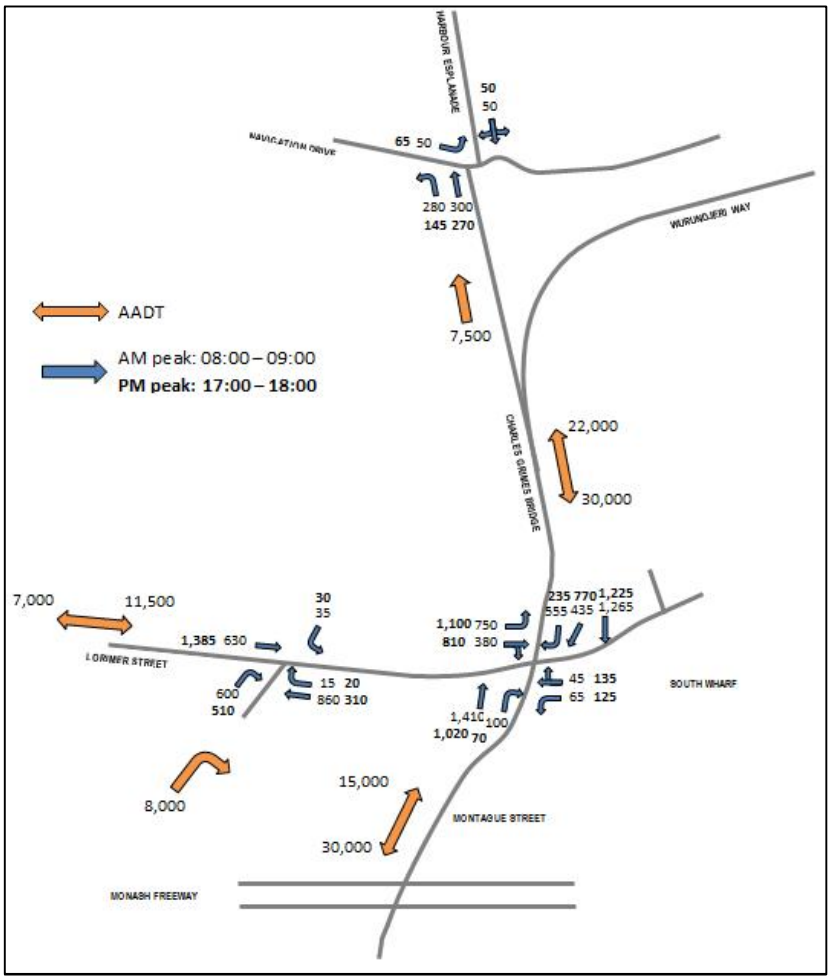


Figure 2.6 – Existing Traffic Volumes around Charles Grimes Bridge

The daily SCATS traffic volumes were recorded on Wednesday 22 June 2016. It should be noted that the SCATS volume data is slightly limited as the presence of shared lanes does not separate the recorded through volumes and turning volumes for some movements. Additionally, detector lanes are not installed in all left turn slip lanes, so traffic volumes for some left turn movements are unknown.

2.3 Existing Structures

2.3.1 Existing Condition Reports

In general the condition of the existing Charles Grimes Bridge is good and no major issues were identified in the inspection reports provided by VicRoads. A reported dated 19/3/14 only highlights some minor maintenance issues associated with line marking which would have no impact on the suitability of the bridge structure. A surveillance report from 23/10/2009 is also included which appears to observe the bridge during a heavy load (750tonne) passing over the structure, however no major issues or damage to the bridge were reported.

2.3.2 Existing Structural Drawings

The data provided includes the original drawings for the bridge as well as the more recent (around 2000) bridge drawings for the modification to the current 'Charles Grimes Bridge'. The original bridge was constructed on a straight alignment across the Yarra River in the early 1970s and consisted of two separate carriageways (separate structures) with five main spans and a short approach span on the north bank. The original structure consisted of bored piles, a reinforced concrete pier and the superstructure was precast I-beams with a reinforced concrete deck. When the bridge was modified in around 2000-2001, it appears that the entire superstructure was removed and replaced with Super-T beams and a reinforced concrete deck. The alignment was modified with traffic lanes deviated towards the east to connect with the Flinders St alignment and connect to Wurundjeri Way. This required the construction of new piers towards the north and east. Other works included strengthening of the existing piers, modification to the top of piers to suit the new beam and deck configuration and modification of abutments and approach slabs. The section of bridge which retains the original straight alignment utilises the existing piers and accommodates a single traffic lane for northbound traffic and a pedestrian pathway and on road bike lane.

The drawings provided indicate the following:

- Design traffic loading on the Charles Grimes Bridge are SM1600;
- Barriers are Medium performance level on both sides;
- Single Lane exit road section of bridge is approximately 8.2m between face of barriers (2.5m footpath, 4.7 bike/traffic lane, 1.0 verge); and
- Consists of 4 x Super T Girders, the western 2 girders have wider flanges compared to the eastern 2 girders.

2.3.3 Suitability of Existing Structure to Accommodate Trams and Buses

The current bridge has been designed for SM1600 loading. SM1600 is a design load combination, which considered both stationary and moving traffic loads on bridge structures as detailed in AS5100.2 (Part 6 – Road Traffic) Bridge Design Standard. Therefore it is expected that with a change to trams and / or buses only, the bridge would have adequate strength (no strengthening required as the tram load is significantly less than SM1600 loads).

The exit ramp section does have a crossfall – it would be necessary to check that this would suit the geometry required for the proposed tram rails.

The bridge deck incorporates a reinforced concrete deck that is approximately 200mm thick, with thickening on each side for the footpath and verge. In order to reconfigure the deck to suit the tram tracks it would be potentially be possible to break back the thickening on each side and regrade with additional concrete. The additional load of extra concrete could likely be accommodated due to the lower live loads of the trams compared to SM1600 loading, however further checks would be required to confirm this. The existing conduits

cast underneath the footpath on the western edge would need to be carefully exposed during this modification works. The barriers on each side have kerb bars connected to the thickened concrete so the reinforcement at this location would need to remain in place and not be modified to avoid affecting the barriers.

The width between barriers is approximately 8200mm. Based on the information provided the minimum distance for two tracks and clearance to barriers is 7628mm which is sufficient space to accommodate two trams without any additional widening, excluding the requirements for the active transport connection. As it is a requirement to incorporate a shared path onto the bridge, it would be necessary to add an extra structure to the outer edge of the bridge. This could potentially be cantilevered from the edge of deck/barrier or supported on a new structure from the existing piers below. Further structural review would be required to confirm this.

The vertical geometry of the bridge shows that it will suit a maximum grade of 6.7% for trams (estimated vertical grade is a maximum of 4.7%).

Overhead structures required for tram line equipment could be mounted on the existing bridge structure or mounted to the side of the existing piers. This is not expected to present a significant issue.

Overall, the existing bridge appears that it would be capable of modifying for use as a dedicated tram and / or bus bridge with relatively minor modifications to the deck without any strengthening.

2.4 Existing Planning Assessment / Land Ownership Issues

2.4.1 Land Tenure

Land tenure arrangements within the Charles Grimes Bridge option area is a combination of Crown land, private land and road reservations. Table 2.7 below identifies each of the separate parcels of land within the area and ownership details. **Appendix B** includes the Allotment Detail Plans. Title information was reviewed to gain information for each Allotment.

There are some complex property and easement details around the Yarra's Edge development on the north west corner of the Lorimer Street / Montague Street / Charles Grimes Bridge intersection. A review of the title for this area has shown that generally the edge of the building on this corner is the boundary between road reserve and private land. The existing ramp down from Charles Grimes Bridge to River Esplanade is part of the road reserve. Cargo Lane and the access from Lorimer Street to Cargo Lane are common property but a number of easements are in place in this area in favour of the land owners (Tower owners) which would make it difficult to obtain access through this area for a formal pedestrian / cycle path.

Table 2.7 – Land Tenure

Appendix B Label	Allotment Details	Address	Ownership details	Land use
1	Allot. 2095 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	REAR 50-102 LORIMER STREET DOCKLANDS 3008 RESERVE 1/80 LORIMER STREET DOCKLANDS 3008	Crown land – City of Melbourne is the administrator	River Esplanade
2	Allot. 2002 PARISH OF MELBOURNE SOUTH	RESERVE 2/80 LORIMER STREET DOCKLANDS 3008 RESERVE 3/80 LORIMER STREET DOCKLANDS 3008	Crown land – City of Melbourne is the administrator	
3	Allot. 2004 PARISH OF MELBOURNE SOUTH	All properties from BERTH 1 to BERTH 149 RIVER ESPLANADE DOCKLANDS	Crown land – City of Melbourne is the administrator	Marina
4	Allot. 2003 PARISH OF MELBOURNE SOUTH		No information available	

Appendix B Label	Allotment Details	Address	Ownership details	Land use
5	Allot. 2034 PARISH OF MELBOURNE SOUTH	All properties from BERTH 1 to BERTH 149 RIVER ESPLANADE DOCKLANDS and Allot. 2034 PARISH OF MELBOURNE SOUTH	Crown land – Department of Environment, Land, Water and Planning (DELWP) is the administrator	marina
6	Allot. 2038 PARISH OF MELBOURNE SOUTH		Crown land –Melbourne Water is the administrator	Yarra River
7	Allot. 2028 PARISH OF MELBOURNE NORTH		Crown land – Department of Environment, Land, Water and Environment (DELWP) is the administrator	Road reserve
8	Allot. 2029 PARISH OF MELBOURNE NORTH		Crown land – Melbourne Water Corporation is the administrator	Australian Wharf and Yarra River.
9	Lot R1 PS545345 (ROAD parcel)		City of Melbourne	Capital City Trail (north bank)
10	Lot R2 PS428541 (ROAD parcel)		City of Melbourne	Road (Charles Grimes Bridge)
11	Lot 2 PS648081	7 NAVIGATION DRIVE DOCKLANDS	Urban Renewal Authority Victoria	Vacant land adjacent to footbridge
12	Lot 1 PS648081	835-839 COLLINS STREET DOCKLANDS	Urban Renewal Authority Victoria	Australia Wharf
13	Allot. 2143 CITY OF MELBOURNE, PARISH OF MELBOURNE NORTH	1-91 HARBOUR ESPLANADE DOCKLANDS	Crown land: Melbourne City Council is the administrator	Open space
14	Lot R2 PS545345 (ROAD parcel)		City of Melbourne	Navigation Drive
15	Lot R7 PS545345 (ROAD parcel)		City of Melbourne	Navigation Drive
16	Allot. 2002 (ROAD parcel) PARISH OF MELBOURNE NORTH		Crown land – DELWP is the administrator	River Esplanade
17	Allot. 2021 PARISH OF MELBOURNE NORTH		Crown land – DELWP is the administrator	Yarra River
18	Allot. 2004 (ROAD PARCEL PARISH OF NORTH MELBOURNE		Crown land – DELWP is the administrator	Wurundjeri Way
19	Allot. 2149 CITY OF MELBOURNE, PARISH OF MELBOURNE NORTH	3 MCCRAE STREET DOCKLANDS	Places Victoria	Disused shed fronting Yarra River at Flinders Wharf adjacent to The Mission to Seafarers.
20	Allot. 11D1 Sec. 98 CITY OF MELBOURNE, PARISH OF MELBOURNE NORTH		Crown land: Department of Environment, Land, Water and Planning administrator	Wurundjeri Way road reserve (north bank)
21	Allot. 11D Sec. 98 CITY OF MELBOURNE, PARISH			

Appendix B Label	Allotment Details	Address	Ownership details	Land use
	OF MELBOURNE NORTH			
22	Allot. 2221 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	29 SOUTH WHARF PROMENADE SOUTH WHARF 33 SOUTH WHARF PROMENADE SOUTH WHARF	Crown land – Department of Development, Business and Innovation is the administrator	South Wharf Promenade
23	Allot. 2220 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	35 SOUTH WHARF PROMENADE SOUTH WHARF 37 SOUTH WHARF PROMENADE SOUTH WHARF 39 SOUTH WHARF PROMENADE SOUTH WHARF 43 SOUTH WHARF PROMENADE SOUTH WHARF 45 SOUTH WHARF PROMENADE SOUTH WHARF 53 SOUTH WHARF PROMENADE SOUTH WHARF 57 SOUTH WHARF PROMENADE SOUTH WHARF 61 SOUTH WHARF PROMENADE SOUTH WHARF		
24	Allot. 2015 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	40 RIVER ESPLANADE DOCKLANDS	Crown land – Melbourne City Council is the administrator	Land beneath Wurundjeri Way
25	Allot. 2124 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH		Crown land – Melbourne City Council is the administrator	Land beneath Wurundjeri Way
26	Allot. 2123 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH		Crown land – DELWP is the administrator	Wurundjeri Way or potentially land below Wurundjeri Way
27	Lot R1 PS434811 (ROAD parcel)		Roads Corporation (VicRoads)	Charles Grimes Bridge
28	Lot 2212 PS615749	CLARENDON STREET SOUTH WHARF	Secretary of the Department of Innovation, Industry and Regional Development	South Wharf
29	Lot R10 PS428541 (ROAD parcel)		Roads Corporation (VicRoads)	Lorimer Street
30	Lot R9 PS428541 (ROAD parcel)		Melbourne City Council	Road reserve (footpath) surrounding apartment block at Point Park
31	Lot R8 PS428541 (ROAD parcel)		Melbourne City Council	Small section of road reserve adjacent to Point Park

Appendix B Label	Allotment Details	Address	Ownership details	Land use
32	Allot. 2100 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	104 LORIMER STREET DOCKLANDS	Crown land: Melbourne City Council administrator	Point Park Reserve
33	Lot R11 PS428541 (ROAD parcel)		Melbourne City Council	Lorimer Street service road reserve
34	Lot CM11 PS428541		Owners Corporation 1 Plan No. PS428541D (no Owners Corporation manager identified on title)	Common property at 90 Lorimer Street.
35	Lot RES1 PS428541	REAR 50-102 LORIMER STREET DOCKLANDS RESERVE 1/80 LORIMER STREET DOCKLANDS RESERVE 2/80 LORIMER STREET DOCKLANDS RESERVE 3/80 LORIMER STREET DOCKLANDS	Melbourne City Council	Land adjacent to Ferryman Lane
36	Allot 14B Section 102 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH		Department of Environment, Land, Water and Planning	Crown land (unreserved)
37	Allot. 2019 (ROAD parcel) CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH		(provisional) Department of Environment Land Water and Planning	
38	Allot. 2202 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH Allot. 2203 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	63-67 Lorimer Street	Department of Environment, Land, Water and Planning	
39	Allot. 2033 CITY OF SOUTH MELBOURNE, PARISH OF MELBOURNE SOUTH	75 Lorimer Street	RODMARC INVESTMENTS PTY LTD – 14/257 COLLINS STREET, MELBOURNE	

2.4.2 Planning Approval Requirements

Charles Grimes Bridge and Lorimer Street are located within the City of Melbourne and area therefore subject to the provisions of the Melbourne Planning Scheme.

2.4.3 Planning Scheme definitions

The Melbourne Planning Scheme contains standard land use definitions at Clause 72 and Clause 74; however, a definition for a road is not found within either of these clauses.

A road is defined in Section 3 (1) of the *Planning and Environment Act 1987* as:

> *"road" includes highway, street, lane, footway, square, court, alley or right of way, whether a thoroughfare or not and whether accessible to the public generally or not*

"Tramways" is defined in Clause 74 of the Melbourne Planning Scheme as:

> *Land used to provide a system of transport in vehicles connected to a network of tracks, and includes tram stops, shunting areas and associated passenger facilities.*

2.4.4 Melbourne Planning Provisions

The Melbourne Planning Scheme sets out a range of planning controls including zones and overlays. These provisions determine whether planning approval is required for the use and / or development of land.

The option considered is predominantly within the Docklands Zone:

- Schedule 2 – Victoria Harbour Precinct (DZ2);
- Schedule 3 – Batman Hill Precinct (DZ3); and
- Schedule 7 – Waterways (DZ7).

The outbound lanes (eastern side) of the Charles Grimes Bridge / Wurundjeri Way is within the Capital City Zone (Schedule 1 - Outside the Retail Core) (CCZ1) and Public Park and Recreation Zone (PPRZ) , while the inbound lanes (western side) of the Charles Grimes Bridge and Road Zone Category 1 (RDZ1). Lorimer Street is within the RDZ1.

West of Charles Grimes Bridge is within DZ7, while the east of the bridge is within CCZ1 and PPRZ.

Figure 2.7 shows the site in relation to relevant zones of the Melbourne Planning Scheme.

The following overlays are found within the project area:

- Design and Development Overlay (Schedule 12 – Noise Attenuation Area) (DDO12);
- Design and Development Overlay (Schedule 49 – Yarra's Edge Precinct) (DDO49);
- Development Plan Overlay (Schedule 2 – Docklands-Yarra's Edge Precinct) (DPO2); and
- Parking Overlay (Schedule 11 – Docklands-Yarra's Edge) (PO11).

Source: http://services.land.vic.gov.au/maps/pmo.jsp

Figure 2.7 – Zoning Map

The planning controls and approval triggers that apply to the project area are described in **Table 2.8** below.

Table 2.8 – Planning Permit Triggers Summary

Planning Control	Planning Approval Required? (Y/N)	
	Buildings and Works	Use for Road or Tramway
Zones		
Public Park and Recreation Zone (PPRZ)	Y	Y
Road Zone, Category 1 (RDZ1)	N	N
Capital City Zone (Schedule 1 – Outside the Retail Core) (CCZ1)	Y	N
Docklands Zone (Schedule 2 – Victoria Harbour Precinct) (DZ2)	Y	N
Docklands Zone (Schedule 3 – Batman Hill Precinct (DZ3)	N[2]	N
Docklands Zone (Schedule 7 – Waterways (DZ7)	Y[3]	Y
Overlays		
Design and Development Overlay (Schedule 12 – Noise Attenuation Area) (DDO12)	N	N
Design and Development Overlay (Schedule 49 – Yarra's Edge Precinct) (DDO12)	Y[4]	N

[2] Permit not required for buildings and works for road purposes or carried out behalf of the roads authority and within the confines of the arterial road – Wurundjeri Way.
[3] An application for a permit requiring disturbance of the bed of the Yarra River and Victoria Harbour must be accompanied by appropriate maritime archaeological investigations
[4] Some exemptions may apply in relation to extent of building.

Planning Control	Planning Approval Required? (Y/N)	
	Buildings and Works	Use for Road or Tramway
Development Plan Overlay (Schedule 2 – Yarra's Edge Precinct) (DPO2)	N	N
Parking Overlay (Schedule 7 – Docklands-Batman's Hill) (PO7)	N	N
Parking Overlay (Schedule 11 – Docklands -Yarra's Edge) (PO11)	N	N

2.4.5 Particular Provisions

The Particular Provisions of the Melbourne Planning Scheme may also trigger the need for planning approval associated with this project.

2.4.5.1 Clause 52.29 - Land adjacent to a road in a Road Zone, Category 1, or a Public Acquisition Overlay for a Category 1 Road.

Clause 52.29 aims to ensure appropriate access to identified roads. An application to create or alter access to, or to subdivide land adjacent to, a road declared as a freeway or arterial road under the *Road Management Act 2004*, land owned by the Roads Corporation for the purpose of a road, or land in a Public Acquisition Overlay if the Roads Corporation is the acquiring authority for the land, must be referred to the Roads Corporation under Section 55 of the Act.

2.5 Existing Services and Utilities

A Dial Before you Dig (DBYD) search was undertaken for the area around Charles Grimes Bridge. Some of the key utility services within this area are shown on the Existing Conditions Plan included in Appendix A. Not all utility services are provided due to the significant number of services in the area. A summary of the key utility services are noted below:

- Gas - High pressure transmission gas marked (Batmans Hill Drive). Other distribution gas not marked but are widespread;
- Electricity - Only high voltage cable and substations marked. Other electricity lines widespread; and
- Water/Sewerage – Only pipes >450mm marked. No drainage marked. Other pipes widespread. Large sewer pipes travel along Flinders Street, under the Yarra River and towards Montague Street.

Services crossing underneath the bridge include Telstra conduit bank suspended underneath as well as cast into the footpath on the western side of the bridge, 400mm diameter water pipe suspended underneath the bridge, 150mm diameter drainage pipe suspended underneath the bridge.

2.6 Geotechnical

Geological conditions in the vicinity of the Charles Grimes Bridge have been inferred from geotechnical boreholes available from the adjacent Melbourne Main Sewer, reported by GHD in 2007. The sewer crosses the Yarra River to the east of the bridge. Four geotechnical boreholes and four Cone Penetrometer Tests (CPTs) were undertaken across the river and at the river banks for the sewer. These holes identify a consistent ground profile comprising very soft Coode Island Silt and recent river muds, overlying firm to stiff Fishermen's bend Silt and medium dense to dense Moray Street Gravel. Very dense sandy gravels and residually weathered siltstone of the Brighton Group and the Melbourne Mudstone formation respectively were encountered below the Moray Street Gravels.

The inferred ground profile is summarised in **Table 2.9**, along with a summary of measured strength results (Standard Penetration Testing 'N' values and undrained shear strength where measured) and is consistent with the expected profile of the Yarra Delta area, as described by Ervin (1992) and others.

Table 2.9 – Inferred Ground Profile adjacent to Charles Grimes Bridge

Geological map code	Unit name: material description	Elevation (mAHD) to top of layer		Strength information[1,2]
		From	To	
FILL	**FILL:** Concrete (north bank of river), Silty Clay (south bank of river)	1.2	0.9	N/A
RAMS	**Recent alluvial / marine muds:** Silty Clay, Clay, some organics	1.2	0.4	N=0
Qri	**Coode Island Silt:** Very soft clay and silt with some sand	0.4[3]	-9.4	N=0 to 1 s_u = 8 to 28kPa
Qpf	**Fisherman's Bend Silt:** Firm to stiff Clay with Sand, Sandy Clay, occasional pockets of silty sand and gravel	-9.9	-11.9	N = 0 to 16 Su = 12-49kPa
Qpg	**Moray Street Gravels**: Medium dense to dense sand and sandy gravel, generally well graded	-23.1	-24.4	N= 8 to 48
Tew	**Werribee formation:** Very stiff to hard clay, dense sandy gravels	-26.6	-28.3	N = 5 to 39
Sud	**Melbourne formation:** Siltstone, residually to extremely weathered.	-29.5	-33.4	N/A

Notes:

(1) N – Standard Penetration Test 'N' value

(2) su = peak undrained shear strength measured by hand vane shearin U63 sample tube

(3) interface between RAMS and Qri difficult to discern. Materials can be considered the same from an engineering point of view

We expect that any new foundations required to accommodate a new bridge or a widened Charles Grimes Bridge would be piled, and it is likely that driven piles would be adopted, founded at the level of the Werribee formation, or deeper (depending on design loads). The surficial sediments of the Yarra Delta (i.e. river muds and Coode Island Silt) have low strength and are prone to significant consolidation and creep settlements, and shallow footings are not recommended. Elsewhere, where above-grade or elevated infrastructure is proposed, we consider that elevated structures founded on piles extending to the moray street gravels or deeper would be more appropriate than earthfill embankments or structures founded on shallow footings, which would be prone to extensive settlement over time.

References:

GHD (2007) Melbourne Water Melbourne Main Sewer Replacement Project Factual Report on Geological, Geotechnical and Hydrogeological Investigations (Phase 1 and 2).

Ervin, M.C., (1992) Engineering properties of Quaternary age sediments of the Yarra Delta, Engineering Geology of Melbourne, Balkema, Rotterdam.

2.7 Recent / Future Upgrades in Adjacent Area

2.7.1 West Gate Freeway Upgrade – Bolte Bridge to Power Street

As part of the City Link Tulla Widening project, an additional lane will be added in each direction across the Bolte Bridge and an additional lane on the ramp that takes traffic to the West Gate Freeway and toward the south eastern suburbs (Burnley Tunnel). A review was undertaken of the upgrade plans proposed for the widening works to determine what (if any) impact this may have on the Lorimer Street / Montague Street corridor adjacent to Charles Grimes Bridge. This review showed that the proposed widening works in this area will be incorporated within the existing Freeway corridor with changes to lane arrangements finishing prior to the Lorimer Street intersection. Therefore these works will not impact on any proposed options for a PTAT link across Charles Grimes Bridge.

2.7.2 Wicked Problems Cycling Upgrade Works

As part of the Wicked Problem Cycling Upgrade works program 2015-16 some minor upgrade works have been completed through the Montague Street Interchange. This work included the installation of bicycle lanterns at the Montague Street / Westgate Freeway interchange for northbound cyclists as cyclists were getting stuck in the intersection along Montague Street once the traffic signals turned red and cars started coming off the Westgate Freeway. This was due to them not having enough clearance time to safely cross the intersection.

2.7.3 Western Distributor

The Western Distributor project is a $5.5 billion transport solution that will streamline traffic from Geelong to Pakenham. It is made up of three interrelated major projects: the Monash Freeway Upgrade, Webb Dock Access, and the Western Distributor. This project is being delivered by Transurban and the State.

The Western Distributor will provide a vital second river crossing, reduce travel times from the west by 20 minutes and remove 6000 trucks off local streets. The project includes widening the West Gate Freeway and connecting it to the Port of Melbourne, City Link and the CBD via a new road tunnel under Yarraville. A bridge over the Maribyrnong River will provide an alternative river crossing to the West Gate Bridge. A direct connection to the Port from Hyde Street will get trucks off local streets to relieve congestion. The project Reference Design has just been released into the public domain and for tender with three proponent teams developing tender designs in a design construct environment. The Reference Design includes widening of Wurundjeri Way from two lanes in each direction to three lanes in each direction up to the Flinders Street intersection.

The key impact this project will have on Charles Grimes Bridge will be changes to traffic patterns around this area with the potential for traffic redistribution away from Westgate Freeway to Western Distributor for people who access the CBD to the north as Western Distributor will provide a more direct route for these motorists. Further consideration of these impacts will need to be taken into account when developing concept designs.

A review of the DEDJTR Western Distributor Network Impact Assessment Report completed in November 2015 was undertaken to determine what the modelled impacts were for Charles Grimes Bridge / Wurundjeri Way. This report provided an overview of the transport modelling undertaken and outcomes of this modelling on the wider transport network, which included the Westgate Freeway and Wurundjeri Way. This modelling showed that 24hr volumes across Charles Grimes Bridge were expected to reduce in 2031 with Western Distributor in place. The 24hr volumes along Wurundjeri Way were expected to increase in 2031. Further investigation of the changes in volumes around the project area will be assessed during Stage 3 of the study.

3. Existing Conditions – North Wharf

Three North Wharf options have been assessed as shown in Figure 3.1 below. Each of the alignments intersects with the Yarra's Edge Precinct on the southern side of the Yarra River, and the Lend Lease proposed Development Plan for Collins Wharf (North Wharf) on the northern side of the Yarra River.

Figure 3.1 – North Wharf Options

Two of the three options were assessed as part of the Fishermans Bend LRT Alignment Options Report completed by Aurecon in 2013. These were the Orange (centre) alignment and Green (eastern) alignment. Neither option were considered feasible due to the significant required to the Victoria Harbour Development Plan (north side of the river) plus the impacts on the Yarra's Edge Development (south side of the river) with this area either now fully developed or under construction. The road connections on the south side are narrow and would struggle to fit a tram connection plus active mode facilities. Therefore these options have not been considered further as part of this study.

The feasibility of the Brown (western) alignment has not been considered previously. Places Victoria provided information on the proposed development of North Wharf and Yarras Edge. This information has been reviewed to determine the feasibility of the western alignment option.

3.1 Existing Structures – North Wharf

A review of the Robert Bird Group (RBG) Report Structural Report of North Wharf – Collins Street Remediation completed in November 2014 was completed to understand whether the North Wharf structure was proposed to be strengthened as part of the Victoria Harbour Collins Wharf Development and if it was could it cater for tram and / or bus loadings.

The RBG report states that the Collins St extension is to be located on the piled structure on the land side of the North Wharf (Collins St Wharf) with no allowance for tram access. See Figure 3.2 below.

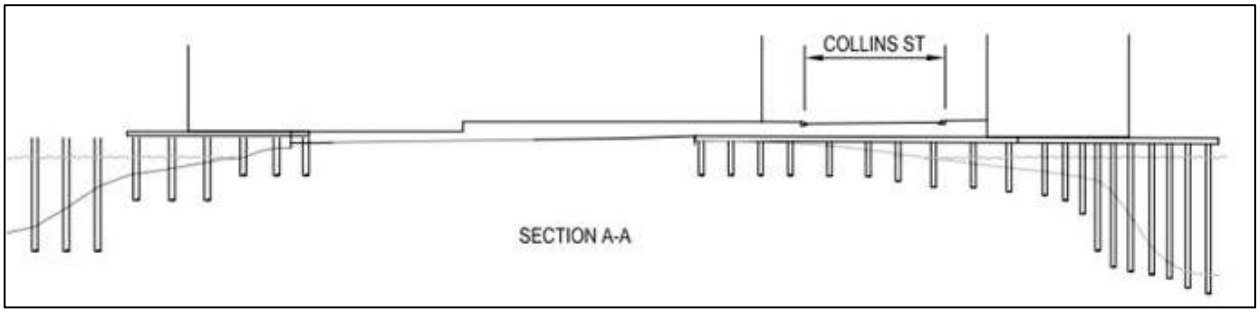


Figure 3.2: Proposed location of Collins St Extension (from RBG Report)

The design traffic loads nominated for the structure are 12.0 kPa. This is well below that required for an E Class tram axle load, which could be in the order of around 70kPa. Therefore, based on the proposed wharf development and remediation outlined in the RBG report the wharf will not be capable of supporting tram loadings in the future. The work required to strengthen the wharf to cater for an E Class tram could include providing additional piles and deck slab strengthening. This is not currently proposed within the strengthening works been undertaken as part of the development of this area of the wharf.

3.2 Existing Planning Assessment / Land Ownership Issues

3.2.1 Land Tenure

Land tenure arrangements within the North Wharf option area is a combination of Crown land, private land and road reservations. Table 3.1 below identifies each of the separate parcels of land within the area and ownership details.

Table 3.1 – Land Tenure

Appendix B Label	Allotment Details	Address		
40	Lot S5 PS724267	172-192 LORIMER STREET DOCKLANDS	Urban Renewal Authority Victoria	Vacant land, part of Yarra's Edge
41	Lot S6 PS724267	80 SOUTH WHARF DRIVE DOCKLANDS	Mirvac (Docklands) Pty Ltd	Catalina Place
42	Lot S3 PS724267	72-78 SOUTH WHARF DRIVE DOCKLANDS	Urban Renewal Authority Victoria	Town house development under construction
43	Lot S4 PS724267	69-85 SOUTH WHARF DRIVE DOCKLANDS	Mirvac (Docklands) Pty Ltd	Apartment under construction
44	Lot (unknown) PS428541	140 RIVER ESPLANADE DOCKLANDS	No information available	River Esplanade
45	Allot. 2038 PARISH OF MELBOURNE SOUTH			Yarra River
46	Allot. 2382 PARISH OF DOUTTA GALLA		Crown land: Melbourne Water is the administrator	Yarra River
47	Allot. 24 Sec. 1B PARISH OF DOUTTA GALLA	NORTH WHARF ROAD DOCKLANDS		Western end of North Wharf
48	Lot S39 PS545345	2/ NORTH WHARF ROAD DOCKLANDS 3/ NORTH WHARF ROAD	Urban Renewal Authority Victoria	North Wharf

Appendix B Label	Allotment Details	Address		
		DOCKLANDS 4/ VICTORIA HARBOUR PROMENADE DOCKLANDS SHED 4 NORTH WHARF ROAD DOCKLANDS SUBSTATION NORTH WHARF ROAD DOCKLANDS		
49	Allot. 2029 PARISH OF MELBOURNE NORTH		Crown land: Melbourne Water Corporation is the administrator	Yarra River
50	Lot R17 PS545345 (ROAD parcel)		Melbourne City Council	Road

3.2.2 Planning Approval Requirements

As per the Charles Grimes Bridge option in Section 2 of this assessment, the North Wharf options area is located within the City of Melbourne and therefore subject to the provisions of the Melbourne Planning Scheme.

3.2.3 Planning Scheme definitions

The Melbourne Planning Scheme contains standard land use definitions at Clause 72 and Clause 74; however, a definition for a road is not found within either of these clauses.

A road is defined in Section 3 (1) of the *Planning and Environment Act 1987* as:

> *"road" includes highway, street, lane, footway, square, court, alley or right of way, whether a thoroughfare or not and whether accessible to the public generally or not*

“Tramways” is defined in Clause 74 of the Melbourne Planning Scheme as:

> *Land used to provide a system of transport in vehicles connected to a network of tracks, and includes tram stops, shunting areas and associated passenger facilities.*

3.2.4 Melbourne Planning Provisions

The Melbourne Planning Scheme sets out a range of planning controls including zones and overlays. These provisions determine whether planning approval is required for the use and / or development of land.

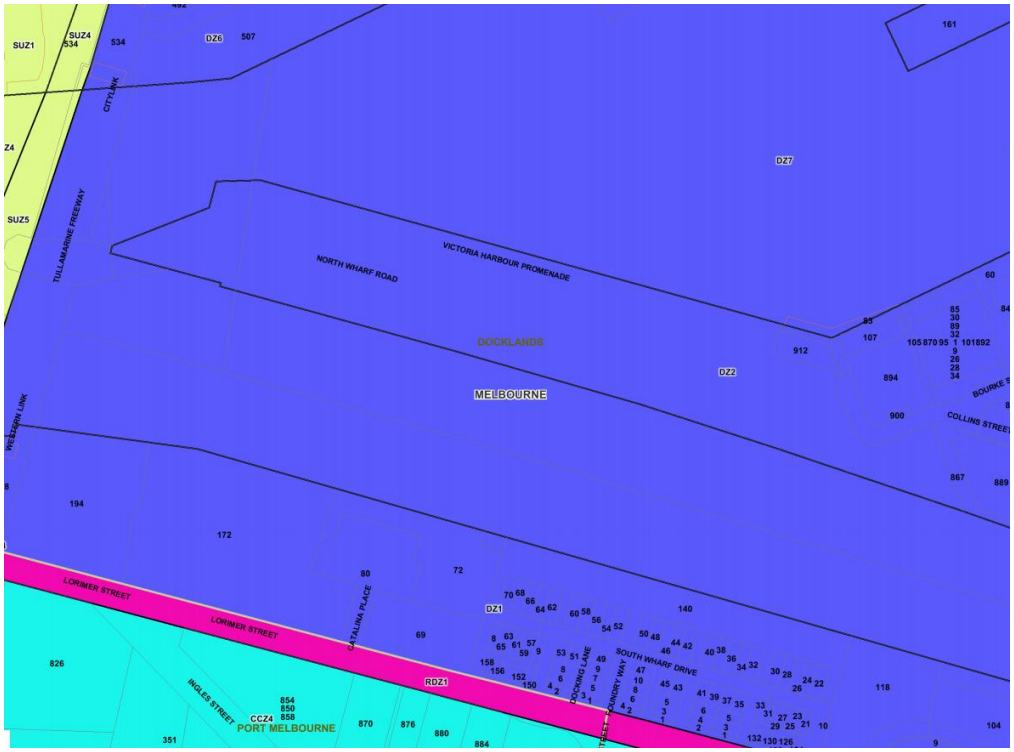
The option considered is predominantly within the Docklands Zone:

- Schedule 1 – Yarra’s Edge Precinct (DZ1);
- Schedule 2 – Victoria Harbour Precinct (DZ2);
- Schedule 7 – Waterways (DZ7); and
- Lorimer Street is within the RDZ1.

Figure 3.3 shows the site in relation to relevant zones of the Melbourne Planning Scheme.

The following overlays are found within the project area:

- Design and Development Overlay (Schedule 12 – Noise Attenuation Area) (DDO12);
- Design and Development Overlay (Schedule 49 – Yarra's Edge Precinct) (DDO49);
- Design and Development Overlay (Schedule 50 – Victoria Harbour Precinct) (DDO50);
- Development Plan Overlay (Schedule 2 – Docklands-Yarra's Edge Precinct) (DPO2);
- Development Plan Overlay (Schedule 3 – Victoria Harbour Precinct) (DPO3);
- Parking Overlay (Schedule 6 – Docklands-Victoria Harbour) (PO6); and
- Parking Overlay (Schedule 11 – Docklands-Yarra's Edge) (PO11).



Source: http://services.land.vic.gov.au/maps/pmo.jsp

Figure 3.3 – North Wharf Zone Map

The planning controls and approval triggers that apply to the project area are described in Table 3.2 below.

Table 3.2 – Planning Controls

Planning Control	Planning Approval Required? (Y/N)	
	Buildings and Works	Use for Road or Tramway
Zones		
Public Park and Recreation Zone (PPRZ)	Y	Y
Road Zone, Category 1 (RDZ1)	N	N
Docklands Zone (Schedule 1 – Yarra's Edge Precinct) (DZ1)	Y	N for Tramway Y for Road

Planning Control	Planning Approval Required? (Y/N)	
	Buildings and Works	Use for Road or Tramway
Docklands Zone (Schedule 2 – Victoria Harbour Precinct) (DZ2)	Y	N
Docklands Zone (Schedule 7 – Waterways (DZ7)	Y[5]	Y
Overlays		
Design and Development Overlay (Schedule 12 – Noise Attenuation Area) (DDO12)	N	N
Design and Development Overlay (Schedule 49 – Yarra's Edge Precinct) (DDO12)	Y[6]	N
Design and Development Overlay (Schedule 50 – Victoria Harbour Precinct) (DDO50)	Y[7]	N
Development Plan Overlay (Schedule 2 – Yarra's Edge Precinct) (DPO2)	N	N
Development Plan Overlay (Schedule 3 – Docklands-Victoria Harbour) (DPO3)	N	N
Parking Overlay (Schedule 6 – Docklands-Victoria Harbour) (PO6)	N	N
Parking Overlay (Schedule 11 – Docklands -Yarra's Edge) (PO11)	N	N

3.2.5 Particular Provisions

The Particular Provisions of the Melbourne Planning Scheme may also trigger the need for planning approval associated with this project.

3.2.5.1 Clause 52.29 - Land adjacent to a road in a Road Zone, Category 1, or a Public Acquisition Overlay for a Category 1 Road.

Clause 52.29 aims to ensure appropriate access to identified roads. An application to create or alter access to, or to subdivide land adjacent to, a road declared as a freeway or arterial road under the *Road Management Act 2004*, land owned by the Roads Corporation for the purpose of a road, or land in a Public Acquisition Overlay if the Roads Corporation is the acquiring authority for the land, must be referred to the Roads Corporation under Section 55 of the Act.:

3.2.6 Other Strategic Documents

3.2.6.1 Victoria Harbour Collins Wharf Development Plan

Places Victoria has advised that the developer of Collins Wharf (the North Wharf) is Lend Lease. A Victoria Harbour Collins Wharf Development Plan has been produced by Lend Lease, which has been approved by the Planning Minister. This development plan does not incorporate a tram corridor through this area and has been developed on this basis. Therefore the cross sections developed for the extension for Collins Street and laneways off this (to the water's edge) have not been developed with corridor widths to incorporate a tram network.

Complex ownership arrangement, lease agreements and maintenance agreements have been developed to support the Collins Wharf Development Plan, which would be significantly impacted by the introduction of a tram connection through this area.

[5] An application for a permit requiring disturbance of the bed of the Yarra River and Victoria Harbour must be accompanied by appropriate maritime archaeological investigations
[6] Some exemptions may apply in relation to extent of building.
[7] ibid

3.2.6.2 Yarra's Edge Bolte Precinct Development Plan

Places Victoria has advised that the developer of the Yarra's Edge Bolte Precinct (western end of the Yarra's Edge development area) is Mirvac. A Yarra's Edge Bolte Precinct Development Plan has been produced by Mirvac, which has been approved by the Planning Minister. This development plan does not incorporate a tram corridor traversing through this area to access Lorimer Street. Therefore the cross sections developed for the access streets running perpendicular to the Yarra River have not been developed with widths to cater for a tram network.

3.3 Other Considerations

3.3.1 Western Connection Alignment

Although no specific alignment plans have been prepared for the Western alignment (Brown) it is assumed that any bridge vertical alignment will be similar to what can be achieved for the proposed Collins Street extension, which would require an opening structure to allow for tall masted boats to access Yarra's Edge Marina. This connection would then require upgraded intersections on either side of the river – Ingles Street on south side and Collins Street extension on the north.

4. Hartley Street Option

The Hartley Street option has been assessed as shown in Figure 4.1 below. The alignment commences on the south side of the river at the intersection of Lorimer Street and Hartley Street and traverses northwards across the Yarra River to the future Tom Thumb Lane before turning onto Collins Street at the Bourke Street intersection.

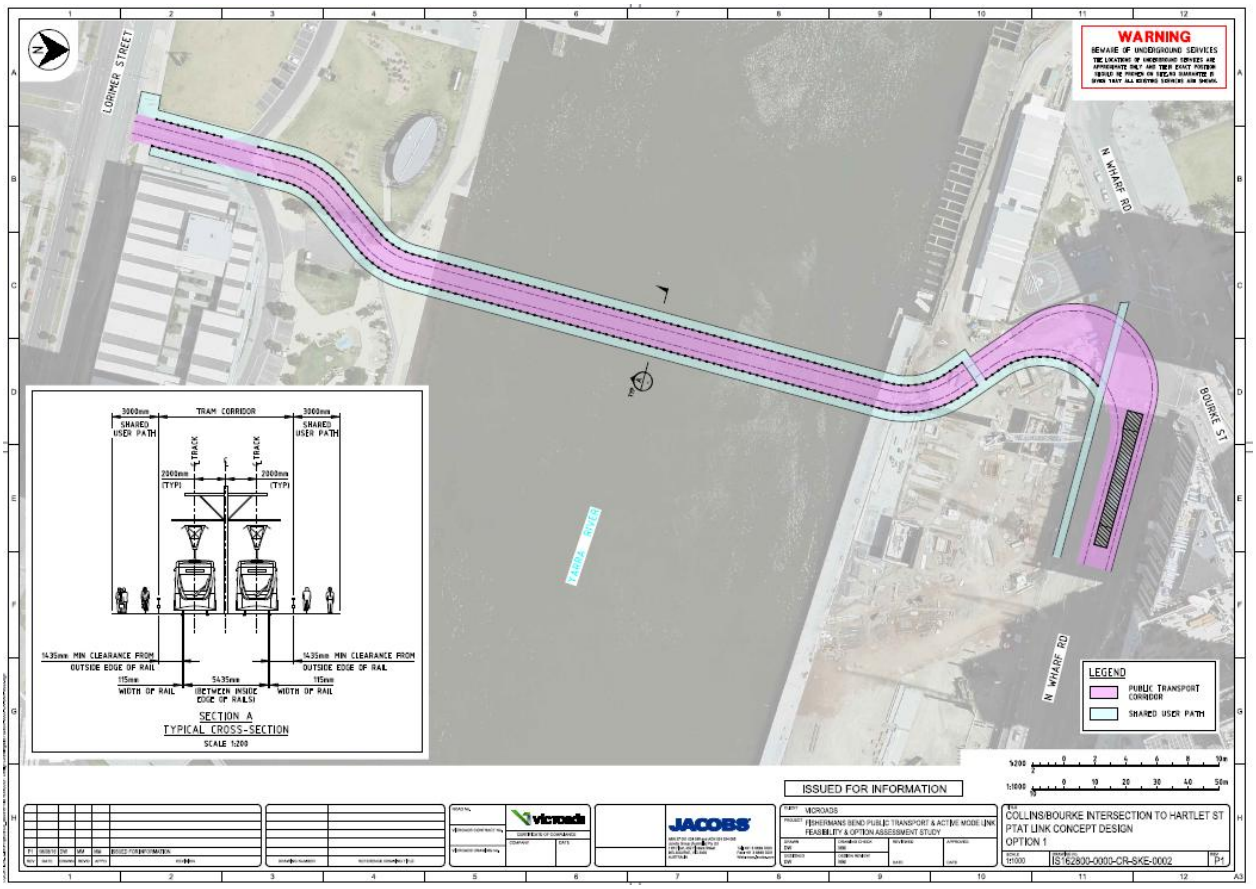


Figure 4.1 – Hartley Street Option

Figure 4.1 shows the required swept path for the tram to turn the tight corner from Collins Street onto the furture Tom Thumb Lane. This swept path cuts through a building with planning approval on the south east corner of the Collins Street (North Wharf Road) / Bourke Street intersection. The details of the planned building on this corner are shown below in Figure 4.2 and 4.3 from the approved City of Melbourne Planning application for 839 to 889 Collins Street, Docklands.

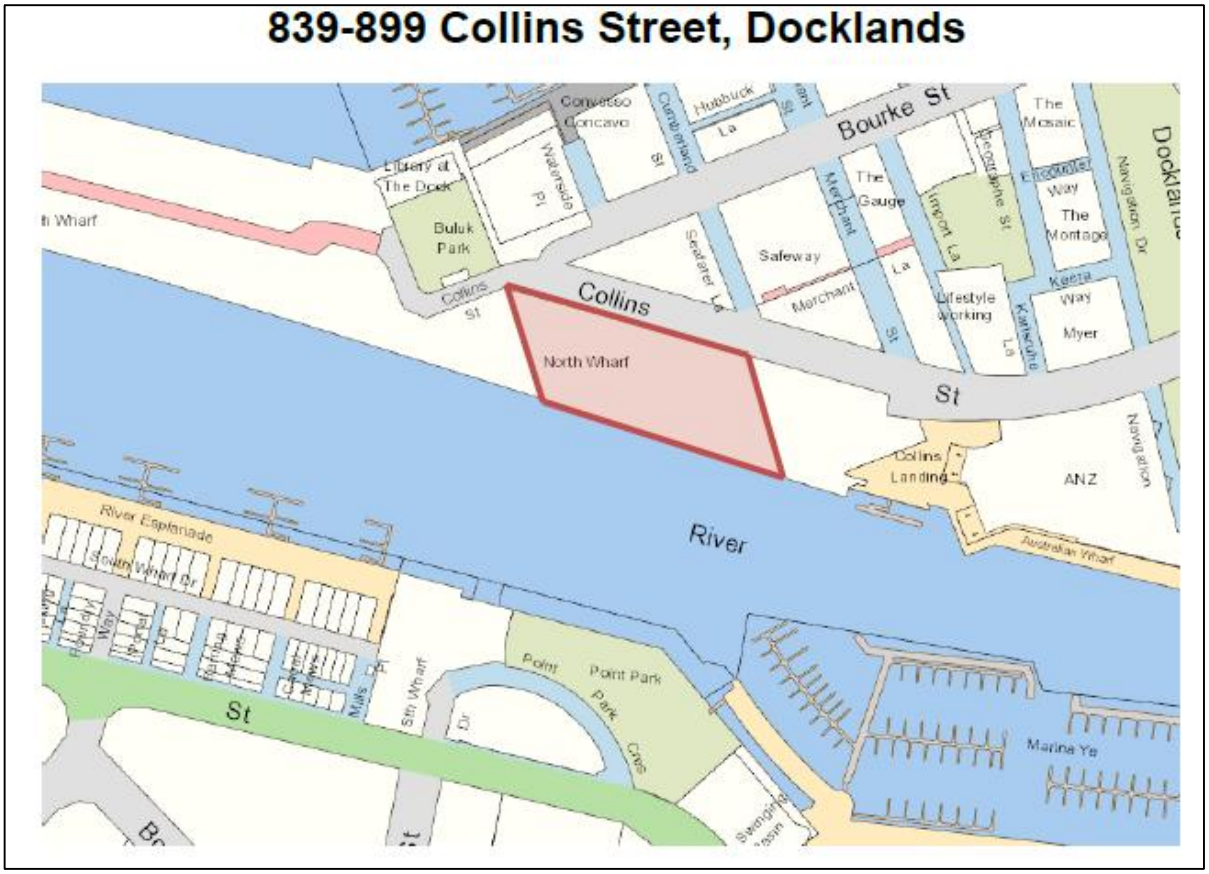


Figure 4.2 – Location of Approved Development - 839 to 889 Collins Street

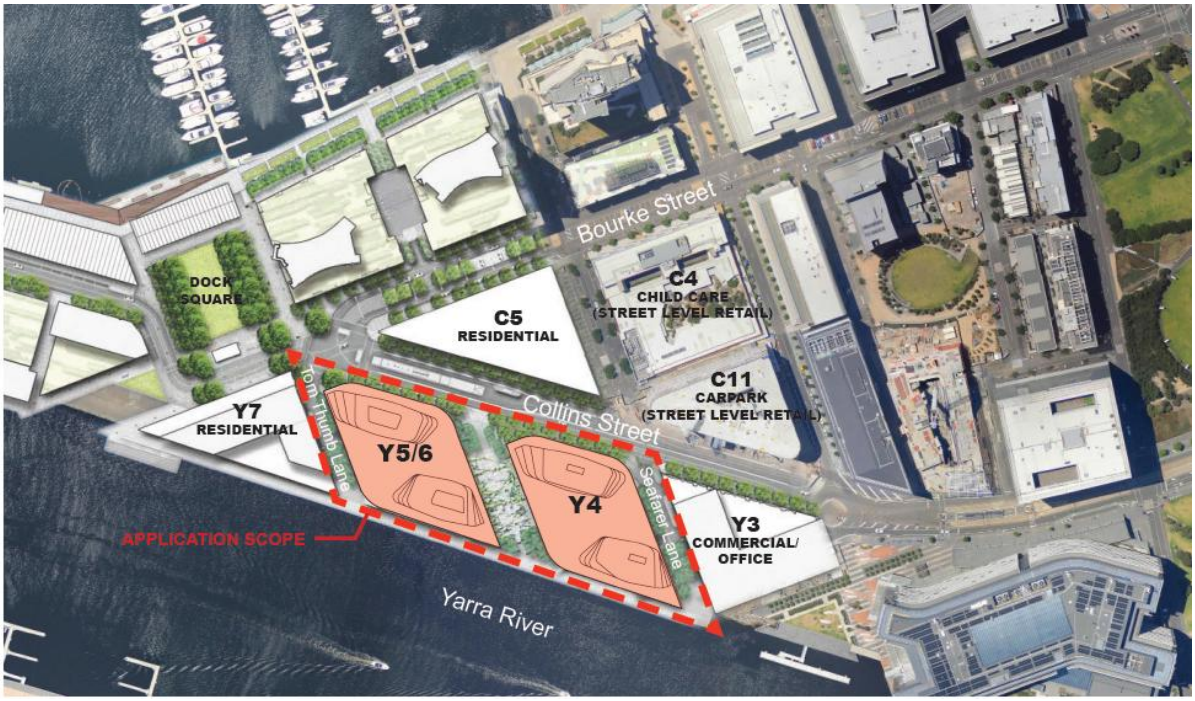


Figure 4.3 – Approved Development – 839 to 889 Collins Street

The extent of overlap of the tram swept path with the closest building on the corner is shown in Figure 4.3. The tram tracks have been pushed as far west as possible to minimise the impact on the building but this still shows that the tram cannot turn the tight corner onto Collins Street within the road corridor available.

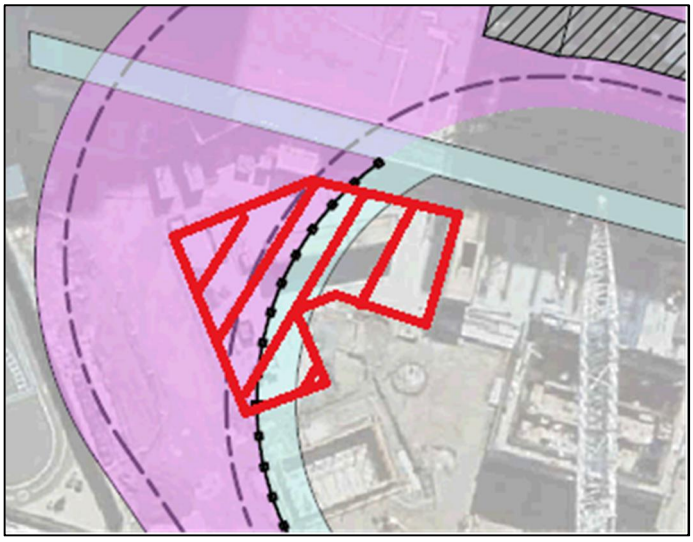


Figure 4.4 – Tram swept path and impact on approved building at 839 to 899 Collins Street

Therefore due to this impact shown in Figure 4.4 this option is deemed unfeasible to continue further in the study.

5. Design Standards for Tram

The design standards required for a future tram connection are provided below for an E-Class Tram. These are based on VRIOGS 005.1 - Tram Track Design Manual.

5.1 Horizontal Alignment

5.1.1 Track Centres

Track Centres: 3.353m (normal straight track)

Track Centres: 3.800m (straight track for minimum kerb access or easy access tram stops)

Track Centres: 4.00m (straight track with centre poles)

5.1.2 Radius

Preferred minimum main line: 350m

Minimum from one street to another 25.0m

Absolute minimum: 18.3m

5.1.3 Clearances (from straight track)

Tram to permanent structures (this includes traffic barriers): 1420mm to nearest rail

Tram to other vehicles (standard clearance line): 900mm to nearest rail (when vehicle is travelling in the same direction to the tram)

Trams to other vehicles (standard clearance line): 1420mm to nearest rail (when vehicle is travelling in the opposite direction to the tram)

5.2 Speed

Max 70km/h

Through special work (points / junctions): 10km/h

5.3 Vertical Alignment

Maximum track longitudinal alignment: 6.67%

Radius – desirable minimum: 760m

Radius – absolute minimum: 500m

5.4 Overhead Requirements

2.0m circular arc clearance around trolley wire (normally 5640mm above top of rail but down to minimum of 5070mm)

Face of Overhead Poles (OHP's) to be 1420mm from nearest rail (on straight track).

When developing concept designs for a tram connection further consideration will need to be given to how the overhead requirements will be catered for within the proposed corridor.

5.5 Potential Tram Configurations – Charles Grimes Bridge

Figure 5.1 and 5.2 show the potential typical cross sections for a tram connection across Charles Grimes Bridge at-grade to give an indication of the width that is likely to be required to cater for a two way tram connection based on the design standards provided above. These assume that the OHP's will be side positioned rather than centrally positioned as centrally positioned OHP's require additional width.

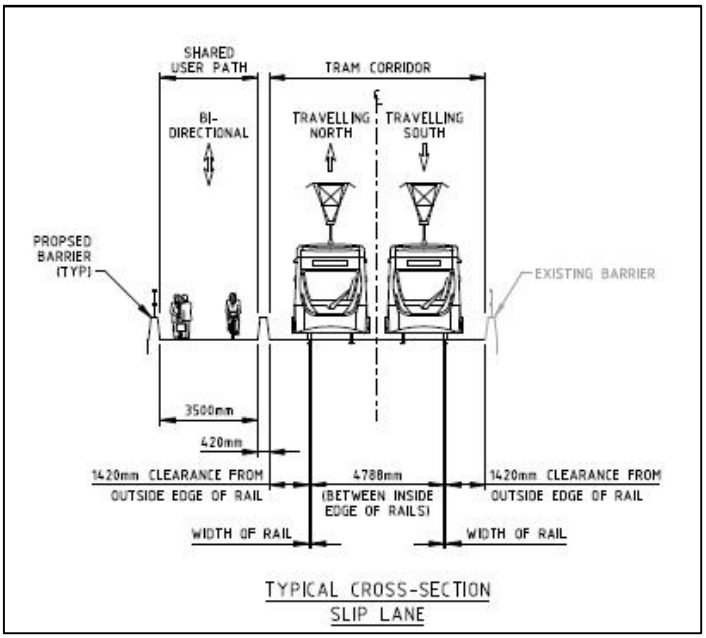


Figure 5.1 – Potential tram connection configuration (two way) on Charles Grimes Bridge Slip Road

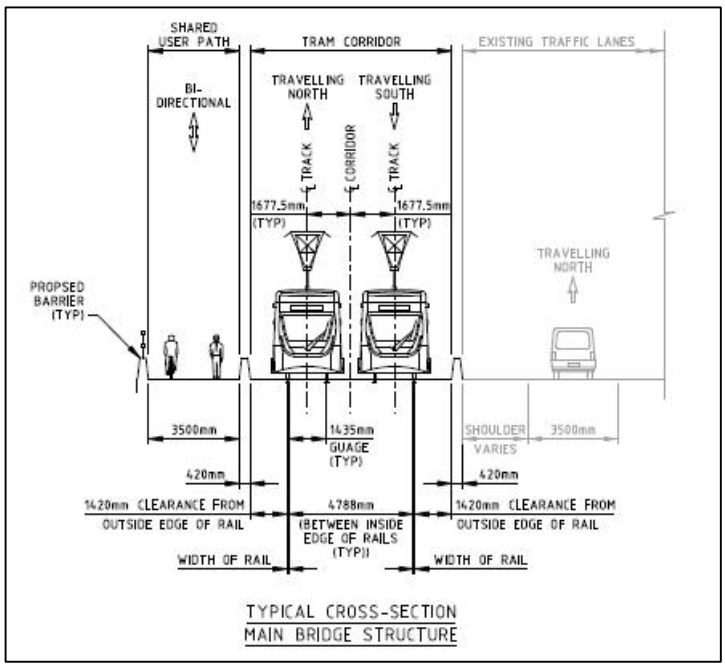
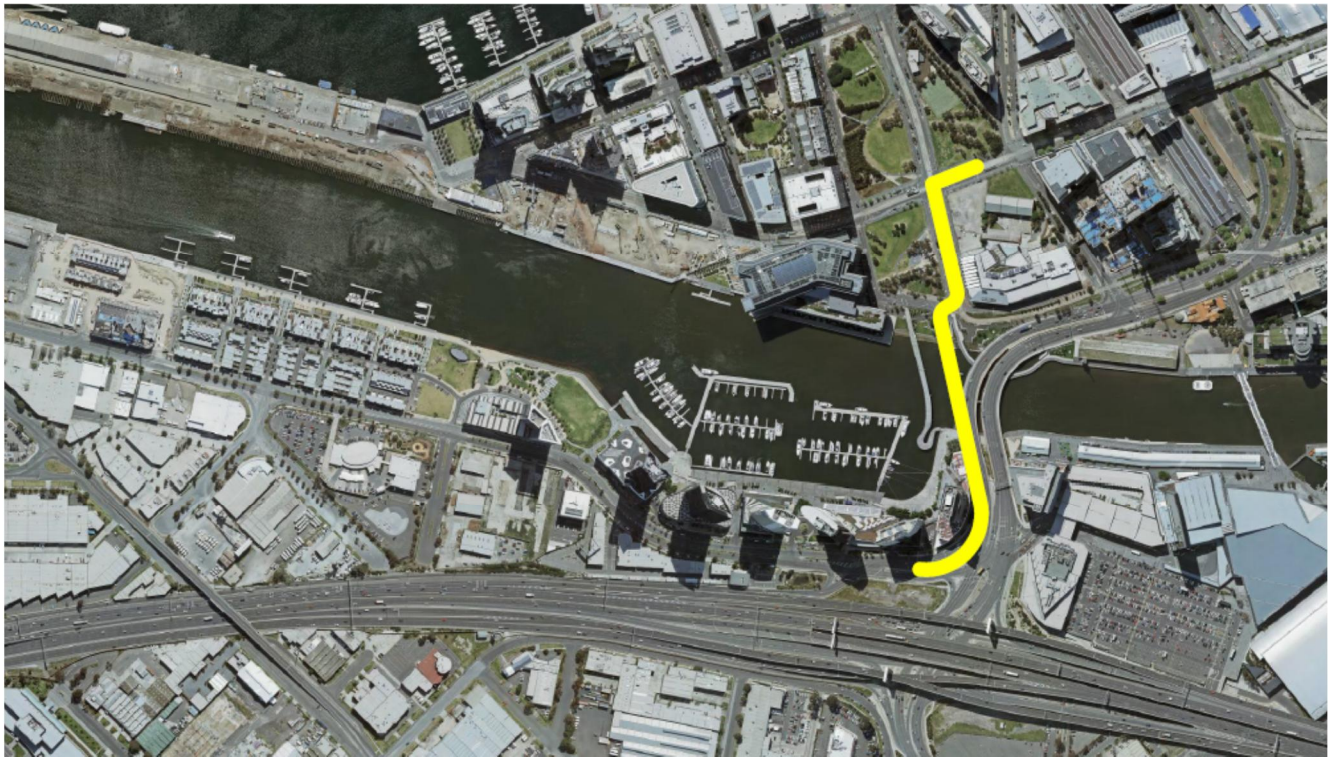


Figure 5.2 – Potential tram connection configuration (two way) on Charles Grimes Bridge Main Carriageway

6. Feasibility Assessment of Options

This section of the report assesses the feasibility of each of the options that the client project team have requested be assessed along with some discussion on any alternatives that could be considered further.

6.1 Charles Grimes Bridge – Option 1 – At Grade PT Corridor



6.1.1 Route Description

This option would utilise the existing Charles Grimes Bridge slip road structure that currently connects to Navigation Drive to incorporate a public transport link. This link would then continue south across the bridge on the western side and continue around the corner onto Lorimer Street and continue west along Lorimer Street. This option will also include additional active transport capacity to cater for the increase in pedestrians and cyclists expected from the Fishermans Bend area. If a light rail option was considered for this link the tram would join into the existing tram tracks running along Harbour Esplanade.

6.1.2 Potential Impacts

The structural assessment completed for the existing Charles Grimes Bridge, refer to Section 2.3, advises that the existing bridge appears that it would be capable of being modified for use as a dedicated tram bridge with relatively minor modifications to the deck without any strengthening required.

One of the potential constraints with an at-grade solution is the limited space available between the building on the northwest corner of the Lorimer Street / Wurundjeri Way intersection and the existing bridge structure. Currently a ramp is provided down from the bridge to the River Esplanade. This will limit the ability to widen the bridge much on the west side in this area until past the existing ramp structure. This will require the need to reallocate more space from the main bridge carriageways for the PTAT connection.

The main impact associated with an at-grade PTAT link is the effect on traffic across the structure and at the adjacent intersections. Some of the key impacts include:

- Removal of northbound traffic movements from the slip lane. These movements would need to be redirected to along Batman Hill Drive and onto Collins Street to access the Docklands area;
- The impacts to the Charles Grimes Bridge / Harbour Esplanade / Navigation Drive intersection should be relatively minor as the current movement off Charles Grimes Bridge will be replaced with a bus / tram movement instead, which should not increase the timing at the intersection significantly. The only consideration will be to the phasing required for the tram connecting onto the existing tracks on Harbour Esplanade and this could be timed with the pedestrian crossing phase across Harbour Esplanande;
- The layout of the Lorimer Street leg of the Lorimer Street / Wurundjeri Way / Montague Street intersection will need to be altered to include a tram around the north western corner of this intersection. This is likely to result in the removal of at least one of the left turn lanes, which will impact on queuing and increase traffic delays along Lorimer Street. It may also impact the through / right turn movements on this leg as modifications will be required to the layout to incorporate an altered left turn movement depending on the concept design solution developed; and
- The tram will need to cross over to the centre of Lorimer Street as soon as possible past the Wurundjeri Way intersection. This is best placed to cross to the centre at the Lorimer Street exit ramp. Remodelling of the traffic signal phasing would be required to allow for this movement to occur but this could potentially run with one of the existing phases. Also consideration will need to be given to how this would work under a bus rapid transit option and how westbound buses would exit the PTAT link.

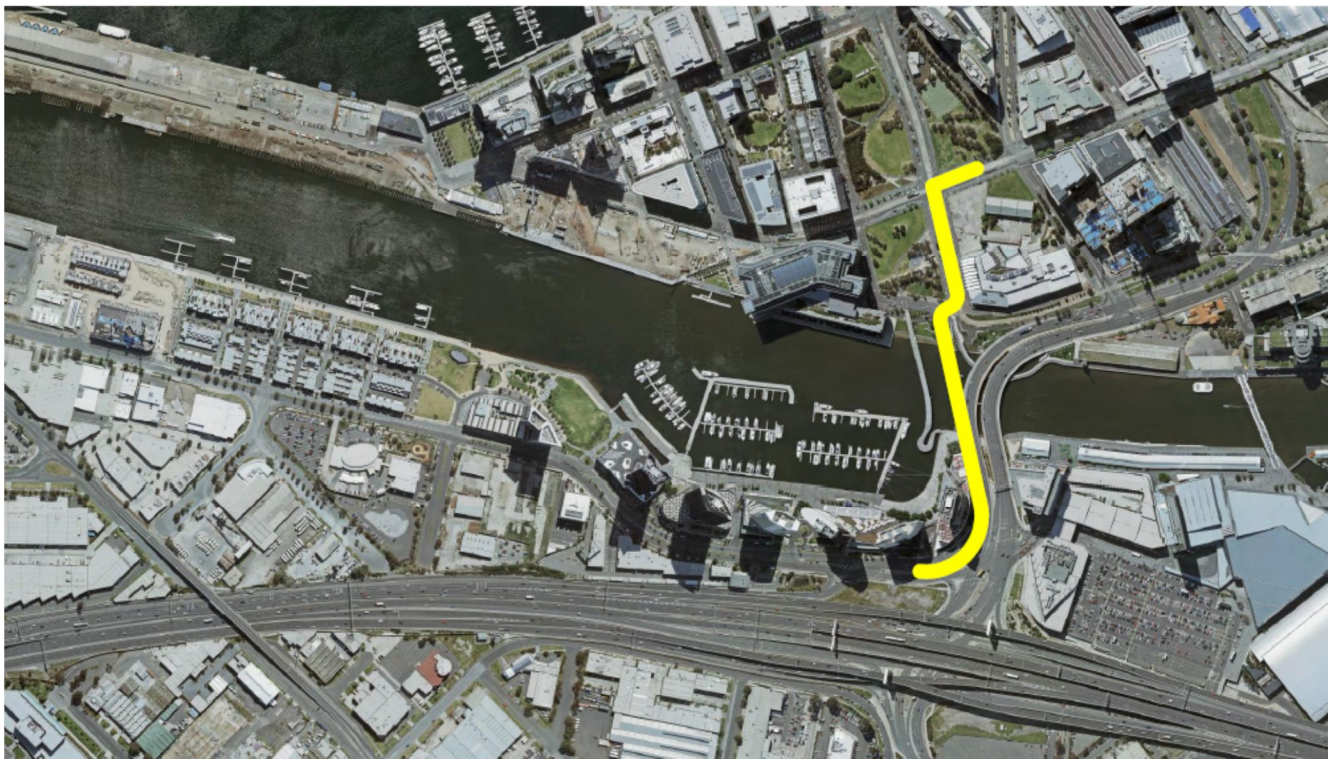
The other consideration for this option will be what effect a PTAT link will have on access to the buildings along the north side of Lorimer Street, such as Cargo Lane, due to the inclusion of a PTAT link along this northern side of Lorimer Street for approximately 100m prior to crossing to the centre of Lorimer Street at the exit ramp.

6.1.3 Option Feasibility

This option is considered feasible to continue through to Stage 2 of the study, acknowledging that there may be adverse traffic impacts associated with this option. These will need to be considered further during the concept design stage. Further information on the potential changes to traffic flows in this area following the completion of Western Distributor will be used to determine the likely traffic impacts for this option.

Further consideration will also need to be given to the form the active transport link will take. Currently it is proposed that this will cantilever off the edge of the existing bridge. Another option that could be considered is introducing a connection through Cargo Lane (Yarra's Edge) connecting to the existing Webb Bridge.

6.2 Charles Grimes Bridge – Option 2 – Elevated PT Corridor



6.2.1 Route Description

This option would utilise the existing Charles Grimes Bridge slip road structure at grade, as per Option 1 but would then increase in grade south of the slip road becoming an elevated structure along the same alignment as Option 1. The structure would potentially cross to the south side of Lorimer Street before proceeding (or alternatively run down the centre of Lorimer Street.

6.2.2 Potential Impacts

6.2.2.1 Structural Options for Elevated Structure

The minimum clearance over Lorimer St would need to be 5.9m (to meet the current requirements for the over dimension route along Lorimer Street and Wurundjeri Way). To achieve this height it would be necessary to start elevating the track at approximately Pier 2/Pier 3 on the Charles Grimes bridge and continuing the vertical grade up towards Lorimer Street. This would require removal of some girders and deck and modification to existing piers to increase pier height. Traffic barriers would also need to be relocated eastwards to cater for remaining traffic on the bridge which would require modification to the deck and installation of new barriers. Piers could be positioned along the edge of the existing traffic lanes. Due to the high skew of the Lorimer Street intersection with Monatgue Street and the number of lanes the main span is approximately 60-70m depending on location of piers in the central median or traffic islands. Figure 6.1 and Figure 6.2 show some indicative location depending on final geometry of the tram.

Pier protection will be necessary to piers located close to the edge of the traffic lane and would require further review. The bridge would then either continue to span to the south side of Lorimer Street or potentially be aligned along the central median of Lorimer Street. In the case of the bridge spanning to the south of Lorimer Street (Figure 6.1) it would be necessary to keep the structure elevated above the exit ramp from the West Gate Freeway as there is insufficient room to get back to grade before the existing intersection. On the west of this exit ramp the structure could return back to grade however impacts on the existing commercial properties would be high. Similarly, for the option where the structure is aligned in the central median (Figure 6.2 and Figure 6.3), it would be necessary to keep the structure at full elevation to allow vehicles to pass under from the West

Gate Freeway exit ramp. The structure could then return back to grade along the median. However the existing U-turn/right turn would need to be removed to accommodate the structure.

The introduction of an elevated structure would potentially affect views from the existing development closest to the bridge near the edge of the Yarra River. There may also be additional noise considerations to be addressed with an elevated tram.

The approximate length of elevated structure would be over 400m which is expected to have a high capital cost due to the complex brownfield site, proximity to live traffic, works over water, modification to existing structures, impacts to utility services etc.

Figure 6.1 – Sketch plan of potential structure south side of Lorimer Street

Figure 6.2 - Sketch plan of potential structure centre of Lorimer Street

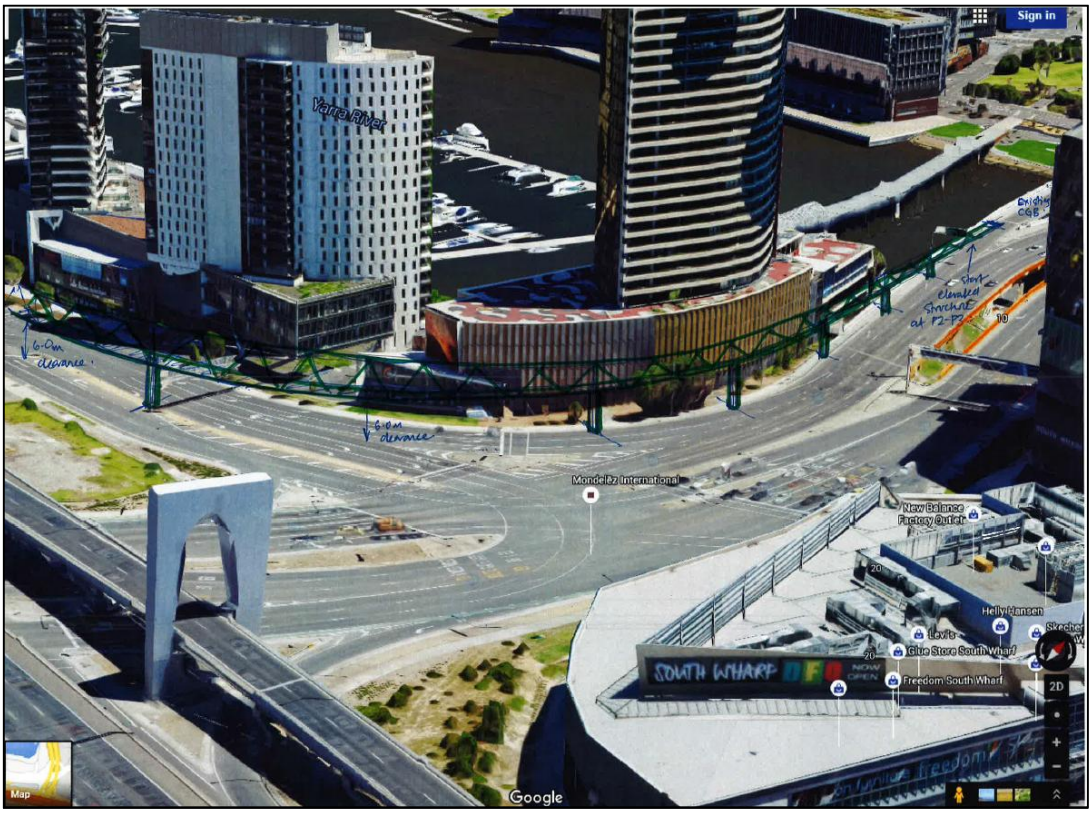


Figure 6.3 – Sketch elevation of potential structure centre of Lorimer Street.

6.2.2.2 Elevated Structure Type

To minimise structure depth a box truss solution could be used which could potentially consist of a pair of steel trusses connected across the top with deck spaning in between. The superstructure could be supported on a single pier column with capital to reduce impact on existing traffic lanes. For both options a large curved section of truss would be necessary which would have significant design/construction challenges. Urban / architectural input would be necessary to create an acceptable form which complements the area. An alternative could be twin steel trough girders with tram on a reinforced concrete deck above. This would potentially provide more visual impact compared to a truss and would need to be reviewed further.

6.2.2.3 Traffic Impacts

The traffic impacts associated with this option will be significantly reduced compared to Option 1 as the main impact would be with the removal of the northbound traffic movements from the slip lane. These movements would need to be redirected to along Batman Hill Drive and onto Collins Street to access the Docklands area.

The impact to the Lorimer Street / Wurundjeri Way / Montague Street intersection would be significant reduced under this option as the PTAT link would be elevated minimising impact to the intersection. However further investigation would need to be undertaken to position the structure piers so to minimise impacts on traffic lanes. This will need to be balanced with the length of span required for the structure. Reducing the spans would be essential to reducing cost of an elevated structure, which would in turn could potentially impact on traffic lanes i.e. if a pier was considered for the raised island between the left turn lanes and through / right turn lanes on Lorimer Street to reduce the 60m span.

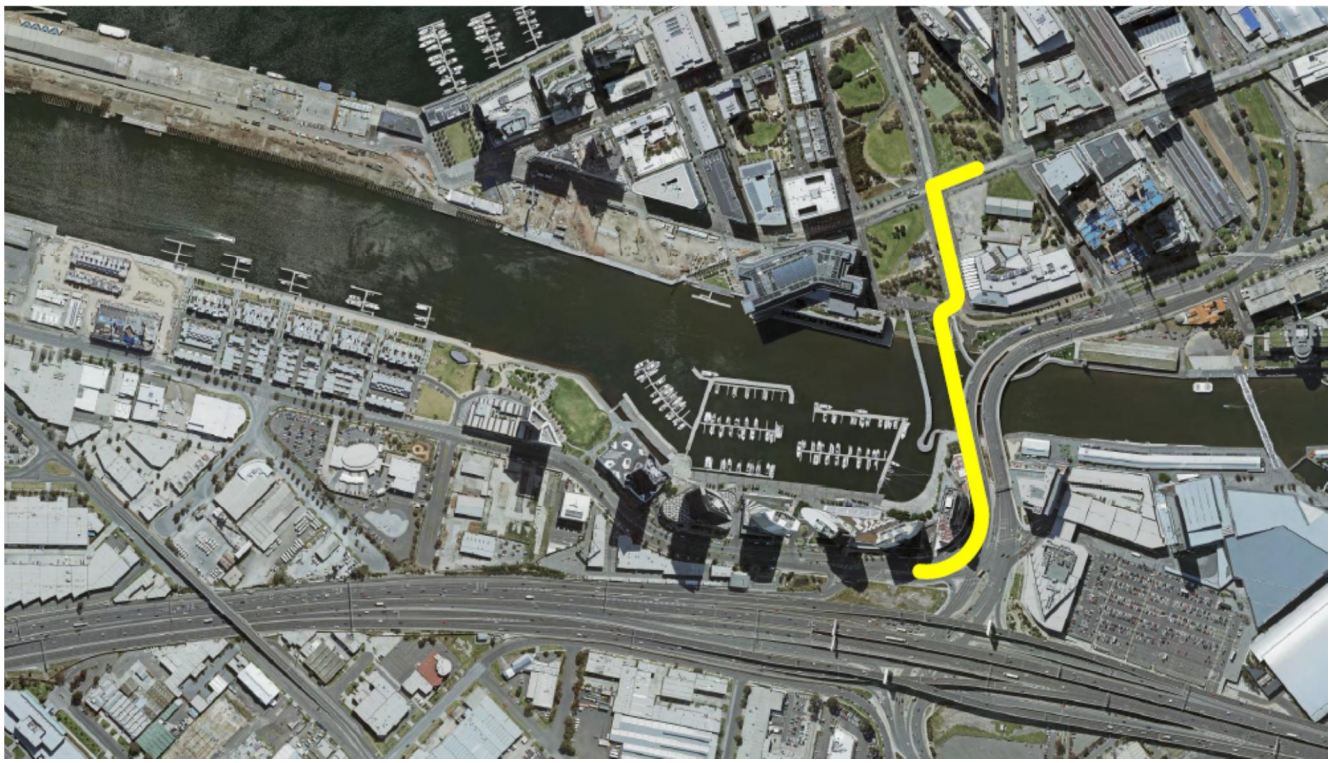
6.2.3 Option Feasibility

The elevated structure utilising the centre of Lorimer Street is considered feasible to continue through to Stage 2 of the study. The key issue with this option will be the cost of the option due to the length of structure being over 400m long. Also further work would be required to see if the spans can be reduced in length. The other key consideration with this option when developing a concept design is the visual impact, particularly the impacts this may have on the corner property (Tower 1 of Yarra's Edge).

The elevated structure utilising the south side of Lorimer Street is not considered feasible due to the significant impact this would have on the properties to the west of the Lorimer Street exit ramp.

Further consideration will also need to be given to the form the active transport link will take under this option. This may be similar to the options considered for Option 1 with a shared user path cantilevered off the edge of the existing bridge.

6.3 Charles Grimes Bridge – Option 3 – Tidal Flow



6.3.1 Route Description

This option would utilise the existing Charles Grimes Bridge slip road structure at grade for the PTAT link, as per Option 1 but would be a tidal flow arrangement with bi-directional bus / tram traffic on bridge utilising tidal flow signalling. This would result in no structural modifications required to the slip lane as the existing approximately 8.2m width between barriers could cater for a single tram track and active transport connection. Suitable waiting areas would need to be provided on either side of the bridge.

6.3.2 Potential Impacts

6.3.2.1 Tram Operations

The main impact of this option will be on future tram operations under a tidal flow scenario. It is seen as unlikely that Yarra Trams will accept this option with a bi-directional track. There is currently no location on the tram network where trams are forced to use a single line of track as bi-directional to allow another tram to pass (with the exception of termini and depots). While the track and overhead design would be relatively straight forward to provide either a single track or gauntlet track, the concept of providing a tidal flow option of single track will create operational delays for trams having to wait for the track to clear. It would also require a complex signalling system to ensure trams don't enter the same section of track in opposing directions and create a safety risk of head on collisions for drivers who don't adhere to the signalling systems.

There would need to be a suitable area for trams to wait without blocking other mainline trams. This is relevant at the northern side of the Yarra River where the existing tram tracks along Harbour Esplanade carry Route 70, 75 and the City Circle tram. There is limited space for a tram to wait off the mainline without delaying these other tram routes. Provision would need to be made for at least two trams for when trams 'bunch' behind each other as a result of delays to the earlier trams. It is not a good design solution to introduce congestion points on the network. Ideally a new PTAT link should be designed for an ideal tram network, not a compromised track alignment.

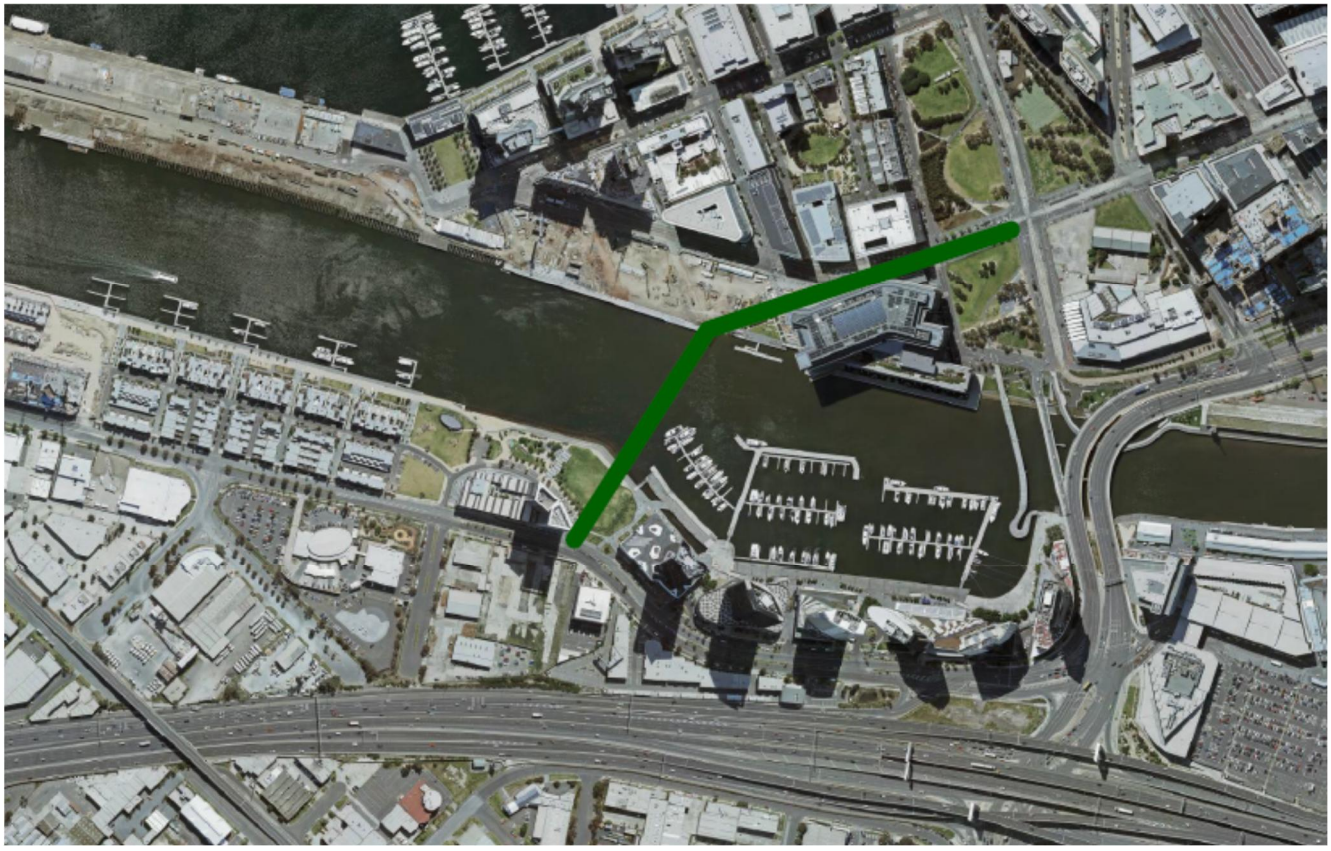
6.3.2.2 Traffic Impacts

The traffic impacts associated with this option will be similar to Option 1 but less severe due to a narrower cross section requirement for the PT link. However the tram waiting areas required at each end of the bi-directional track may introduce additional traffic impacts, particularly at the Charles Grimes Bridge / Harbour Esplanade intersection. Further consideration would be required on where to continue the dual track up to along Lorimer Street and depending on this location this may result in similar impacts to Option 1 around this intersection.

6.3.3 Option Feasibility

This option is not considered feasible unless approval can be gained from Yarra Trams to introduce a tidal flow arrangement onto the network. The operational impacts and potential safety impacts of this solution are considered significant when compare to the potential additional costs associated with a dual track alignment.

6.4 Collins Street Extension



6.4.1 Background Information

As noted earlier in the report a number of previous studies have been undertaken looking at the feasibility of a Collins Street Extension option, which has been considered feasible. A summary of each of the reports completed is noted below:

- Department of Transport, Planning and Local Infrastructure (DTPLI) – 'Fishermans Bend Light Rail Tram Final Report Alignment Options', prepared by Aurecon in May 2013. This study considered five options for providing a light rail tram connection to Fishermans Bend. Three of these options crossed over the Yarra River west of Charles Grimes Bridge and connected to an extension of Collins Street, one utilised Charles Grimes Bridge and one did not cross the Yarra River but spurred off the existing light rail tram route 109;

- City of Port Phillip – 'Fishermans Bend Collins Street Tram Extension', prepared by AECOM in December 2014. This study investigated a tram extension from Collins Street and across the Yarra River and

Westgate Freeway. It considered what type of bridge was feasible for the Yarra River crossing i.e. fixed versus an opening structure. An economic assessment was undertaken to compare a crossing over the Yarra River and Westgate Freeway with the base case of a shuttle tram along Montague Street connecting with Tram Route 109; and

- City of Melbourne – 'Improving Access to Fishermans Bend', prepared by SGS in September 2015. This assessment investigated the benefits and disbenefits of providing improved accessibility to Fishermans Bend through an extension of Collins Street over the Yarra River and Westgate Freeway. It built on previous work investigating the feasibility of light rail route alignment options. It analysed the agglomeration benefits of various alignments, and assessed some of their impacts on the road and tram network.

The studies completed have noted a number of key aspects associated with the alignment. These are provided below:

- Cost of a new bridge across the Yarra River;
- Impact a fixed bridge would have on use by tall masted boats accessing the Yarra's Edge Marina;
- The operational impacts and costs of an opening bridge structure to allow tall masted boats to pass through here;
- The impact on the public open space at Point Park and Yarra's Edge development; and
- Feasibility of relocating tall masted boats to an alternative location west of the proposed bridge alignment.

6.4.2 Additional Aspects to Consider

One key additional aspect that needs to be considered for this option is the operational impact on the tram network if an opening structure is introduced. Yarra Trams produced a report in June 2014 – Fishermans Bend Urban Renewal Catalyst Project – Transport and Access, which discusses the operational requirements for an opening bridge. This notes a number of locations in Amsterdam where opening structures exist on a light rail network.

The key aspect with an opening structure is when this would be available for opening. Yarra Trams aim is to have 10min services on all routes as a minimum and this can be down to a 6min service on some routes (one direction). In both directions this could mean a tram in either direction every 3-5mins. It would take longer than this just for the bridge to shut down and open, let alone let a boat pass through and the bridge to go back down. For this option to be feasible the opening would need to be restricted to particular times of the day out of peak or in the weekends when the tram frequency is lower.

The other considerations around an opening structure would be the overhead structure and the safety and maintenance perspective of having sagging wires (if adopting the same design as the tram bridge in Amsterdam) or developing a new system not tried elsewhere. There is also the increased maintenance of the track connections between the moving and station part of the bridge.

These considerations will be taken into account during the Option Assessment Stage of this study (Stage 3).

6.5 North Wharf Options

As noted in Section 3 of this report three alignment options have been proposed across the North Wharf area for a PTAT link. Two of the three options (central (orange) and eastern (green) alignments) were assessed in previous reports and were not considered feasible due to the significant changes that would be required to the Victoria Harbour Development Plan (north side of the river) plus the impacts on the Yarra's Edge Development (south side of the river) with this area either now fully developed or under construction. The road connections on the south side are narrow and would struggle to fit a tram connection plus active mode facilities.

The proposed western alignment had not previously been considered and has been reviewed as part of this study, although noting that limited information was available at the time of preparing this report.

The review undertaken has focused on the impact that the western option would have on the following:

- North Wharf development – north side of the Yarra River;
- Yarra Edge development – south side of the Yarra River; and
- Boating access along the Yarra River.

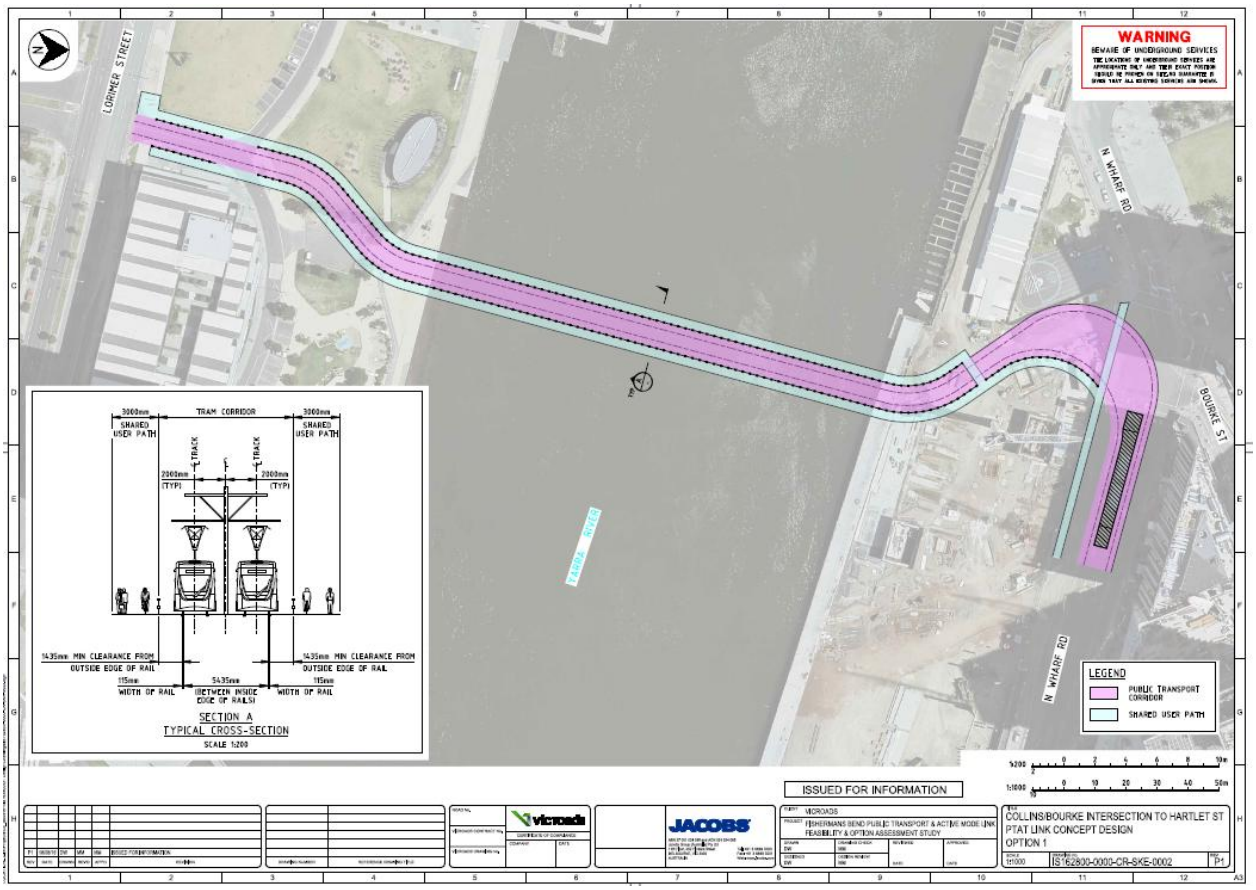
The impacts on each of the elements reviewed have been deemed to be significant for the western corridor alignment. This is due to the following reasons:

- North Wharf Development – the Victoria Harbour Collins Wharf Development Plan does not incorporate a tram corridor through this area and has been developed on this basis. Therefore the cross sections developed for the extension for Collins Street and laneways off this (to the water's edge) have not been developed with corridor widths to incorporate a tram network. Complex ownership arrangements, lease agreements and maintenance agreements have been developed to support the Collins Wharf Development Plan, which would be significantly impacted by the introduction of a tram connection through this area. Also the review of the proposed structural strengthening for the wharf has shown that this has not been designed to cater for a load associated with a tram. The work required to strengthen the wharf to cater for an E Class tram could include providing additional piles and deck slab strengthening;
- Yarra Edge development – this area is mostly now developed or under construction leaving limited space available for a link to traverse through this area without impacting on newly developed residential areas or public open space (Yarra's Edge Bolte Precinct closest development to western link); and

- Boating access along the Yarra River – similar to the Collins Street Extension option it is likely that any bridge design would be not provide sufficient clearance for tall mast boats therefore requiring any new bridge in this location to be an opening structure to provide access to the Yarra Bend Marina.

For these reasons the North Wharf options are not deemed feasible to continue further in this study.

6.6 Hartley Street Option



As noted in Section 4 of this report the proposed alignment for the Hartley Street option commences at the intersection of Lorimer Street / Hartley Street on the south side of the river and traverses northwards across the Yarra River to the future Tom Thumb Lane before turning east at the Collins Street / Bourke Street intersection.

A review of approved City of Melbourne Planning Applications for this area showed an approved building at 839 to 899 Collins Street, Docklands on the southeast corner of the Collins Street / Bourke Street intersection. Section 4 showed the impact the tram swept path had on the approved building on this corner, and is shown below in Figure 6.4 for reference. Due to this significant impact this option has been deemed unfeasible.

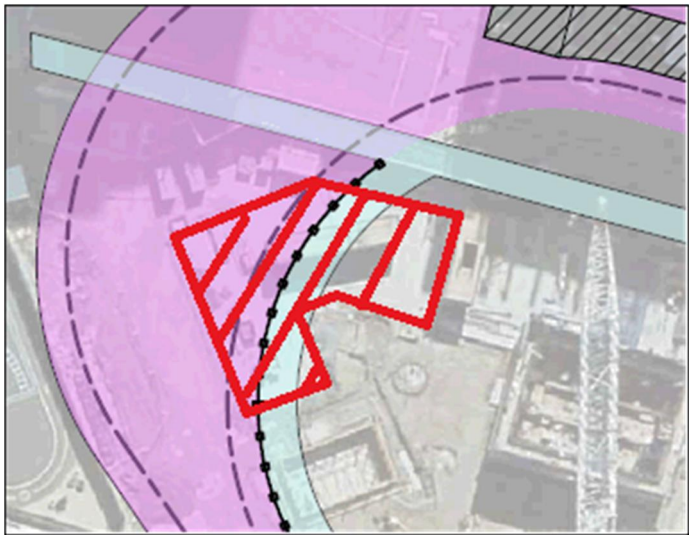


Figure 6.4 - Tram swept path and impact on approved building at 839 to 899 Collins Street

6.7 Charles Grimes Bridge Alternative Options

When reviewing the feasibility of the three alignment options for Charles Grimes Bridge some alternative options were noted for potential consideration. Details of these are provided below.

6.7.1 At-Grade Solution with widening into the Median – Charles Grimes Bridge

A further option for consideration would be widening Charles Grimes Bridge in the median so that traffic lanes could potentially be shifted towards the east to create more room for a tram corridor on the west, thereby reducing the traffic impacts of an at-grade solution. This would require removal of the existing inner barriers, installation of a new deck between the two carriageways, a new central barrier, and modification to existing piers below and possibly installation of a new crosshead between existing piers. Further investigation of the feasibility of this option would be required from a structural perspective as the two carriageways run at different levels, with the level difference increasing the further north you are on the bridge. It may be feasible to widen up to a certain point along the structure but then it may become unfeasible to widen without significant structural changes.

This option could be considered further as a sub option to Option 1 during the concept design stage to try and mitigate adverse traffic impacts.

6.7.2 Centre of Charles Grimes Bridge and Connection to either Collins Street or Flinders Street Tram Network

A further option raised during this feasibility stage of the project was whether the tram link could travel along the centre of Charles Grimes Bridge, filling the gap between the two structures which is over 6m wide at the southern end and centre of the bridge. This could then cross over to the centre of Lorimer Street utilising the phase for right turning traffic. This would minimise impact to traffic at this intersection. However at the northern end of bridge closer to Batmans Hill Drive this gap closes up and would require the bridge to be widened on the western / northern side of the structure to not impact on the through movements for this key traffic connection. The tram would then need to cross over and join the existing tracks that continue along Flinders Street or new tracks would need to be installed along Batmans Hill Drive to connect to Collins Street. Following further investigation of this option some key issues were raised:

- At the northern end of the structure the level difference between the northbound and southbound carriageway become quite significant. This may make it extremely difficult to use the median for widening purposes as the cross falls of the two bridges result in a significant step in levels between carriageways towards the northern end of the bridge. Major modification of the bridges would be needed to utilise this space and it may not even be practical/possible;

- Batmans Hill Drive would need to be significantly altered to accommodate a tram although space is available within the road reserve to include a tram if space is reallocated between modes; and
- The potential impacts on Wurundjeri Way through traffic may be too significant to consider this option further due to it being a priority traffic route. This could be mitigated if the bridge was widened at the northern end so all traffic lanes could remain.

Due to these significant constraints it is considered unfeasible to consider this option further.

6.8 Option Feasibility Summary Assessment

An overall option feasibility assessment has been undertaken for each of the options noted above, with this summarised in an Options Assessment Framework provided in Figure 6.5, with a larger copy provided in Appendix C. This framework has been produced by the project team and assesses each option against key assessment criteria to determine whether the options are feasible to continue to the next stage of the study. Note: the Hartley Street option has not been included in this assessment due to it already been deemed unfeasible due to the significant impact it has on the approved building at 839 to 899 Collins Street. A traffic light system has been used to assess each criteria:

- Green – positive impact or no additional impact
- Orange – moderate impact
- Red – significant impact

The criteria have been split into two areas:

- Primary Assessment Criteria; and
- Secondary Assessment Criteria.

If an option is deemed to have significant impact on any of the primary assessment criteria these have deemed to be too significant to continue to the next stage of the study.

A more detailed Option Assessment Framework will be developed for the Stage 3 assessment but will be broadly based on the same criteria listed in this assessment but with a more detailed assessment undertaken, including cost estimate, rough order economic benefits, quantifiable travel time information and the like.

Assessment Criteria		Option 1 - CGB	Option 2 - CGB	Option 3 - CGB	Option 4 - Collins St Ext	Option 5 - Collins Street Ext	Option 6 - North Wharf	Option 7 - North Wharf	Option 8 - North Wharf	Option 9 - CGB Alternative	Option 10 - CGB Alternative
Crossing Type	Criteria Description	At Grade	Elevated	Tidal Flow At Grade	Fixed Structure	Opening Structure	Western Link	Central Link	Eastern Link	At Grade - central median widening	PT link centre of Bridge with Collins St or Flinders St connection
Primary Assessment Criteria											
PT Operational Impacts	Impacts to journey time, operational complexities (OHW), safety risks, reliability, maintenance issues										
Planning / Property Impact	Impact to properties and access, planning constraints, ownership issues	Depending on route along Lorimer									
Structural Feasibility	Feasibility of structural solutions / complexity and extent of additional work required										
Secondary Assessment Criteria											
Impact to Traffic	Likely impacts on traffic flows along routes impacted by tram and wider area				assumed elevated across Lorimer St	assumed elevated across Lorimer St					
Active Mode Connectivity	Feasibility of providing active mode connectivity and quality of route										
Environmental Impacts (noise etc)	Environmental impacts such as noise, impacts to water quality etc										
Visual Impact	Visual impact of solutions										
Cost	Likely cost of solution										
Outcome		Proceed to next stage	Proceed to next stage	primary criteria rated as significant impact - operational issues with proposed PT corridor (safety and complexity)	Proceed to next stage	Proceed to next stage	Dismised due to two of the primary criteria rated as significant impact - planning / property impacts and structural feasibility	the primary criteria rated as significant impact - planning / property impacts and structural feasibility	the primary criteria rated as significant impact - planning / property impacts and structural feasibility	Continue to next stage as sub option to Option 1	Dismised due to one of the primary criteria rated as significant impact - strucural feasibility of solution at north end of CGB
Scoring System											
Positive or No additional impact											
Moderate Impact											
Significant Impact											

Figure 6.5 – Option Feasibility Assessment

7. Recommendation

During Stage 1 of the Fishermans Bend PTAT Link Feasibility Assessment and Option Development Study a number of options have been assessed for feasibility to continue through to Stage 2 – Concept Design Development.

The recommendation is that the following options continue through to Stage 2 – Concept Design Development:

- Charles Grimes Bridge Option 1 - At grade PT corridor, utilising Charles Grimes Bridge slip road to incorporate a PT only corridor. A sub option to consider widening Charles Grimes Bridge in the median so that traffic lanes could potentially be shifted towards the east to create more room for a tram corridor on the west, thereby reducing the traffic impacts of an at-grade solution. This would be for the southern section of the bridge where the level difference between the two structures isn't as significant;
- Charles Grimes Bridge Option 2 – An elevated PT corridor, utilising a similar alignment to Option 1. The recommended corridor for Lorimer Street is to proceed along the centre of Lorimer Street rather than the option to proceed along the south side of Lorimer Street due to the significant impacts this would have on properties west of the exit ramp; and
- Collins Street Extension – Fixed Bridge Option – this has previously been assessed in a number of other previous studies and deemed feasible; and
- Collins Street Extension - Opening Structure – this has previously been assessed in a number of other previous studies and deemed feasible.

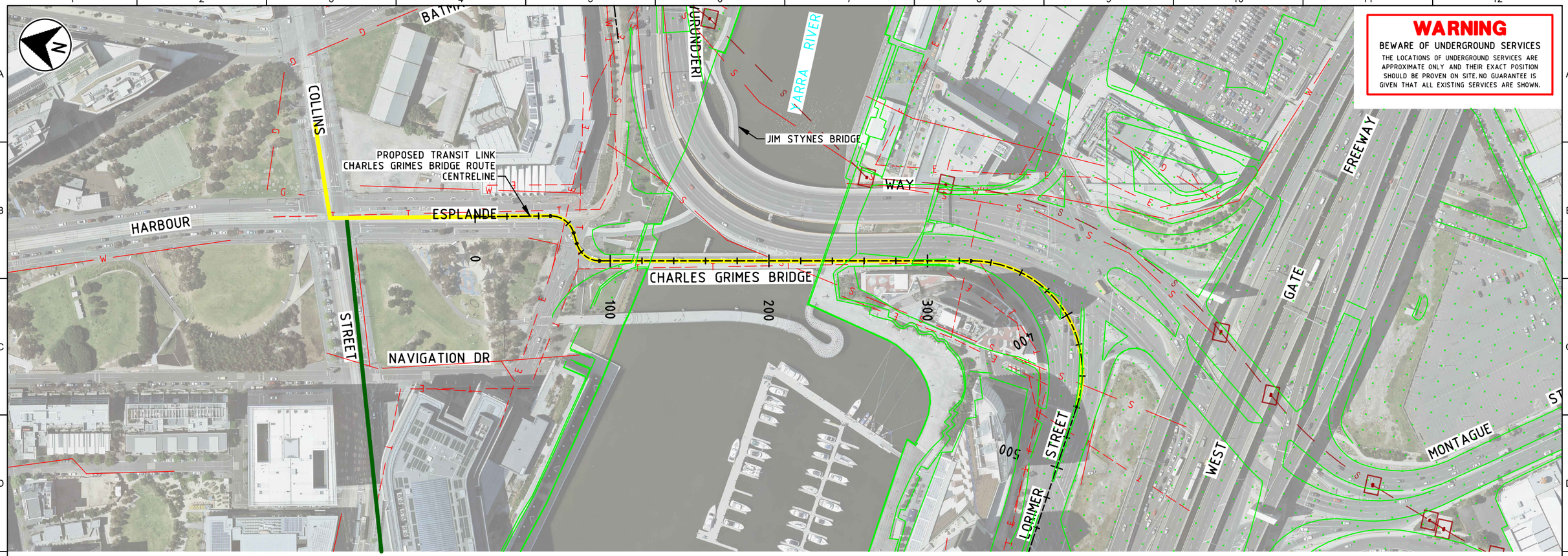
It is not recommended to undertake any concept design work on the following options:

- Charles Grimes Bridge Option 3 – Tidal Flow. This option is not considered feasible unless approval can be gained from Yarra Trams to introduce a tidal flow arrangement onto the network. The operational impacts and potential safety impacts of this solution are considered significant when compared to the potential additional costs associated with a dual track alignment;
- Charles Grimes Bridge Alternative Option – use of centre of Charles Grimes Bridge and connection to either Collins Street or Flinders Street tram network. This is not considered feasible due to significant structural constraints at the northern end of Charles Grimes Bridge and potential impacts on through traffic movements along this key traffic priority route;
- North Wharf – all alignments - significant changes would be required to the proposed layout for the Collins Wharf Development Plan (north side of the river) along with significant additional wharf strengthening works required to cater for a tram along the proposed Collins Street extension road. Also the impacts on the Yarra's Edge Development (south side of the river) would be significant with this area either now fully developed or under construction (Yarra's Edge Bolte Precinct Development Plan). The road connections through Yarra's Edge are narrow and would struggle to fit a tram connection plus active mode facilities. Also a new bridge in this area would have similar constraints on river traffic with an opening structure required to allow for tall masted boats to access Yarra's Edge Marina; and
- Hartley Street Option – due to the impact the tram tracking path has on existing and proposed building developments adjacent to the intersection of Bourke Street and Collins Street intersection i.e. a tram cannot turn the tight corner within the road corridor available.

The Collins Street Extension options for a fixed bridge and opening structure will be carried through to Option Assessment stage. The concept designs already developed will be used for this assessment, with some additional work produced developing artist illustrations for an opening structure option.

Additional information on the changes to traffic flows predicted through this area following the completion of Western Distributor will be used to assess the traffic impacts of the options during the Option Assessment Stage particularly for the Option 1 – At-Grade solution.

Appendix A. Existing Conditions Plan



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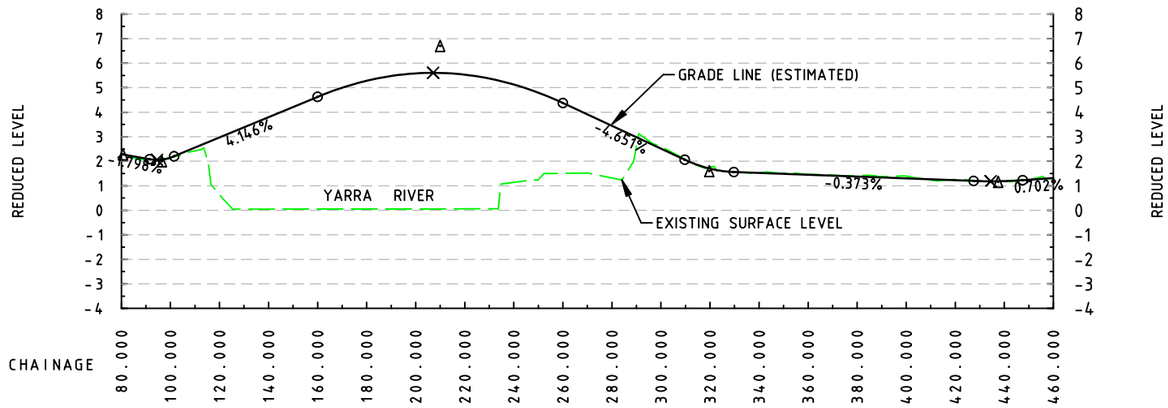

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V 1 : 250

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ISSUED FOR INFORMATION

REV	DATE	DRAWN	REV'D	APP'D	REVISION
P1	12/7/16	AWS			ISSUED FOR INFORMATION

DRAWING NUMBER | REFERENCE DRAWING TITLE

ROAD No.
VICROADS CONTRACT No.
VICROADS DRAWING No.
CERTIFICATE OF COMPLIANCE
COMPANY | DATE

JACOBS
ABN 37 001 024 095 and ACN 001 024 095
Jacobs Group (Australia) Pty Ltd
11th Floor, 452 Flinders Street
MELBOURNE, VIC 3000
AUSTRALIA
Tel: +61 3 8668 3000
Fax: +61 3 8668 3001
Web: www.jacobs.com

CLIENT VICROADS
PROJECT FISHERMANS BEND P.T.A.T LINK FEASIBILITY STUDY

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
AWS			
DESIGNED	DESIGN REVIEW	DATE	DATE APPDATE

TITLE
PROPOSED TRANSIT LINK PLAN & LONG SECTION
CHARLES GRIMES BRIDGE

SCALE	DRAWING No.	REV
AS SHOWN	IS162800-0000-CR-DRG-0120	P1

A3

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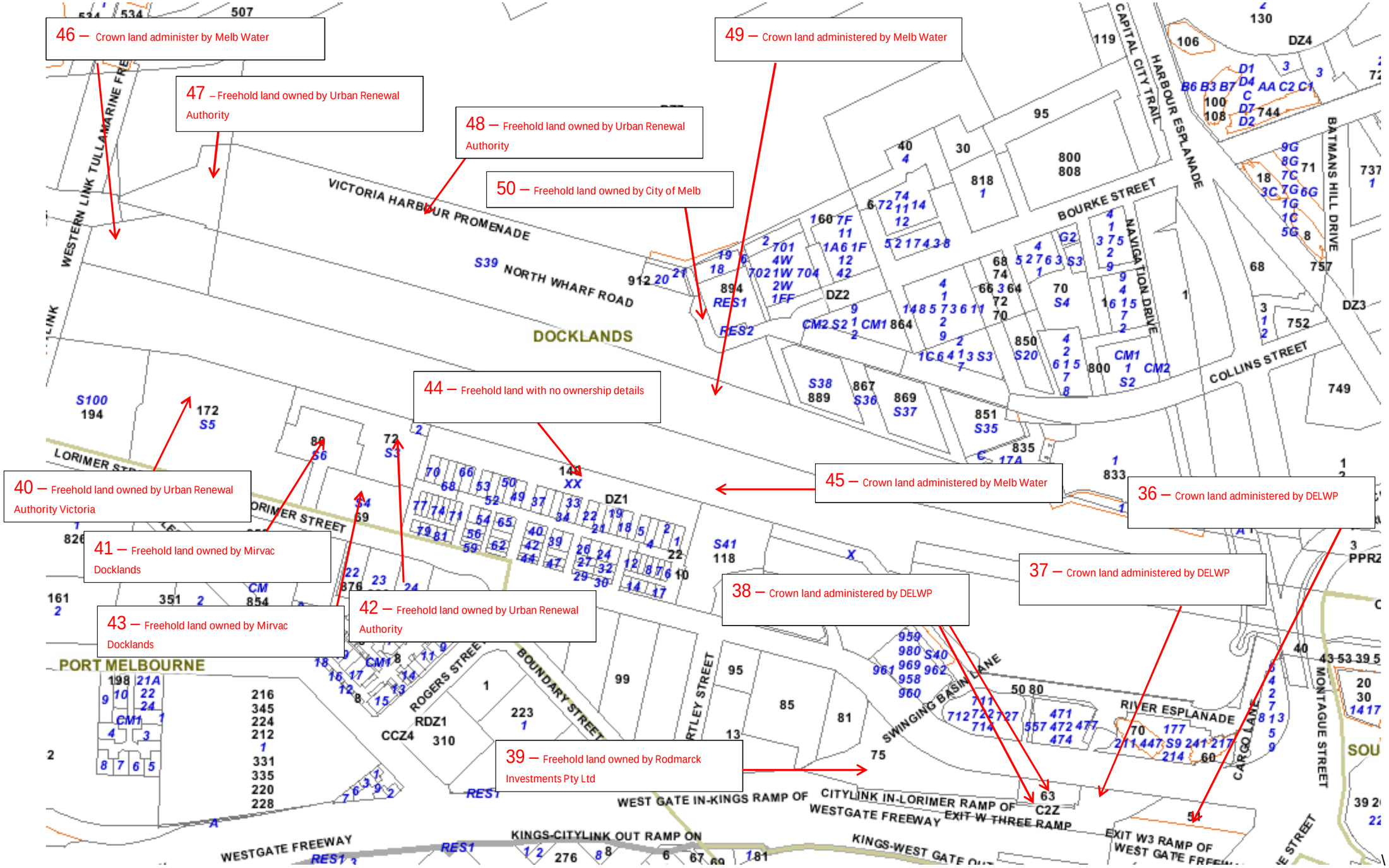
Appendix B. Allotment Details – Charles Grimes Bridge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NORTH WHARF ROAD
DOCKLANDS
PORT MELBOURNE
BOURKE STREET
COLLINS STREET
HARBOUR ESPLANADE
CAPITAL CITY TRAIL
NAVIGATION DRIVE
BATMANS HILL DRIVE
RIVER ESPLANADE
SWINGING BASIN LANE
CARGO LANE
MONTAGUE STREET
ROGERS STREET
BOUNDARY STREET
RUTLEY STREET
LORIMER STREET
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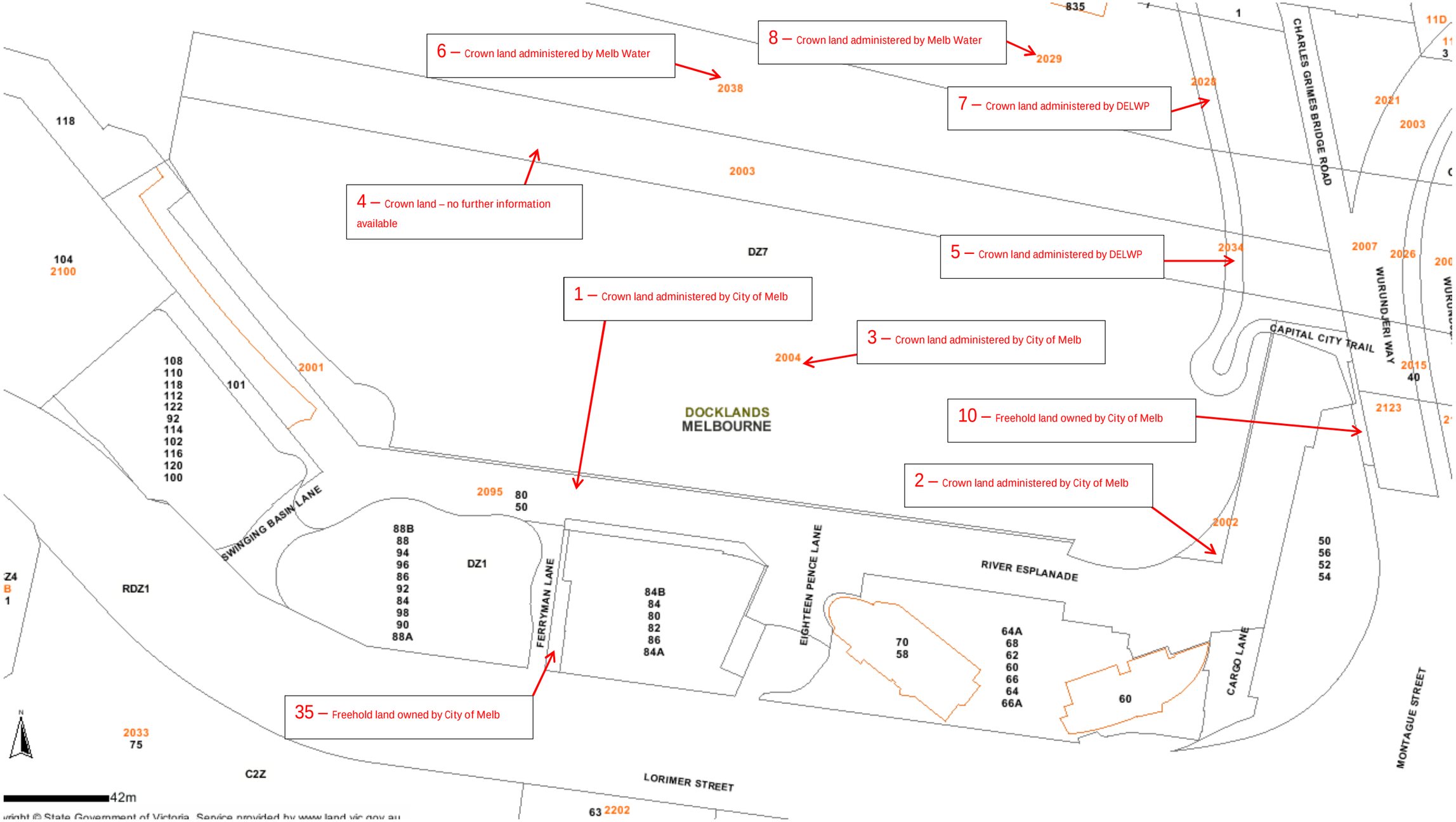
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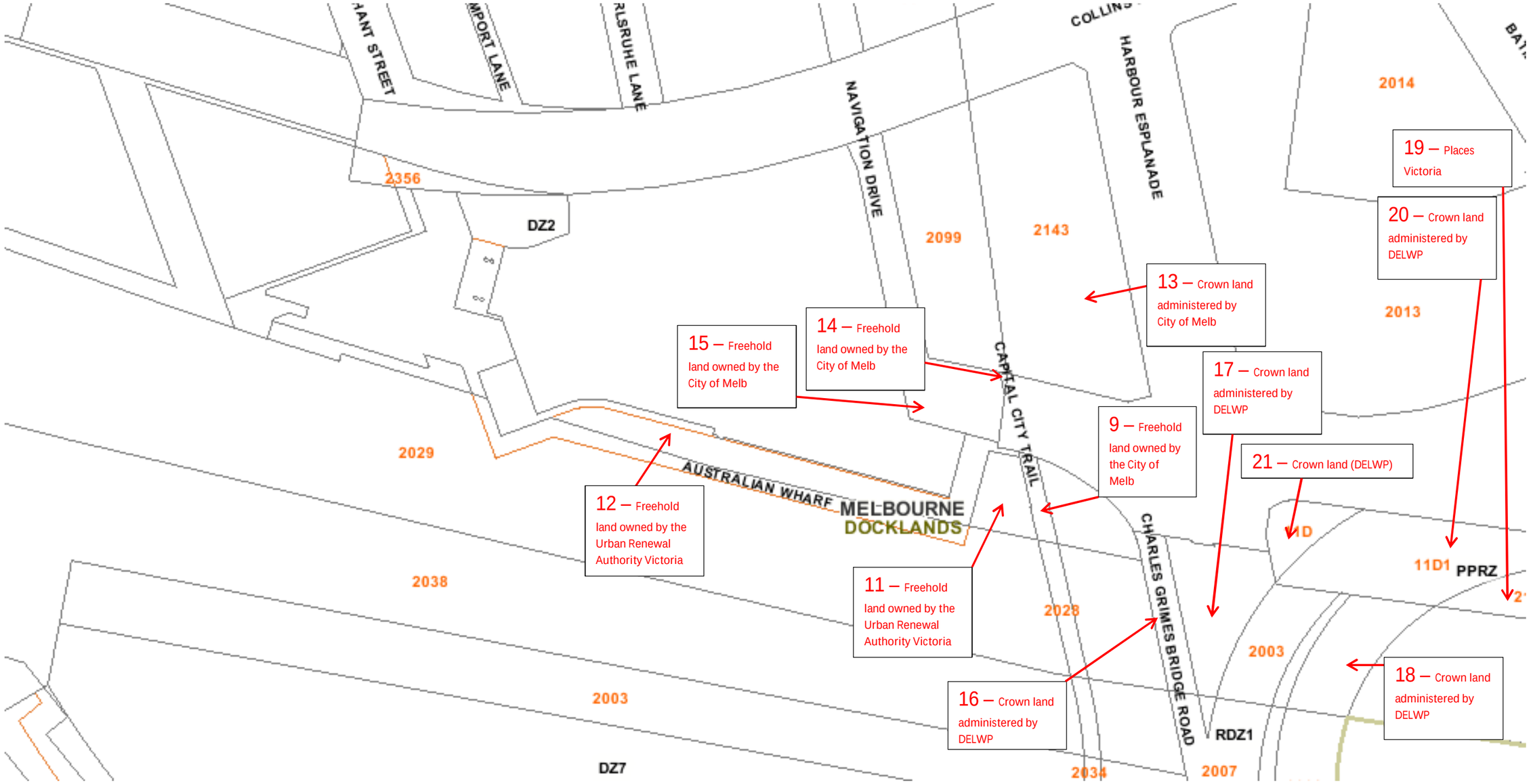
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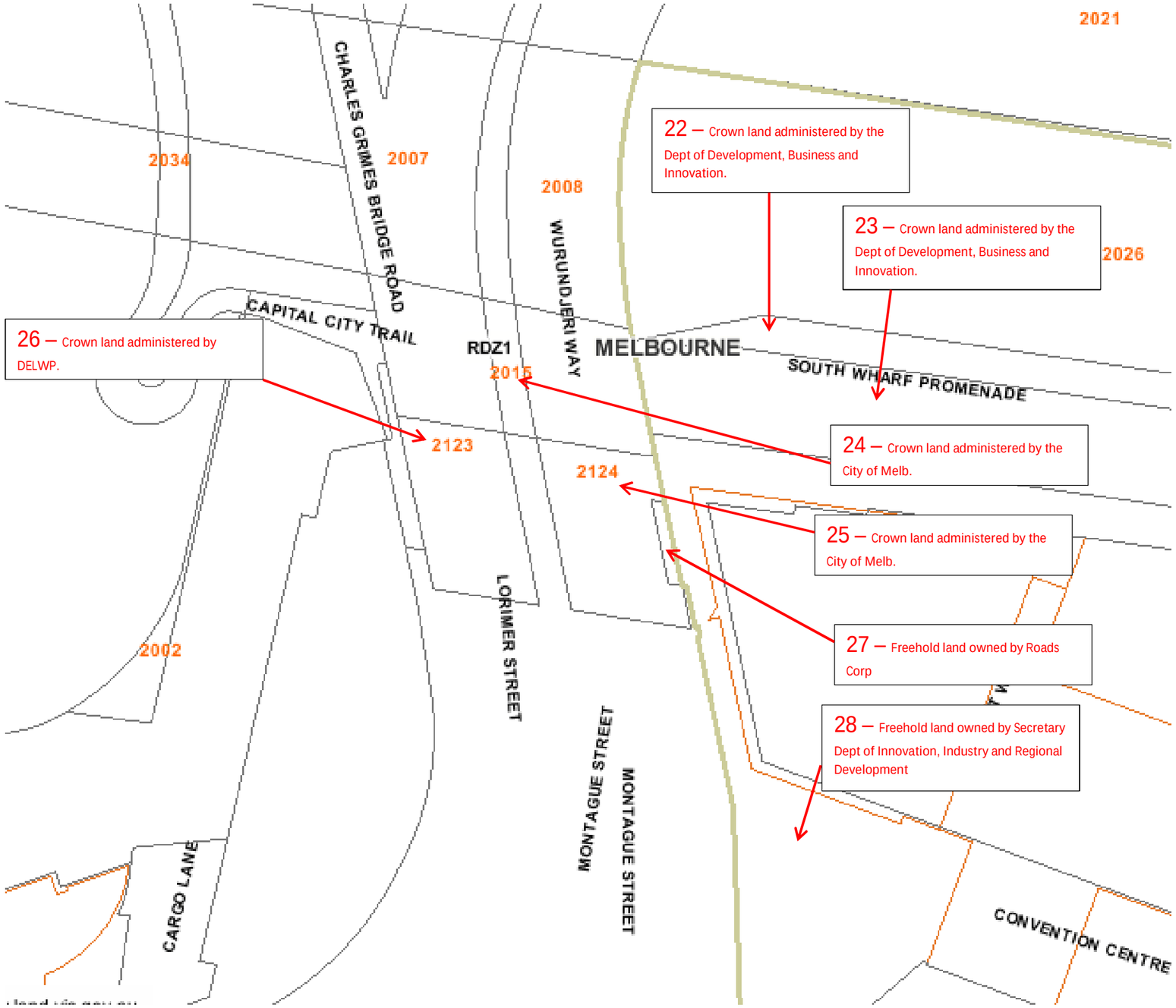
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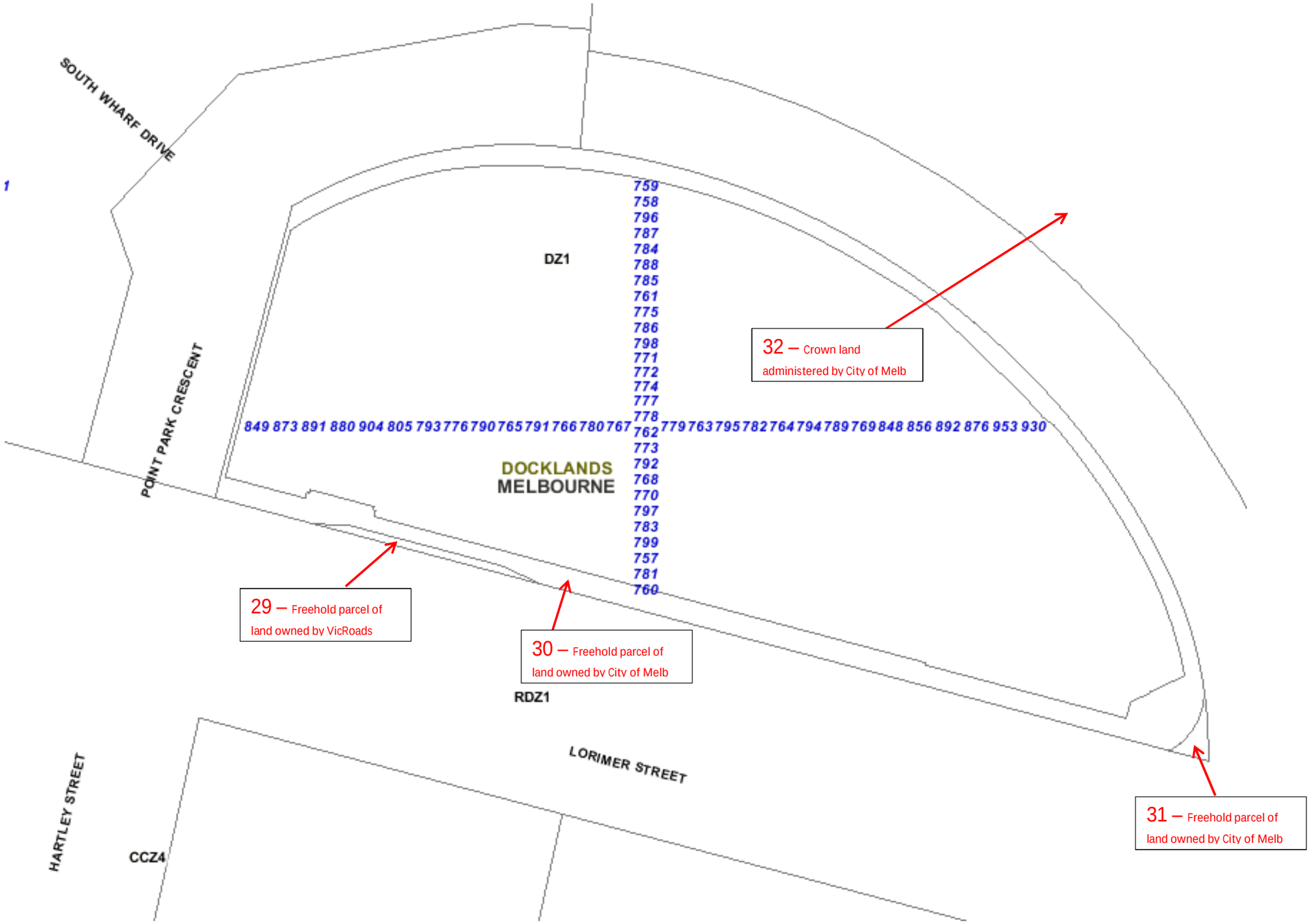
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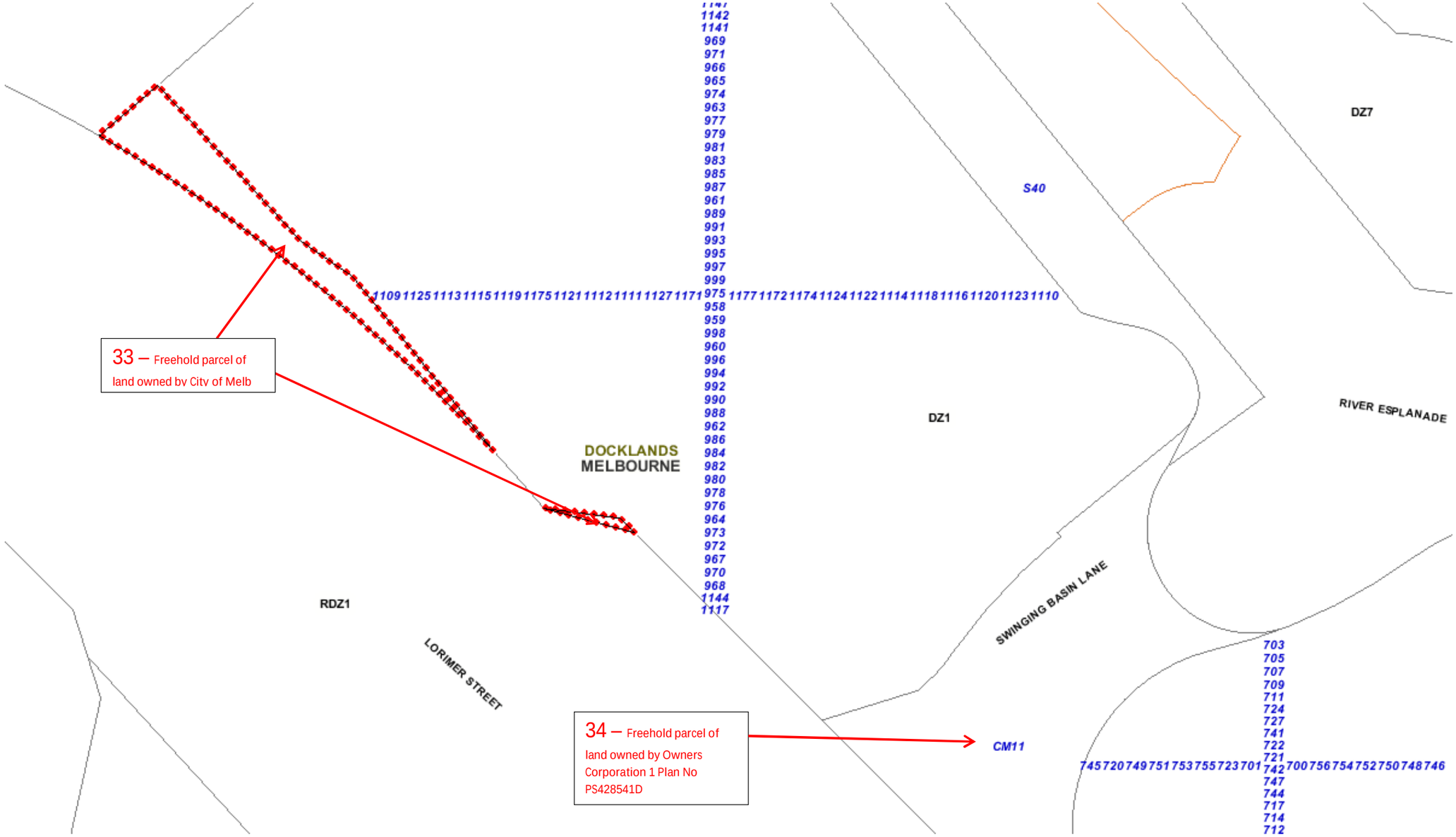
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Appendix C. Feasibility Assessment Table

Fishermans Bend Public Transport and Active Mode Link - Feasibility Assessment Criteria

Assessment Criteria		Option 1 - CGB	Option 2 - CGB	Option 3 - CGB	Option 4 - Collins St Ext	Option 5 - Collins Street Ext	Option 6 - North Wharf	Option 7 - North Wharf	Option 8 - North Wharf	Option 9 - CGB Alternative	Option 10 - CGB Alternative
Crossing Type	Criteria Description	At Grade	Elevated	Tidal Flow At Grade	Fixed Structure	Opening Structure	Western Link	Central Link	Eastern Link	At Grade - central median widening	PT link centre of Bridge with Collins St or Flinders St connection
Primary Assessment Criteria											
PT Operational Impacts	Impacts to journey time, operational complexities (OHW), safety risks, reliability, maintenance issues										
Planning / Property Impact	Impact to properties and access, planning constraints, ownership issues		Depending on route along Lorimer								
Structural Feasibility	Feasibility of structural solutions / complexity and extent of additional work required										
Secondary Assessment Criteria											
Impact to Traffic	Likely impacts on traffic flows along routes impacted by tram and wider area				assumed elevated across Lorimer St	assumed elevated across Lorimer St					
Active Mode Connectivity	Feasibility of providing active mode connectivity and quality of route										
Environmental Impacts (noise etc)	Environmental impacts such as noise, impacts to water quality etc										
Visual Impact	Visual impact of solutions										
Cost	Likely cost of solution										
Outcome		Proceed to next stage	Proceed to next stage	Dismised due to one of the primary criteria rated as significant impact - operational issues with proposed PT corridor (safety and complexity)	Proceed to next stage	Proceed to next stage	Dismised due to two of the primary criteria rated as significant impact - planning / property impacts and structural feasibility	Dismised due to two of the primary criteria rated as significant impact - planning / property impacts and structural feasibility	Dismised due to two of the primary criteria rated as significant impact - planning / property impacts and structural feasibility	Continue to next stage as sub option to Option 1	Dismised due to one of the primary criteria rated as significant impact - strucural feasibility of solution at north end of CGB

Scoring System
Positive or No additional impact
Moderate Impact
Significant Impact