DEPARTMENT OF ECONOMIC DEVELOPMENT, JOBS, TRANSPORT AND RESOURCES (DEDJTR)

Fishermans Bend Tram Extension - VITM Modelling

FINAL REPORT

WSP | PARSONS BRINCKERHOFF

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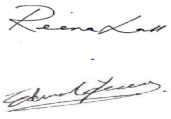
Prepared by:	Reena Lall and Edward Yeung	Date: 17/10/2017	Signature:	
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EXECUTIVE SUMMARY

INTRODUCTION

Fishermans Bend is the largest urban renewal area in Australia, and is expected to provide up to 60,000 jobs and a range of higher density housing options for 80,000 people by the 2050s. The Fishermans Bend Taskforce are working together with an independent Ministerial Advisory Committee and the community to develop a blueprint for Fishermans Bend.

As part of the planning process, the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) have engaged WSP to undertake public transport demand modelling for Fishermans Bend using the Victorian Integrated Transport Model (VITM), to inform assessment of different public transport network options that support the planned land use development. The public transport strategic demand modelling undertaken in this project is therefore part of a wider program for Fishermans Bend which will ultimately inform the development of an Integrated Transport Plan and Infrastructure Plan.

This report documents the VITM modelling process and the demand forecast results of each of the options evaluated as a part of the project. The intention of this report is not to rank options, but is intended to provide a high-level indication of performance relative to the option's forecast demand, noting that different input assumptions need to be considered.

FUTURE YEAR MODEL DEVELOPMENT

A future year VITM model was developed as the foundation for testing the proposed public transport options. The future model was developed by taking the existing 2046 VITM reference case model as a starting point, and updating inputs and assumptions such that significant change in land use density and transport network envisioned for the Fishermans Bend area could be better reflected.

Two 2051 land use scenarios for Fishermans Bend were considered as part of this project, namely:

- **Reference Case:** Assumes moderate intervention with lower population and employment than the current vision (i.e. approximately 69,000 people and 53,000 jobs by 2051). Also, assumes tram or equivalent bus on Plummer alignment and Turner corridors via Collins Street Extension, complementary local bus improvements by 2031 and no heavy rail by 2046.
- **Vision Plus University:** Assumed that the current vision being developed by the Fishermans Bend Taskforce is realised to a large extent (e.g. approximately 80,000 people and 60,000 jobs by 2051). Also, assumes a major university is established in Fishermans Bend Employment Precinct and that heavy rail to Melbourne's West and CBD is operational by 2046.

The future year model developed, together with the Reference Case land use, was considered as the 2046/51 Base Case, and assumed that Fishermans Bend is only serviced by the 2015/16 Fishermans Bend bus network.

PROJECT CASES

The vision for Fishermans Bend is to become a mixed use higher density environment, similar to the CBD, with sustainable transport mode share to support the scale of urban growth. Improving the public transport network for Fishermans Bend will therefore play an important role in achieving this vision, as the future year Base Case only offers minimal bus services to Fishermans Bend.

Like the CBD, the proposed ultimate Fishermans Bend public transport network could include trams or priority buses as a key transport mode to serve the forecast population and employment, while an improved bus network could complement the tram service and provide local area access. Considering that Melbourne Metro is currently being planned, there is also an opportunity to provide a heavy rail option for Fishermans Bend as part of potential future staging. These potential transport solutions

therefore formed the basis of the project cases tested to gain a better understanding of the transport network required for Fishermans Bend.

Four project cases were tested under the Reference Case land use scenario, using the Base Case as the starting point. These project cases were:

- **Tram Extension Only Option (Project Case 1 or PC1):** This option tested how well the transport network would perform if tram routes 11 and 48 were extended from Victoria Harbour to Fishermans Bend via a new Collins Street Extension link (passing through Docklands, and in its own right of way) to provide direct, reliable and frequent connection between the CBD and either side of the West Gate Freeway. A complementary Fishermans Bend bus network was also included in this option.
- **Charles Grimes Bridge Variation Option (Project Case 4 or PC4):** This option tested how well the transport network would perform if the Tram Extension Only Option consisted of an alternative river crossing – i.e. if the extension of tram routes 11 and 48 were via the existing Charles Grimes Bridge (with their own right of way), rather than the Collins Street Extension.
- **SmartBus Variation Option (Project Case 2 or PC2)**: This option tested how well the transport network would perform if the proposed tram on the Turner Street in the Tram Extension Only Option was replaced with a priority SmartBus (i.e. 10 min travel time between ANZ on Collins Street and terminus at Sabre Drive and Wharf Road).
- **New Rail Variation Option (Project Case 3 or PC3):** This option tested how well the transport network would perform if Fishermans Bend was serviced by a new rail line between Clifton Hill and Newport via Plummer Street as part of the potential future stage of Melbourne Metro Rail (i.e. Melbourne Metro Design 2), in addition to public transport services included in the Tram Extension Only Option.

Two additional project cases were also modelled to gain a better understanding of the public transport needs of the Vision Plus University land use scenario. These project cases were:

- **New Rail with Extra Tram Service Option (Project Case 6 or PC6):** This option tested how well the transport network would perform with the same public transport services included in the New Rail Variation Option (Project Case 3), but with an alternative rail alignment west of Fishermans Bend (i.e. a direct connection from Fishermans Bend to Maddox Station, rather than through Newport Station). This option also tested the demand for an additional tram service connecting North Melbourne Station to the Employment Precinct and Wirraway via Turner Street, due to the Craigieburn service not running via Southern Cross in Melbourne Metro Design 2.
- **Northern Rail Alignment Variation Option (Project Case 7 or PC7):** This option tested how well the transport network would perform with the same public transport services included in the New Rail Variation Option (Project Case 3), but with an alternative rail alignment west of Fishermans Bend (i.e. a direct connection from Fishermans Bend to Maddox Station, rather than through Newport Station) and alternative rail alignment through Fishermans Bend (i.e. where the rail alignment is via Fishermans Bend north (Employment Precinct) and Sandridge Precinct instead of via Plummer Street).

DEMAND FORECASTING RESULTS

Under the Reference Case land use scenario, all project cases tested performed better than the Base Case, with public transport (PT) mode share by origin increasing for all precincts in Fishermans Bend when compared to the Base Case (as shown in Table E1.1). In particular, the Lorimer precinct experiences significant increase in PT mode share for all project cases when compared to the Base Case, as this area becomes well serviced by the Plummer Street tram. Similarly, the employment precinct also experiences significant increase in PT mode share for all options due to the Turner Street tram, except in the SmartBus Variation Option (Project Case 2). This suggests that a priority SmartBus along Turner Street is less effective at encouraging PT usage in this area than a tram, possibly due to the reduced frequency and increased boarding penalty and also lesser capacity for the bus compared to the tram option.

In terms of bus patronage, all Reference Case land use scenario options were found to have higher patronage than the Base Case, while capacity issues reduced due to improved bus frequency. For tram patronage, the Tram Extension Only Option (Project Case 1) was found to be greatest, though capacity issues were identified in the AM peak in some locations (e.g. between Southern Cross Station and Lorimer/Sandridge along the tram corridors heading into the CBD). Tram patronage and capacity issues in the Charles Grime Bridge Variation Option (Project Case 4) were found to be slightly less than but comparable to Project Case 1, suggesting that the river crossing does not have a significant impact on tram patronage. Tram patronage in the SmartBus Variation Option (Project Case 2) and the New Rail Line Variation Option (Project Case 3) however, were significantly less than Project Case 1 due to the replacement of the tram on Turner Street (in Project Case 2) and a shift in mode from tram to rail on Plummer Street (in Project Case 3, where rail provides a faster and more direct route between the Sandridge/Wirraway Precincts and the CBD). Capacity issues were also found to worsen on Plummer Street in Project Case 2 due to it being the only tram connection between the CBD and Fishermans Bend; while in contrast, little capacity issues were seen on Plummer Street in the New Rail Line Variation Option (Project Case 3) due to a reduction in tram patronage caused by the alternative rail service.

Options modelled under the Vision Plus University land use scenario were found to perform very similarly in terms of network-wide public transport patronage, with increases in daily public transport trips of 91,000 and 89,000 for the Southern Alignment with Extra Tram Option (Project Case 6) and the Northern Rail Alignment Variation Option (Project Case 7), respectively. Daily tram, bus and rail patronage between the options were also similar, as were PT mode share for all Fishermans Bend precincts except for the employment precinct which were higher for Project Case 7 and the Wirraway Precincts in the south of Fishermans Bend which were slightly lower for Project Case 7 due to the rail shifting to the north. Compared to the Reference Case land use scenario, the Vision Plus University land use scenario also resulted in 15% more person trips entering Fishermans Bend, and 11% more person trips leaving Fishermans Bend across the day, due to the higher population and employment.

In general, demand results show that with little improvement to tram or train, public transport trips to Fishermans Bend are likely to be internal (as is the case for the Base Case and Project Case 2); while with the inclusion of two tram services, most public transport trips to Fishermans Bend will come from Melbourne LGA as the CBD becomes more accessible (as is the case for Project Case 1 and 4). Furthermore, with the addition of Melbourne Metro Design 2, public transport trips from Wyndham and Whittlesea become more popular, as these LGAs become easier to access (i.e. in Project Case 3, 6 and 7).

Table E1.1 AM peak public transport mode share by origin precincts (2046/51) - Fishermans Bend precincts

PRECINCT	BASE CASE	PROJECT CASE 1	PROJECT CASE 4	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 6	PROJECT CASE 7
Wirraway West	39.3%	46.8%	46.6%	46.7%	51.9%	52.7%	50.9%
Wirraway East	38.9%	47.5%	47.3%	47.5%	53.6%	54.0%	52.0%
Sandridge North	45.3%	51.4%	51.0%	51.3%	55.2%	56.1%	57.3%
Sandridge South	46.8%	50.3%	50.1%	50.4%	55.0%	56.2%	54.6%
Lorimer	21.9%	46.1%	45.8%	41.0%	46.7%	47.5%	47.3%
Montague	51.9%	53.2%	53.3%	53.2%	53.7%	55.1%	54.9%
Employment Precinct - North	3.8%	15.4%	14.7%	5.0%	17.4%	18.5%	22.4%
Employment Precinct - South	3.7%	15.2%	14.5%	3.9%	17.5%	19.4%	23.9%

CONCLUSION

Under the Reference Case land use scenario in 2046, travel demand in the Base Case is unable to be adequately catered for, with all buses serving Fishermans Bend reaching capacity. By comparison, the Tram Extension Option (Project Case 1), which assumes a new crossing over the river and trams along Plummer Street and Turner Street, offers a better outcome than the Base Case as it provides more public transport options and capacity, resulting in higher public transport patronage and mode share.

If the new crossing over the river was to be replaced with the existing Charles Grime Bridge however (as in Project Case 4), this would result in less patronage and longer travel time, though the difference would not be significant. On the other hand, if the Turner Street tram was replaced with a priority SmartBus (as in Project Case 2) there would be a noticeable reducing in public transport patronage and greater capacity issues for trams on Plummer Street. As such, modelling suggests that the Tram Extension Option (Project Case 1) is the most preferable option of all options without heavy rail.

Nevertheless, as there are some capacity constraints on both Turner Street and Plummer Street near Collins Street in Project Case 1, if the opportunity for heavy rail exists, a better outcome will be achieved with less congestion, higher PT patronage and higher PT mode share, as is the case in the New Rail Line Variation Option (Project Case 3), though running trams at a higher frequency may also be an option to consider.

Under Vision Plus University land use, (higher population and employment supported by heavy rail), a southern and northern rail alignment would result in similar public transport patronage, though a southern alignment is likely to achieve higher PT mode share for the Wirraway Precincts in the south of Fishermans Bend and a northern rail alignment is likely to achieve higher PT mode share for the employment precinct. The inclusion of a north-south connection may therefore improve both options.

It is important to note that the VITM demand modelling only informs the performance of the options relative to travel demand. Careful consideration should be taken into account when assessing the options presented in this report, and ideally should be combined with other assessments (e.g. environmental, social and economic assessments) to determine the overall preferred option and to inform the development of the Integrated Transport Plan and Infrastructure Plan for Fishermans Bend.

1 INTRODUCTION

Fishermans Bend in the largest urban renewal area in Australia, and is expected to be home to 80,000 people and up to 60,000 jobs by the 2050s. Currently the Fishermans Bend Taskforce, comprising members of Places Victoria, the Victorian Planning Authority, the Department of Environment, Land, Water and Planning, and the Cities of Melbourne and Port Phillip, are working together with an independent Ministerial Advisory Committee and the community to develop a blueprint for Fishermans Bend.

As part of the planning process, The Department of Economic Development, Jobs, Transport and Resources (DEDJTR) have engaged WSP to undertake public transport demand modelling for Fishermans Bend using the Victorian Integrated Transport Model (VITM), to inform assessment of different public transport network options that support the planned land use development.

The public transport strategic demand modelling undertaken in this project is therefore part of a wider program for Fishermans Bend which will ultimately inform the development of an Integrated Transport Plan and Infrastructure Plan.

1.1 Project scope

The scope for this project consisted of the following three tasks:

- validating the base year model
- developing a future year model
- testing various project cases in the future year model, where the scope for the project cases included modelling different public transport options, such as:
  - an extended tram network into Fishermans Bend
  - an upgraded Fishermans Bend bus service, including bus priority
  - a new rail line between Clifton Hill and Newport via Fishermans Bend.

Two land use scenarios for Fishermans Bend were also considered as part of the future year modelling, namely:

- the Reference Case land use scenario
- the Vision Plus University land use scenario.

The time periods modelled as part of this project include:

- Weekday AM peak (AM): 7:00 am – 9:00 am
- Weekday Inter peak (IP): 9:00 am – 3:00 pm
- Weekday PM peak (PM): 3:00 pm – 6:00 pm
- Weekday Off peak (OP): 6:00 pm – 7:00 am
- Average weekday (Daily): 24-hour.

1.2 This report

This report discussed the following:

- application of VITM
- base year model validation
- future year model development
- future year project cases modelled
- demand forecasting results
- conclusions.

2 MODEL DEVELOPMENT

2.1 Suitability of VITM

The Victorian Integrated Transport Model (VITM) is a strategic transport model owned by the Department of Economic Development, Jobs, Transport, and Resources (DEDJTR). It is a powerful strategic planning tool commonly used in Victoria for comparing the likely impacts of scenarios under different land use and transport network assumptions. Its strength lies at representing strategic level demand and travel patterns and comparing the options based on the same assumptions. VITM is a suitable tool for this project as it requires transport modelling at the strategic level to inform assessment of different public transport network options that support the planned land use development.

For this project, public transport capacity constraints in VITM have been applied, which considers the effect and limitations that public transport in-vehicle capacity has on demand. This approach allows a more realistic assessment of how the public transport services (e.g. trams) are expected to perform to meet the demand compared to the 'unconstrained' approach.

It should be noted that any demand forecast is subject to uncertainties. Inevitably, some assumptions (e.g. land use, transport network) used to develop the forecasts will not be realised, and unanticipated events/circumstances may occur. No form of assurance can therefore be provided that the reported forecasts will be achieved. The actual outcomes will vary from those forecasts.

2.2 Base year model validation overview

Validation is an exercise in making sure the forecasting model represent the observed level of activity and travel in a base year model (reflective of 'today's' conditions) so that it is fit for purpose in predicting travel demands in subsequent years. Network-wide public transport validation, as well as public transport validation within Fishermans Bend were of particular interest for this project.

The most recent version of the 2011 VITM (i.e. reference case model) was used as the starting point for the base year model for the Fishermans Bend project.

Network-wide public transport validation showed that the reference case model was underestimating daily tram boardings across the network by 11.3%, which was not considered adequate for this project where tram options are a major public transport mode supporting the proposed development. Tram validation was therefore improved by adjusting the tram boarding penalties in the VITM, which affected all tram services, such that the daily modelled tram boardings were much closer to the observed boardings (i.e. only 0.8% less than observed, across the network), while ensuring that no adverse effects were made to the other modes.

Public transport validation within Fishermans Bend showed that average weekday tram volumes from the model on Route 109 (Box Hill to Port Melbourne) and along Collins Street compared well with the survey data after the tram boarding penalties were adjusted. Boardings on some bus routes in the model also matched well with the survey data, while boardings on other routes were overestimated. Nevertheless, bus patronage load profiles from the model did compare well with the survey data. As such, no further refinement was undertaken in the study area to improve validation following the adjustment to the tram boarding penalties.

Highway validation results within Fishermans Bend were also reviewed and found to be reasonable at a strategic level. At a local area level, model results differed in places from the observed results, though this is not uncommon as VITM is a strategic model and is not designed to model traffic movements to such a fine level of detail. Furthermore, as the focus of this modelling exercise was on public transport, no refinements were undertaken for the highway network to improve validation.

Full details of the validation results are provided in Appendix A.

Acceptance of base year VITM model

Following the validation process, WSP recommended that the VITM was fit for the purpose of modelling public transport options for strategic assessment. The 2011 validated model was then accepted by DEDJTR and the Fishermans Bend Taskforce for the project.

2.3 Future year model development

A future year model was developed as the foundation for testing the project cases. The future year model was developed by taking the existing 2046 VITM reference case model as a starting point, and updating inputs and assumptions such that significant change in land use density and transport network envisioned for the Fishermans Bend area could be better reflected. In particular:

- Two new Statistical Local Areas (SLAs) and Local Government Areas (LGAs) were created by separating Fishermans Bend from the SLAs and LGAs it was currently contained in (i.e. City of Melbourne and the City of Port Phillip). This allowed modelling parameters, such as car ownership and car parking charges, to be updated specifically for Fishermans Bend. These modelling parameters were based on the specifications provided by DEDJTR, and are explained further in Appendix B1.
- 35 new transport zones were added to the 2046 VITM reference case model in the Fishermans Bend/Docklands area by splitting existing zones to allow land use specifications for Fishermans Bend to be modelled. A map of the new zone structure is shown in Appendix B2.
- The latest 2046 VITM highway network was refined to include key roads as per the Fishermans Bend Strategic Road Network[1]. A map of the updated highway network is shown in Appendix B3.
- The most appropriate 2046 public transport network (i.e. PT line file) available was updated to match the train, tram and bus specifications provided by DEDJTR, to arrive at the existing 2046/51 public transport network. In general, the existing 2046/51 public transport network included Melbourne Metro Design 1 with no services to Fishermans Bend. No tram services to Fishermans Bend were also included in the existing 2046/51 public transport network, leaving only buses to service Fishermans Bend. Further details on the PT line file used as the starting point, updates made and Melbourne Metro assumptions are provided in Appendix B4.

2.3.1 Land use assumptions

The future year model contained a hybrid of 2046 and 2051 land use assumptions such that 2051 land use assumptions were applied to Fishermans Bend, while land use assumptions for the wider metropolitan Melbourne were based on 2046. This was a compromise based on the need for the modelling to represent a 'full build out' of Fishermans Bend, whist keeping the changes to the 2046 VITM reference case to a minimum.

Two 2051 land use scenarios for Fishermans Bend were considered as part of this project, namely:

- **Reference Case:** Assumes moderate intervention with lower population and employment than the current vision (i.e. approximately 69,000 people and 53,000 jobs by 2051). Also, assumes tram or equivalent bus on Plummer alignment and Turner corridors via Collins Street Extension, complementary local bus improvements by 2031 and no heavy rail by 2046.
- **Vision Plus University:** Assumed that the current vision being developed by the Fishermans Bend Taskforce is realised to a large extent (e.g. approximately 80,000 people and 60,000 jobs by 2051). Also, assumes a major university is established in Fishermans Bend Employment Precinct and that heavy rail to Melbourne's West and CBD is operational by 2046.

[1] Provided by DEDJTR and last updated on 18/08/2016

The distribution of key land use assumptions at the precinct level (shown in Figure 2.1) are summarised in Table 2.1 below for each land use scenario.

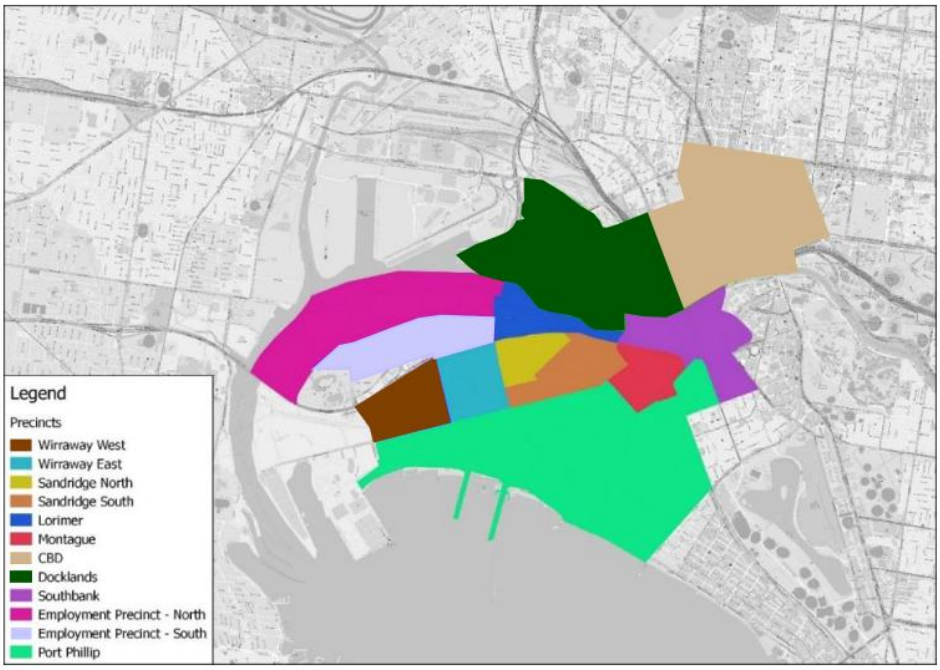

Figure 2.1 Fishermans Bend and surrounding precincts

Table 2.1 2051 land use assumptions in Fishermans Bend precincts

LAND USE SCENARIO	REFERENCE CASE			VISION PLUS UNIVERSITY		
PRECINCT	POPULATION	EMPLOYMENT	ENROLMENTS[2]	POPULATION	EMPLOYMENT	ENROLMENTS[2]
Wirraway West	8,140	5,017	870	9,005	4,963	870
Wirraway East	8,880	4,839	840	9,429	4,955	840
Sandridge North	9,462	4,061	-	10,047	4,146	-
Sandridge South	15,788	6,944	-	16,956	7,217	-
Lorimer	15,891	6,270	-	15,580	8,400	-
Montague	13,809	4,799	1,611	18,858	5,661	1,611
Employment Precinct – North	-	16,484	675	-	18,543	3,922
Employment Precinct - South	-	5,641	1,228	-	6,664	7,722
Fishermans Bend Total	**71,970**	**54,055**	**5,224**	**79,875**	**60,550**	**14,965**
Metropolitan Melbourne	**7,277,705**	**3,884,297**	**1,981,847**	**7,277,355**	**3,884,734**	**1,981,667**

Source: VITM Fishermans Bend land use forecast, provided by DEDJTR

[2] Includes primary, secondary and tertiary enrolments

2.3.2 2046/51 Base Case

The future year model developed, together with the Reference Case land use, was considered as the 2046/51 Base Case. The 2046/51 Base Case therefore assumed Fishermans Bend is only serviced by the 2015/16 Fishermans Bend bus network as illustrated by the tram, bus and rail network plots in Figure 2.3, Figure 2.4 and Figure 2.5. A map of the road network with key road names is also shown in Figure 2.2 below.

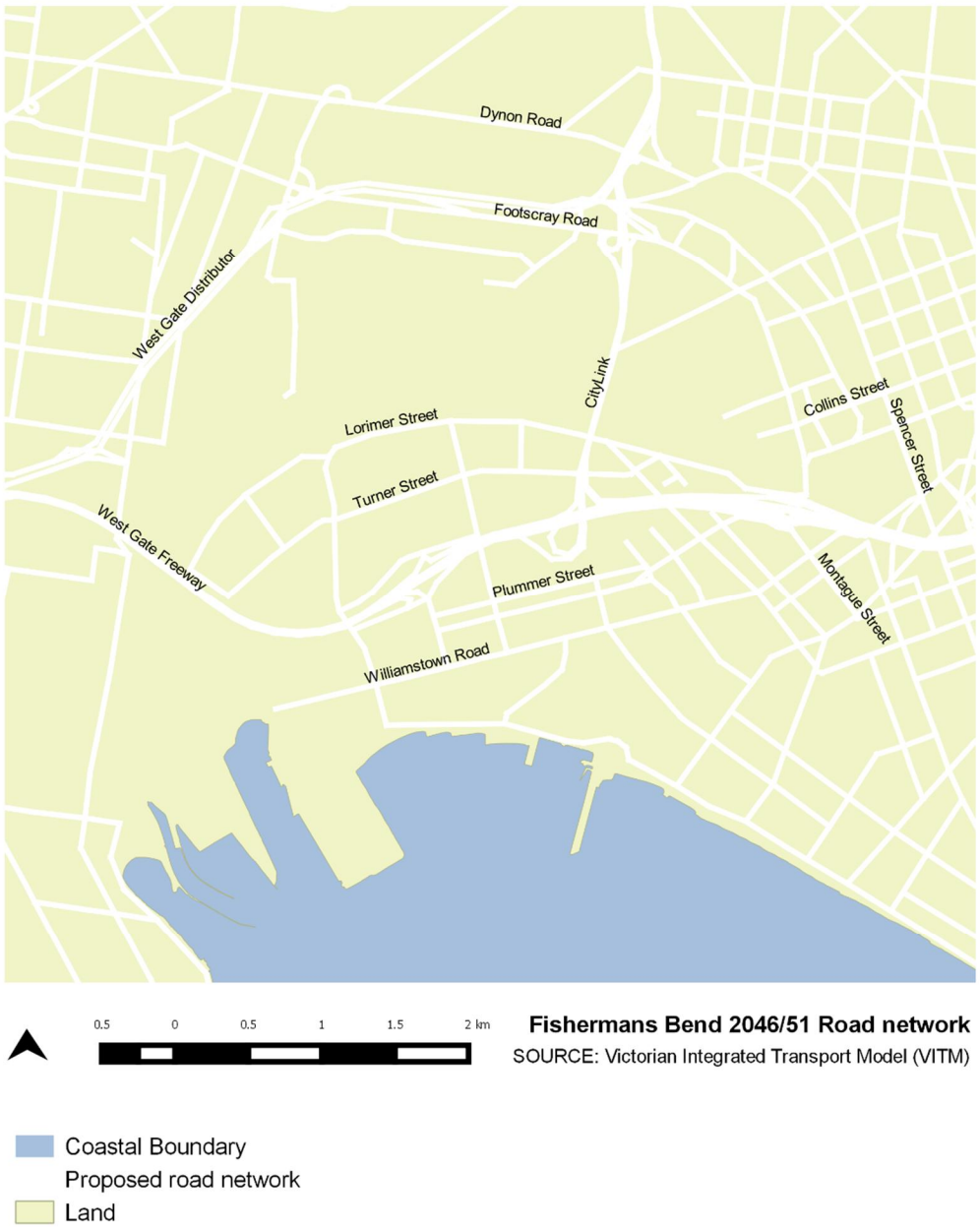

Figure 2.2 Fishermans Bend 2046/51 road network

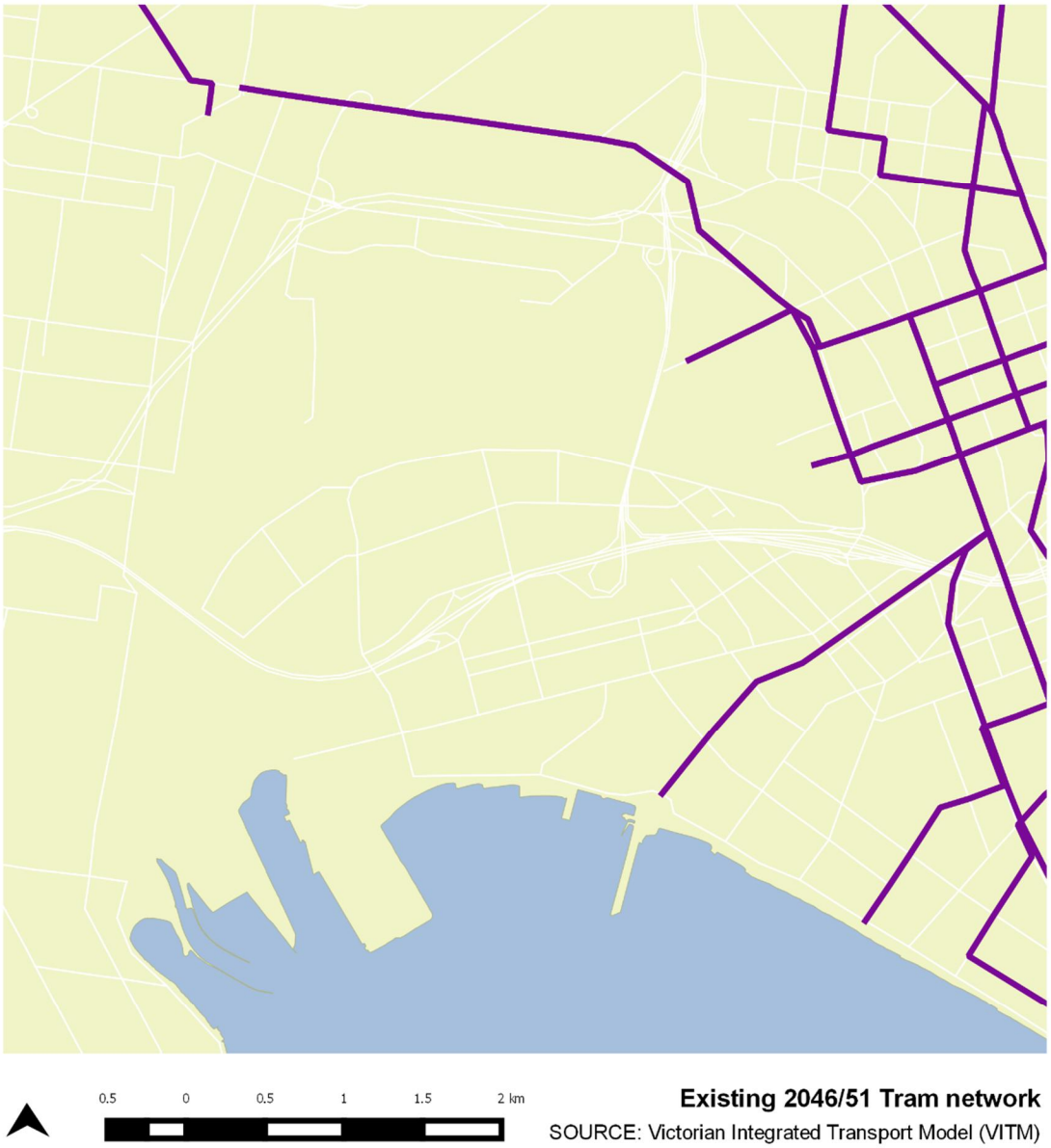

Figure 2.3 Existing 2046/51 tram network

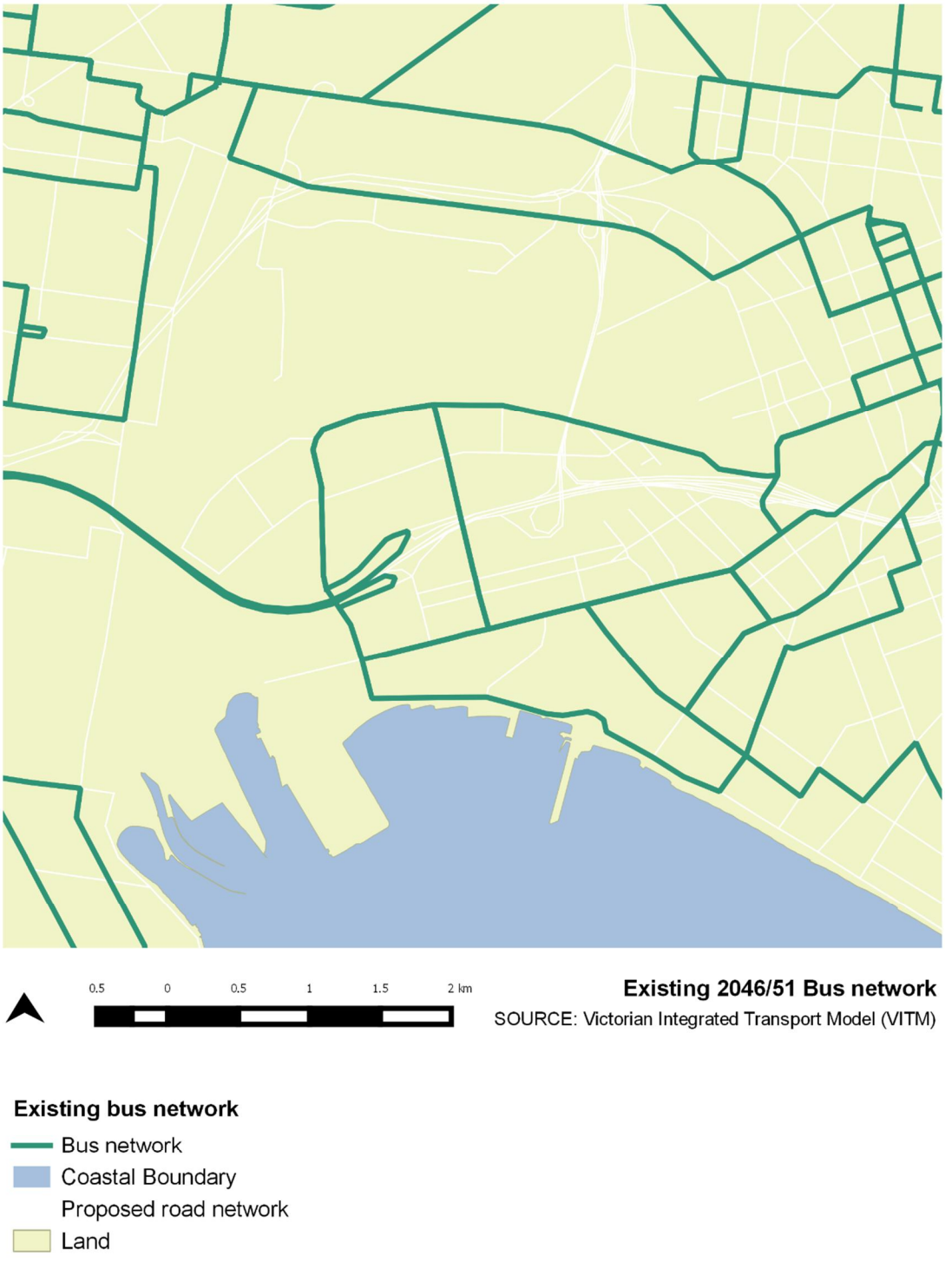

Figure 2.4 Existing 2046/51 bus network

Figure 2.5 Existing 2046/51 rail network (Melbourne Metro Design 1)

3 PROJECT CASES

3.1 Overall rational for project cases

The vision for Fishermans Bend is to become a mixed use higher density environment, similar to the CBD, with sustainable transport mode share to support the scale of urban growth. Improving the public transport network for Fishermans Bend will therefore play an important role in achieving this vision, as the future year Base Case only offers minimal bus services to Fishermans Bend.

Like the CBD, the proposed ultimate Fishermans Bend public transport network could include trams or high frequency buses as a key transport mode to serve the forecast population and employment, while an improved bus network could complement the tram service and provide local area access. Considering that Melbourne Metro is currently being planned, there is also an opportunity to provide a heavy rail option for Fishermans Bend as part of potential future staging. These potential transport solutions therefore formed the basis of the project cases tested to gain a better understanding of the transport network required for Fishermans Bend.

3.2 Description of project cases[3]

Four project cases were tested under the Reference Case land use scenario, using the Base Case as the starting point. These project cases are listed below:

- **Tram Extension Only Option (Project Case 1 or PC1):** This option tested how well the transport network would performance if tram routes 11 and 48 were extended from Victoria Harbour to Fishermans Bend via a new Collins Street Extension link (passing through Docklands, and in its own right of way) to provide direct, reliable and frequent connection between the CBD and either side of the West Gate Freeway. A complementary Fishermans Bend bus network was also included in this option.
- **Charles Grimes Bridge Variation Option (Project Case 4 or PC4):** This option tested how well the transport network would perform if the Tram Extension Only Option consisted of an alternative river crossing – i.e. if the extension of tram routes 11 and 48 were via the existing Charles Grimes Bridge (with their own right of way), rather than the Collins Street Extension.
- **SmartBus Variation Option (Project Case 2 or PC2)**: This option tested how well the transport network would perform if the proposed tram on the Turner Street in the Tram Extension Only Option was replaced with a priority SmartBus (i.e. 10 min travel time between ANZ on Collins Street and terminus at Sabre Drive and Wharf Road).
- **New Rail Variation Option (Project Case 3 or PC3):** This option tested how well the transport network would perform if Fishermans Bend was serviced by a new rail line between Clifton Hill and Newport via Plummer Street as part of the potential future stage of Melbourne Metro Rail (i.e. Melbourne Metro Design 2, see Appendix B4 for further details), in addition to public transport services included in the Tram Extension Only Option.

Two additional project cases were also modelled to gain a better understanding of the public transport needs of the Vision Plus University land use scenario. These project cases are listed below:

- **New Rail with Extra Tram Service Option (Project Case 6 or PC6):** This option tested how well the transport network would perform with the same public transport services included in the New Rail Variation Option (Project Case 3), but with an alternative rail alignment west of Fishermans Bend (i.e. a direct connection from Fishermans Bend to Maddox Station, rather than through Newport Station). This option also tested the demand for an additional tram service connecting North Melbourne Station to the

[3] Note: Project case numbers in this section refer to the naming convention specified in the modelling scope, and therefore may not be listed in chronological order, if this does not support the narrative. Furthermore, Project Case 5 was removed from modelling scope, and therefore has not been referred to.

Employment Precinct and Wirraway via Turner Street, due to the Craigieburn service not running via Southern Cross in Melbourne Metro Design 2.

- **Northern Rail Alignment Variation Option (Project Case 7 or PC7):** This option tested how well the transport network would perform with the same public transport services included in the New Rail Variation Option (Project Case 3), but with an alternative rail alignment west of Fishermans Bend (i.e. a direct connection from Fishermans Bend to Maddox Station, rather than through Newport Station) and alternative rail alignment through Fishermans Bend (i.e. where the rail alignment is via Fishermans Bend north (Employment Precinct) and Sandridge Precinct instead of via Plummer Street).

A summary of all six project case developed for 2046/51 is provided in Table 3.1, while specific tram, bus and rail service included in each project case is also summarised in Table 3.2. The Fishermans Bend tram and bus networks are illustrated in Figure 3.1 to Figure 3.6, while the Fishermans Bend rail service is shown in Figure 3.7 to Figure 3.9.

A summary of capacity and frequency of tram, bus and train services in Fishermans Bend is also provided in Table 3.3 to Table 3.5 respectively.

Table 3.1 Future year model scenarios

PROJECT CASE	PROJECT CASE DESCRIPTION	LAND USE	FISHERMANS BEND TRAM SERVICES	FISHERMANS BEND BUS SERVICES	FISHERMANS BEND RAIL SERVICES
Reference Case land use options					
Base Case	2046/51 with current PT in Fishermans Bend	Reference Case	No new tram services to Fishermans Bend.	2016 Fishermans' Bend Bus Network	No rail service in Fishermans Bend (Melbourne Metro Design 1)
Tram Extension Only Option (PC1)	2046/51 Plummer St and Turner St Tram via Collins Street Extension	Reference Case	**Two new tram services to Fishermans Bend** **(Plummer Street and Turner Street trams via Collins Street Extension link)**	Complementary Fishermans Bend bus services	No rail service in Fishermans Bend (Melbourne Metro Design 1)
Charles Grimes Bridge Variation Option (PC4)	2046/51 Plummer St and Turner St Tram via CGB	Reference Case	Two new tram services to Fishermans Bend **(Plummer Street and Turner Street trams via Charles Grimes Bridge (elevated))**	Complementary Fishermans Bend bus services	No rail service in Fishermans Bend (Melbourne Metro Design 1)
SmartBus Variation Option (PC2)	2046/51 Plummer St Tram and Turner St SmartBus via Collins Street Extension	Reference Case	One new tram service to Fishermans Bend (Plummer Street tram via Collins Street Extension link)	**Premium SmartBus service on Turner Street via Collins Street Extension link** and complementary Fishermans Bend bus services	No rail service in Fishermans Bend (Melbourne Metro Design 1)
New Variation Option (PC3)	2046/51 Plummer St and Turner St Tram via Collins Street Extension and rail line via Plummer St	Reference Case	Two new tram services to Fishermans Bend (Plummer Street and Turner Street trams via Collins Street Extension link)	Complementary Fishermans Bend bus services	**Two rail stations in Fishermans Bend as part of Melbourne Metro Design 2** (default Plummer Street alignment option)
Vision Plus University land use options					
New Rail with Extra Tram Option (PC6)	2046/51 Plummer St and two Turner St Trams via Collins Street Extension and rail line via Plummer St	Vision Plus Uni	**Three new tram services to Fishermans Bend** (one Plummer Street and two Turner Street trams via Collins Street Extension link)	Complementary Fishermans Bend bus services	Two rail stations in Fishermans Bend as part of Melbourne Metro Design 2 (default Plummer Street alignment option)
Northern Rail Alignment Variation Option (PC7)	2046/51 Plummer St and Turner St Tram via Collins Street Extension and rail line via the Employment Precinct	Vision Plus Uni	Two new tram services to Fishermans Bend (Plummer Street and Turner Street trams via Collins Street Extension link)	Complementary Fishermans Bend bus services	Two rail stations in Fishermans Bend as part of Melbourne Metro Design 2 **(alternative rail alignment via Employment Precinct)**

Table 3.2 Fishermans Bend tram, bus and rail services included in each project case

ROUTE	DESCRIPTION	INCLUDED					
	Project Case	1	4	2	3	6	7
Fishermans Bend tram services							
Route 11	Reservoir – Fishermans Bend via Plummer St	✓	✓	✓	✓	✓	✓
Route 48	Doncaster Park and Ride – Fishermans Bend via Turner St	✓	✓		✓	✓	✓
Route 46	North Melbourne Station - Fishermans Bend South via Turner St					✓	
Connection to CBD							
Alignment 1	via Collins St Extension	✓		✓	✓	✓	✓
Alignment 2	via Charles Grimes Bridge		✓				
Complementary Fishermans Bend bus services							
Route FB-B1	Elsternwick - Fishermans Bend	✓	✓	✓	✓	✓	✓
Route FB-B2	Garden City - Queen Vic Market	✓	✓	✓	✓	✓	✓
Route FB-B3	Domain - Fishermans Bend	✓	✓	✓	✓	✓	✓
Route FB-B4	Gardenvale - Albert Park	✓	✓	✓	✓	✓	✓
Route FB-B6	Southern Cross Station - Newport	✓	✓	✓			
Route FB-B6	Southern Cross Station - Fishermans Bend				✓	✓	✓
Route FB-B7	Garden City - Queen Vic Market	✓	✓	✓	✓	✓	✓
Premium SmartBus service on Turner Street via Collins Street Extension link							
Route FB-B5	Southern Cross Station - Fishermans Bend (SmartBus)			✓			
Fishermans Bend rail services							
Rail stations	Two rail stations in Fishermans Bend as part of Melbourne Metro Design 2				✓	✓	✓
Melbourne Metro Design 2 alignment through Fishermans Bend							
Alignment 1	Default Plummer St Option				✓	✓	
Alignment 2	Alternative northern alignment						✓
Melbourne Metro Design 2 alignment west of Fishermans Bend							
Alignment 1	Default to Newport				✓		
Alignment 2	Alternative alignment to new Maddox Station					✓	✓

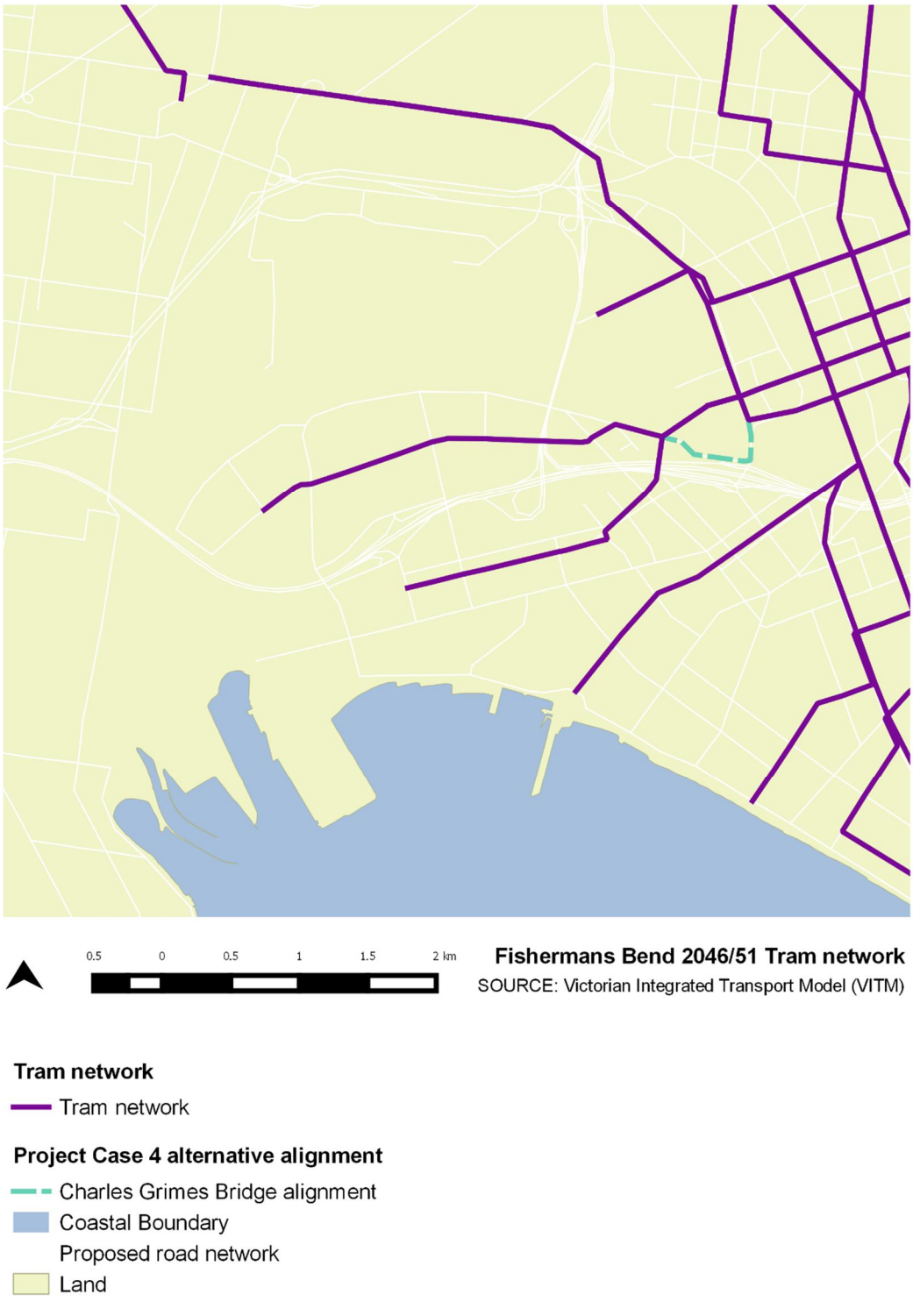

Figure 3.1 Fishermans Bend tram network in Project Case 1, 3, 4, 6 and 7

Figure 3.2 Fishermans Bend tram network in the SmartBus Variation Option (Project Case 2)

Figure 3.3 Additional North Melbourne tram service included in Project Case 6

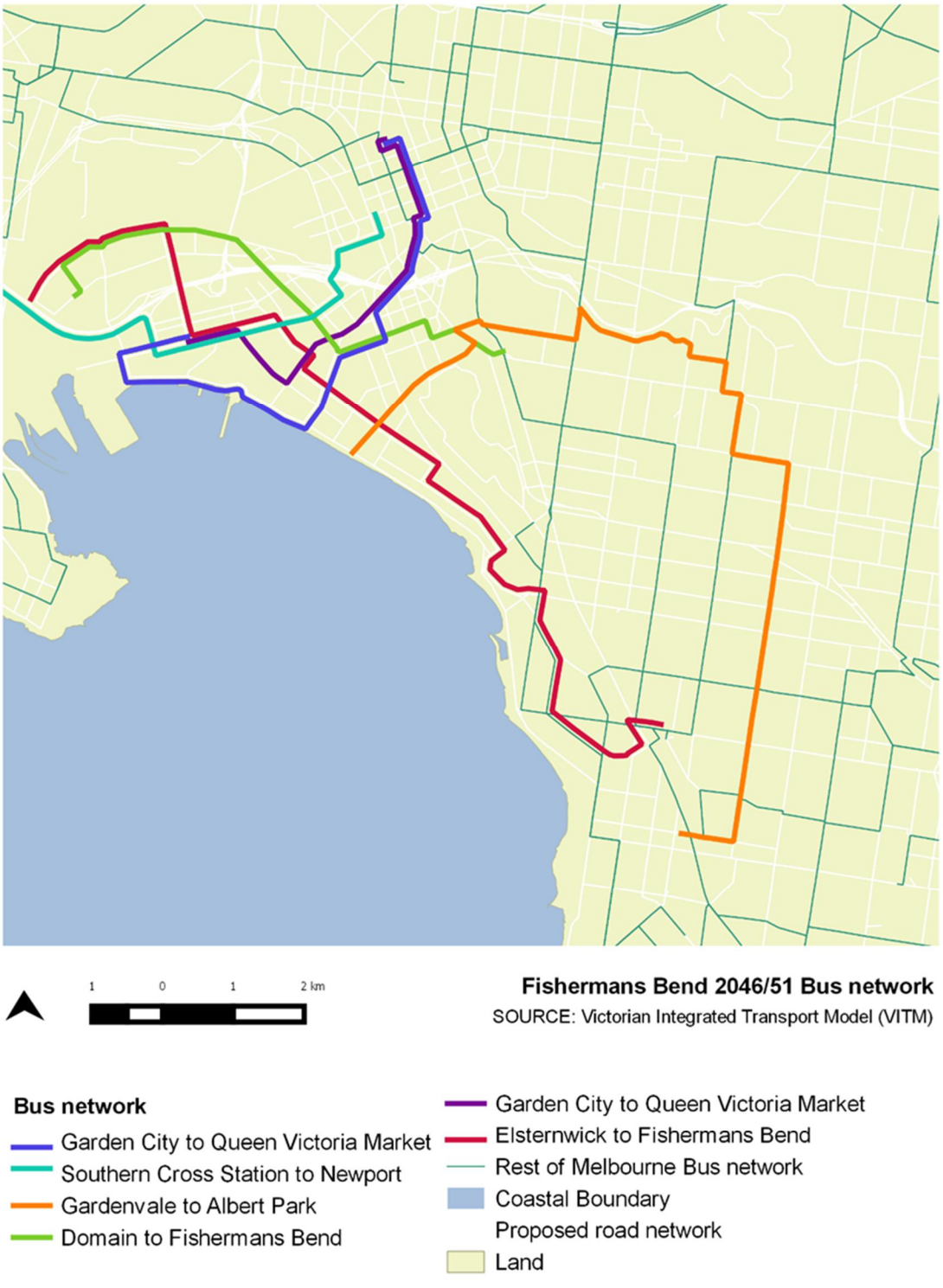

Figure 3.4 Fishermans Bend bus network in Project Case 1 and 4

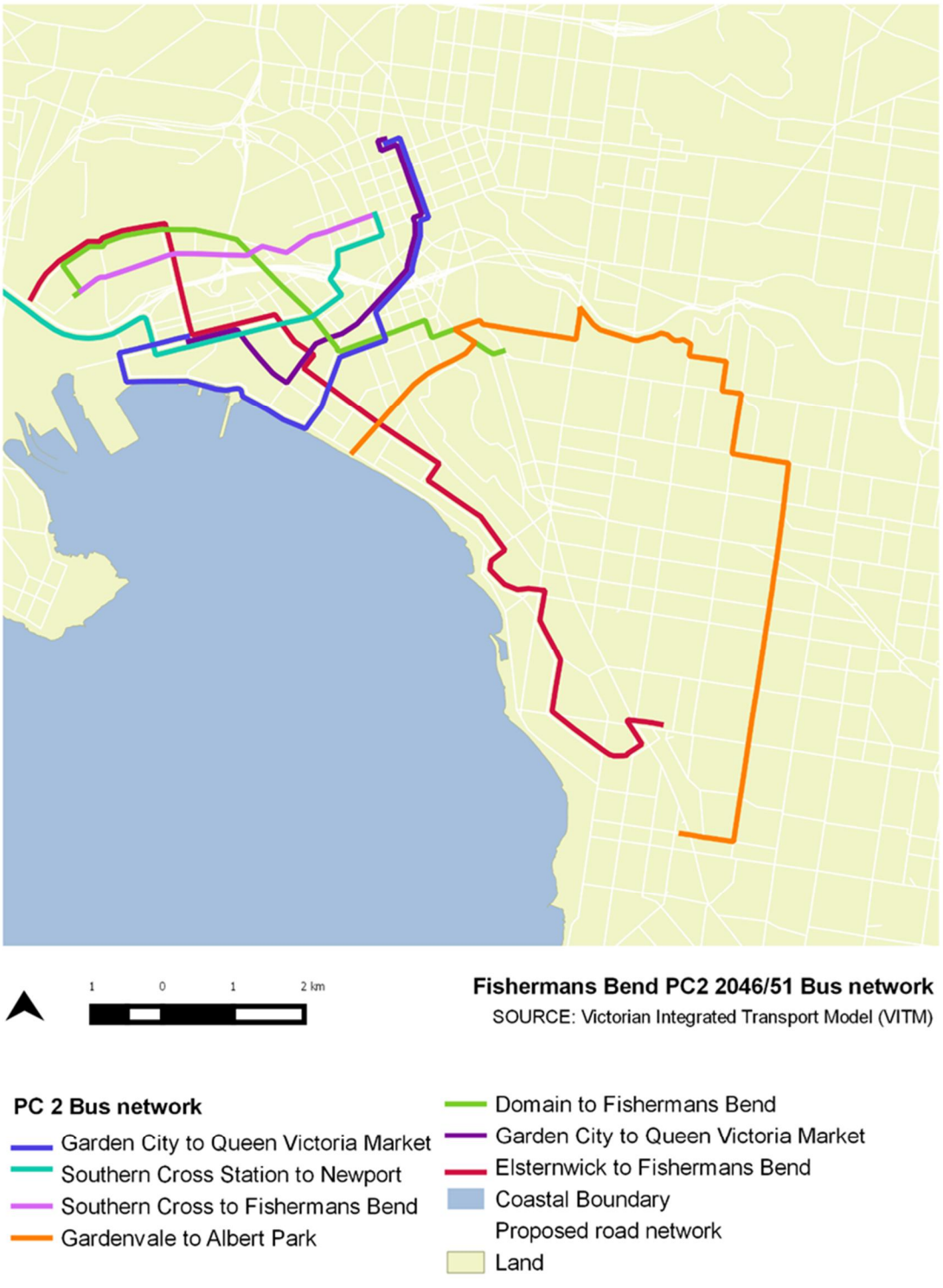

Figure 3.5 Fishermans Bend bus network in Project Case 2

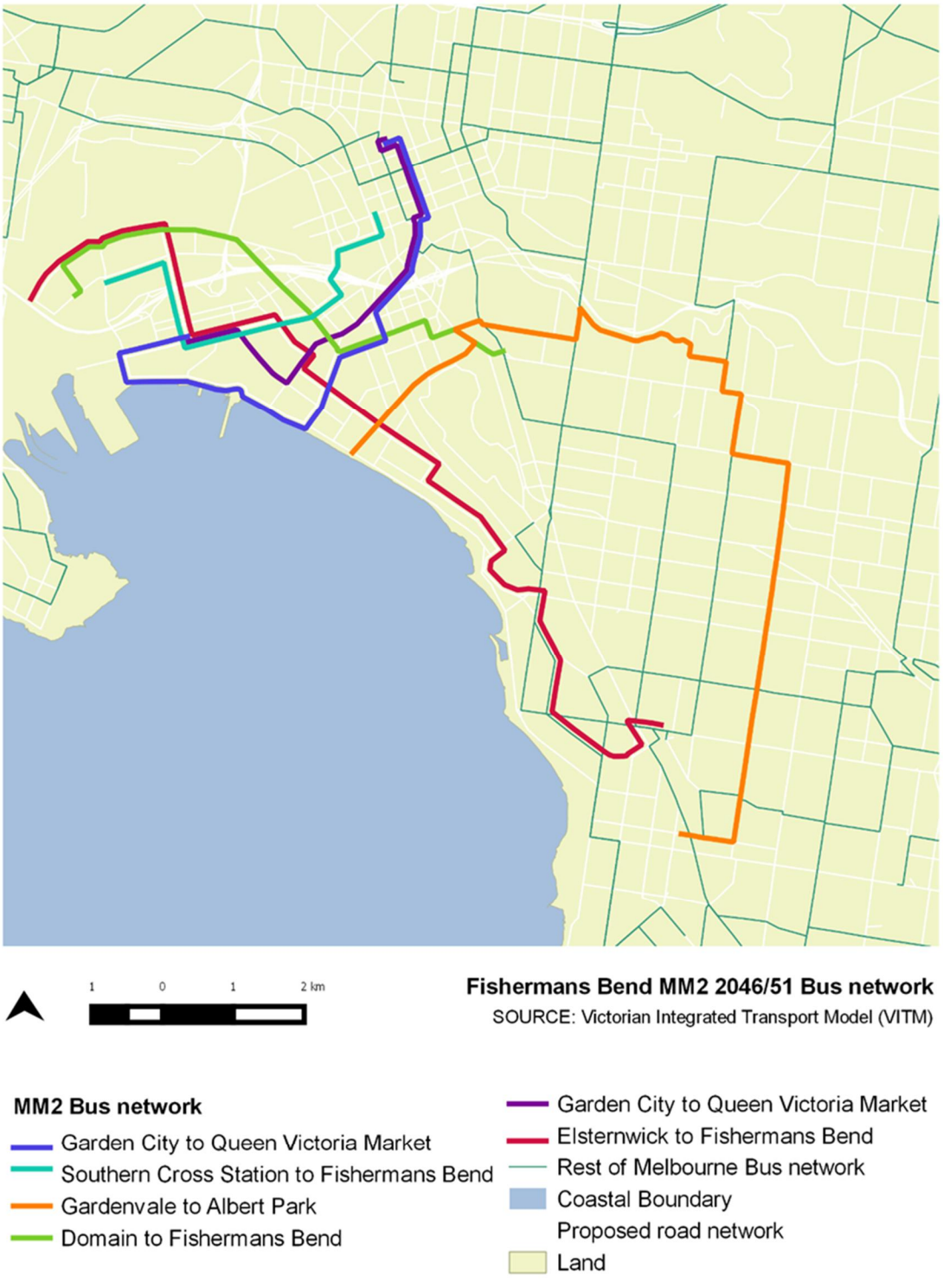

Figure 3.6 Fishermans Bend bus network in Project Case 3, 6 and 7

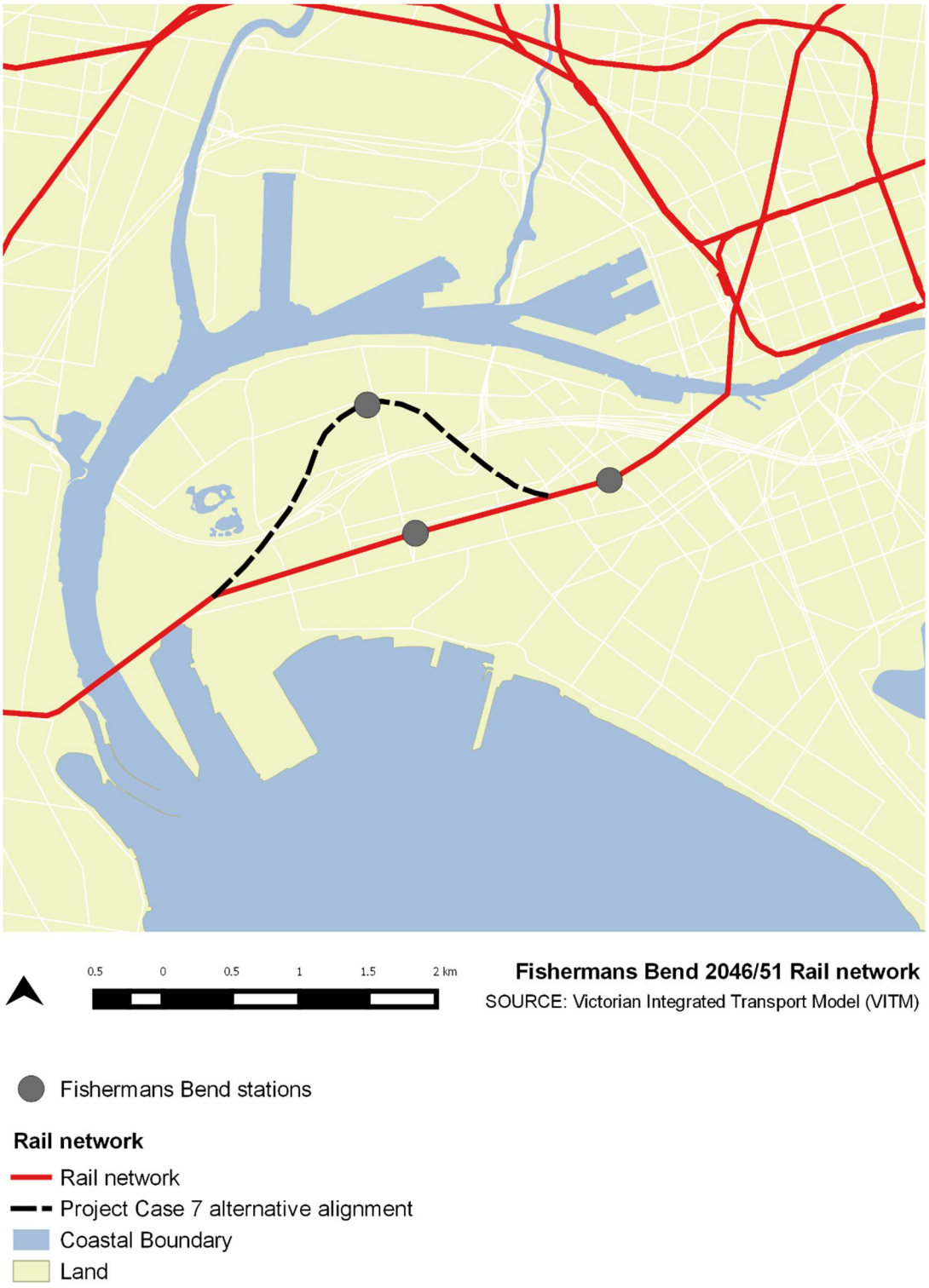

Figure 3.7 Fishermans Bend rail service in Project Case 3, 6 and 7

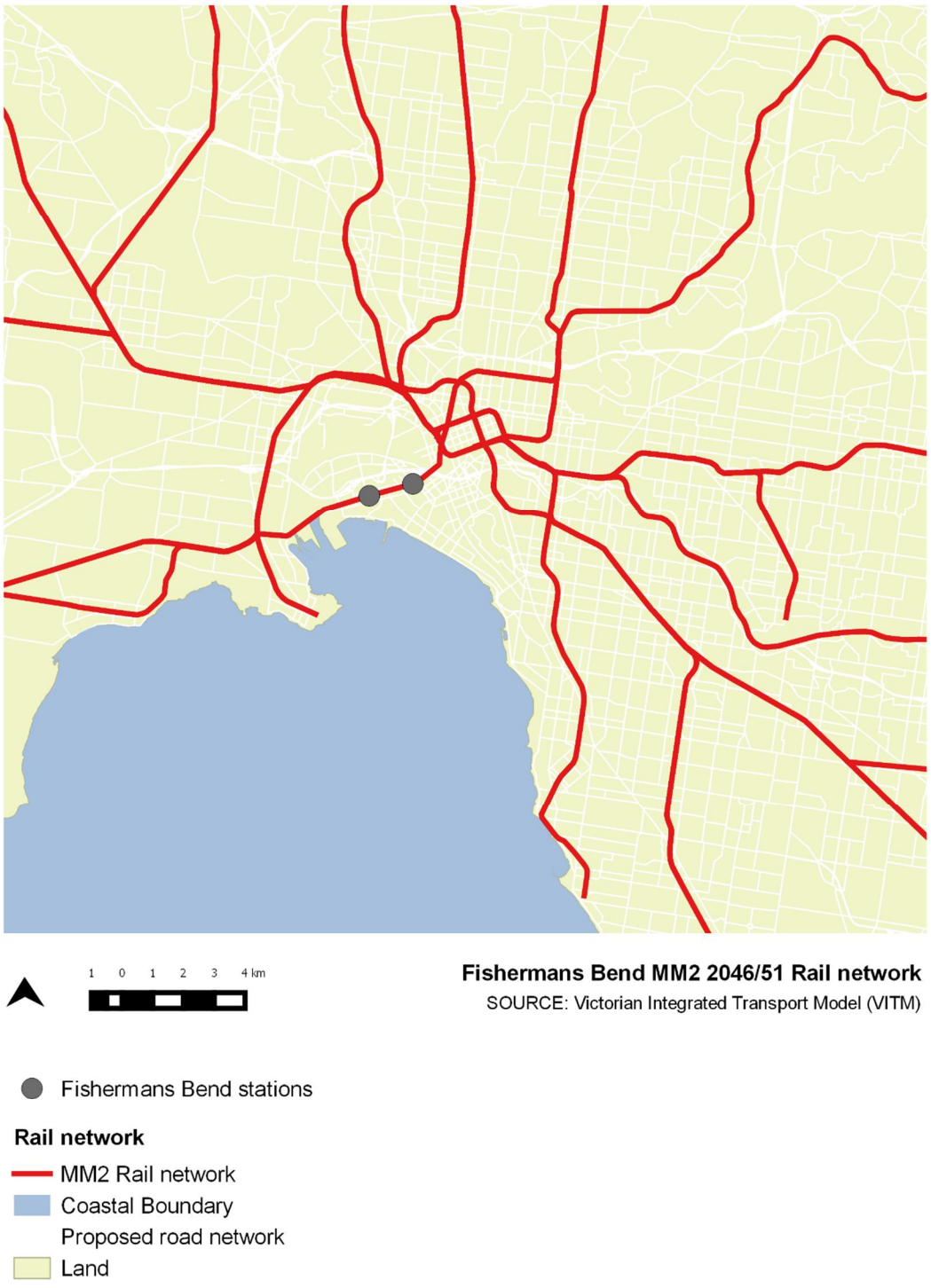

Figure 3.8 Melbourne Metro Design 2 (Default Southern Alignment through Fishermans Bend)

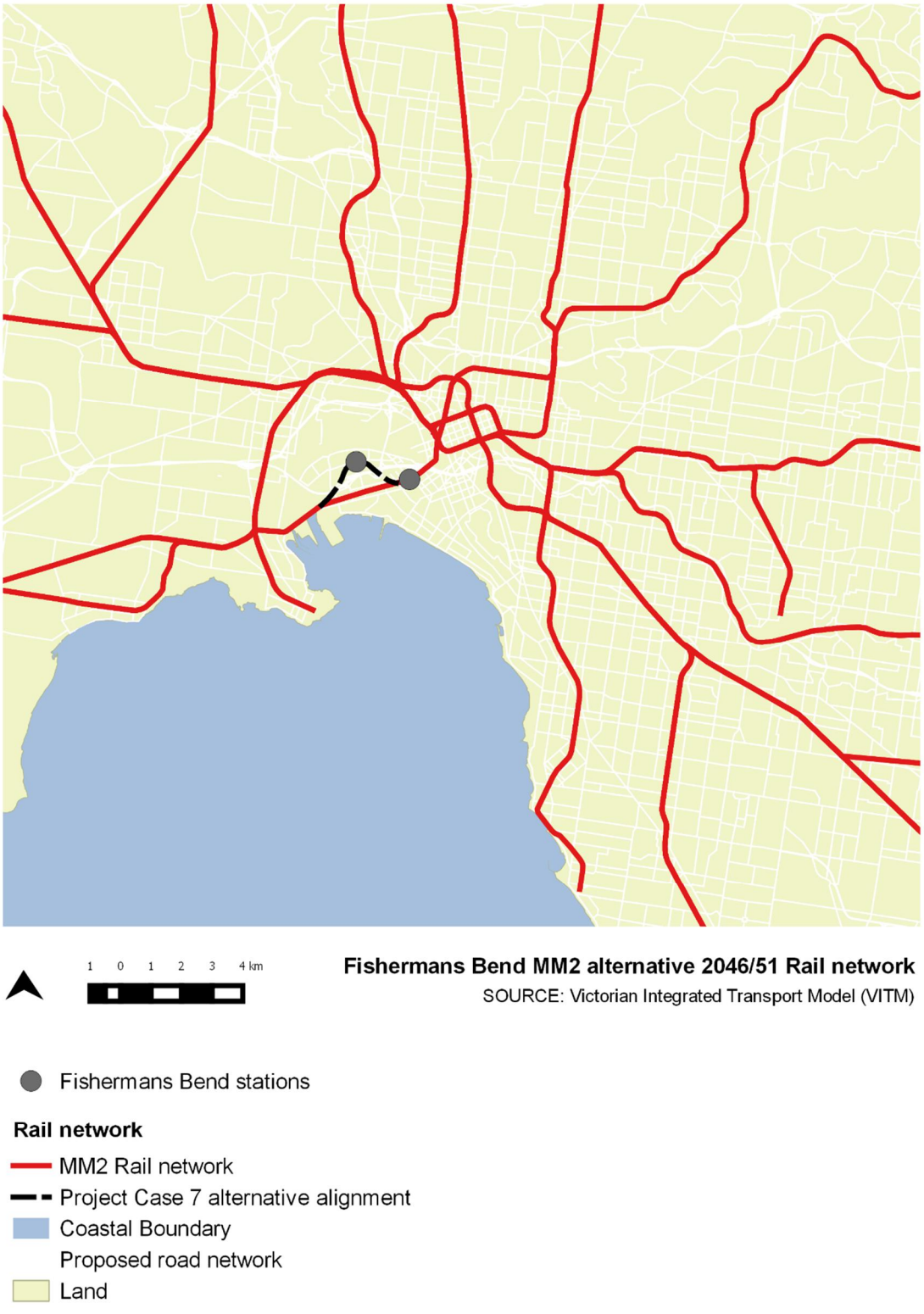

Figure 3.9 Melbourne Metro Design 2 (Alternative Northern Alignment through Fishermans Bend)

Table 3.3 Capacity and frequency of trams servicing the study area

TRAM ROUTE	LOAD STANDARD CAPACITY PER SERVICE	AM FREQUENCY	PM FREQUENCY	OP FREQUENCY
Route 11 (via Plummer Street in Project Case 1, 2, 4, 6 and 7)	180	6 mins	6 mins	10 mins
Route 46 (via Turner Street in Project Case 6)	180	10 mins	10 mins	10 mins
Route 48 (via Turner Street in Project Case 1, 4, 6 and 7)	180	6 mins	6 mins	10 mins
Route 86 (currently Route 109)	180	5 mins	5 mins	10 mins

Table 3.4 Capacity and frequency of buses servicing the study area

BUS ROUTE	LOAD STANDARD CAPACITY PER SERVICE	AM FREQUENCY	PM FREQUENCY	OP FREQENCY
Complementary Bus Network Routes	50	10 mins	10 mins	20 mins
SmartBus Route	50	10 mins	10 mins	20 mins

Table 3.5 Capacity and frequency of trains servicing the study area

TRAIN ROUTE	LOAD STANDARD CAPACITY PER SERVICE	AM FREQUENCY	PM FREQUENCY	OP FREQENCY
Werribee - Wollert	1570	7 mins	7 mins	20 mins
Wollert - Werribee	1570	7 mins	7 mins	20 mins

4 OVERVIEW OF FORECASTING RESULTS

4.1 Network-wide performance

An overview of the daily network-wide performance of each project case compared to the base case is presented in Table 4.1, while full network wide statistics are presented in Appendix C.

In general, all project cases modelled under the Reference Case land use scenario result in:

- an increase in total public transport boardings
- an increase in boardings on trams, buses and rail
- a reduction in number of total person car trips and total vehicle trips
- an increase in public transport trips and mode share.

This suggests that all project cases modelled under the Reference Case land use scenario perform better than the base case in terms of reducing vehicle demand and encouraging public transport movements network-wide. More specifically:

- The Tram Only Extension Option (Project Case 1) and Charles Grimes Bridge Variation Option (Project Case 4) are similar in performance, with increase in daily public transport trips of around 42,000 and 40,000 respectively. This suggests that the alignment of the trams between the CBD and Fishermans Bend (and associated travel time) has a small difference to network-wide public transport patronage, which is likely driven by the difference in travel time.
- The SmartBus Variation Option (Project Case 2) does not appear to perform as well as other options modelled under the Reference Case land use scenario, as this option has the least increase in daily public transport trips at approximately 27,000 trips.
- Of the project cases modelled with the Reference Case land use scenario, the New Rail Line Variation Option (Project Case 3) shows the greatest increase in daily public transport trips at, around 81,000 (almost double that of Project Case 1 and 4). This suggests that a transport network with Melbourne Metro would attract the most public transport patronage.

For options modelled under the Vision Plus University land use scenario, results are very similar between options, with daily public transport trips increasing in both Project Case 6 and 7 by around 90,000. This suggested the alignment of the trams through Fishermans Bend does not have a significant impact on network-wide public transport patronage. As daily public transport trips are also higher than Project Case 3, results also show that the increase in population, employment and enrolments associated with the Vision Plus University land use scenario increase public transport trips by almost 10%.

Table 4.1 2046/51 Daily overview of project cases – network wide

MODE	INDICATOR	*BASE CASE*	DIFFERNCE BETWEEN PROJECT CASE AND BASE CASE	PROJECT CASES (PC)					
				PC 1	PC 4	PC 2	PC 3	PC 6	PC 7
Total motorised person trips		*22,407,399*	Total Diff	-8,236	-7,718	-5,244	-16,325	55,640	55,977
			% Diff	0.0%	0.0%	0.0%	-0.1%	0.2%	0.2%
Car	Total person trips	*18,905,708*	Total Diff	-50,484	-47,298	-32,631	-97,427	-34,913	-32,575
			% Diff	-0.3%	-0.3%	-0.2%	-0.5%	-0.2%	-0.2%
	% mode share	*84.4%*	Total Diff	-0.2%	-0.2%	-0.1%	-0.4%	-0.4%	-0.4%
	Total vehicle trips	*13,703,512*	% Diff	-39,043	-36,701	-24,414	-74,907	-25,458	-24,074
			Total Diff	-0.3%	-0.3%	-0.2%	-0.5%	-0.2%	-0.2%
Public transport	Total person trips	*3,501,691*	% Diff	42,248	39,580	27,387	81,102	90,553	88,552
			Total Diff	1.2%	1.1%	0.8%	2.3%	2.6%	2.5%
	% mode share	*15.8%*	% Diff	0.2%	0.2%	0.1%	0.4%	0.4%	0.4%
	Total PT boardings (incl. V/Line)	*5,145,745*	Total Diff	100,377	93,768	60,301	116,567	136,422	134,732
			% Diff	2.0%	1.8%	1.2%	2.3%	2.7%	2.6%
	Metro Rail	*2,269,383*	Total Diff	14,390	12,548	7,811	114,129	116,703	110,425
			% Diff	0.6%	0.6%	0.3%	5.0%	5.1%	4.9%
	Tram	*1,577,203*	Total Diff	77,998	74,147	33,508	23,937	43,522	44,807
			% Diff	4.9%	4.7%	2.1%	1.5%	2.8%	2.8%
	Bus	*1,118,702*	Total Diff	6,062	5,522	18,207	2,139	-2,167	149
			% Diff	0.5%	0.5%	1.6%	0.2%	-0.2%	0.0%

4.2 Fishermans Bend trip generation

Total person trips entering Fishermans Bend in the AM peak are shown in Table 4.2 for the Base Case and each project case; while total person trips leaving Fishermans Bend are shown in Table 4.3. Similar results are shown across the day in Table 4.4 and Table 4.5. It should be noted that numbers in these tables are for comparison purposes only, and shown not be used as reliable forecasts.

In general, modelling undertaken show that:

- Total person trips entering Fishermans Bend are similar for options modelled with the same land use; while the options modelled with the Vision Plus University land use scenario have approximately 15% more trips than that modelled with the Reference Case land use scenario.
- Total person trips leaving Fishermans Bend are similar for options modelled with the same land use; while the options modelled with the Vision Plus University land use scenario have approximately 11% more trips than that modelled with the Reference Case land use scenario.

A detailed breakdown of the total person trips entering and leaving Fishermans Bend by LGA and mode is provided in Appendix D.

Table 4.2 Total person trips entering Fishermans Bend in the AM peak

Land Use	Reference Case Land Use					Vision Plus University Land Use	
Mode/Option	**Base Case**	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
Car	29,300	22,500	22,800	25,900	19,500	21,900	21,500
Public transport	9,900	16,700	16,400	13,300	19,700	23,300	23,800
Total	39,200	39,200	39,200	39,200	39,200	45,200	45,300

Table 4.3 Total person trips leaving Fishermans Bend in the AM peak

Land Use	Reference Case Land Use					Vision Plus University Land Use	
Mode	**Base Case**	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
Car	17,400	14,400	14,500	15,000	13,200	14,700	14,800
Public transport	11,500	13,600	13,500	13,300	14,200	16,400	16,300
Total	28,900	27,900	28,000	28,400	27,400	31,100	31,100

Table 4.4 Total person trips entering Fishermans Bend across the day

Land Use	Reference Case Land Use					Vision Plus University Land Use	
Mode/Option	**Base Case**	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
Car	192,800	156,100	157,600	172,900	136,500	152,200	151,400
Public transport	54,500	85,200	83,800	71,100	101,500	120,300	121,000
Total	247,300	241,300	241,400	244,000	238,000	272,500	272,400

Table 4.5 Total person trips leaving Fishermans Bend across the day

Land Use	Reference Case Land Use					Vision Plus University Land Use	
Mode	**Base Case**	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
Car	83,200	64,300	64,800	69,200	58,100	65,100	65,400
Public transport	83,200	96,000	95,700	93,800	99,000	114,000	113600
Total	166,400	160,300	160,500	163,000	157,100	179,100	179,000

4.3 Fishermans Bend trip distribution

The top five LGAs with the most car trips and public transport (PT) trips to Fishermans Bend in the AM peak are shown in Table 4.6 and Table 4.7 respectively, for the Base Case and each project case; while the top five LGAs with the most car trips and PT trips from Fishermans Bend in the AM peak are shown in Table 4.8 and Table 4.9 respectively. Key observations about Fishermans Bend's trip distribution are listed below:

- LGAs with the most car trips to and from Fishermans Bend have little or no change in the AM peak regardless of land use or option, with Port Phillip being the number one location where car trips originate from (almost 20% of all car trips) and go to (approximately 22% of all car trips). This is consistent with the fact that there is no change in road network between options.
- With little improvement to tram or train, public transport trips to Fishermans Bend are likely to be internal (as is the case for the Base Case and Project Case 2); while with the inclusion of two tram services, most public transport trips to Fishermans Bend will come from Melbourne as the CBD becomes more accessible (see Project Case 1 and 4). Furthermore, with the addition of Melbourne Metro Design 2, public transport trips from Wyndham and Whittlesea become more popular regardless of land use, as these LGAs become easier to access (see Project Case 3, 6 and 7).
- Regardless of land use or public transport option tested, Melbourne is the most popular LGA for public transport trips from Fishermans Bend in the AM peak (approximately 50%-55% of all PT trips), most likely due to high employment opportunities. With improvement to tram and rail, the nearby LGAs of Port Phillip and Yarra also become attractive destinations as does Boroondara; and may be taking away some trips from the Fishermans Bend City of Port Phillip.
- Key origin and destination for PT trips to and from Fishermans Bend are similar for both Project Case 3, 6 and 7, suggesting that the western alignment for Melbourne Metro Design 2 has little impact on trip distribution.

A detailed breakdown of the Fishermans Bend trip distribution by LGA and mode is provided in Appendix D.

Table 4.6 Top five LGAs with the most car trips to Fishermans Bend in the AM peak

	Reference Case Land Use					Vision Plus University Land Use	
	Base Case	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
1	Port Phillip (18.6%)	Port Phillip (19.2%)	Port Phillip (19.1%)	Port Phillip (18.5%)	Port Phillip (19.6%)	Port Phillip (18.8%)	Port Phillip (19.1%)
2	Fishermans Bend – CoM (10.9%)	Fishermans Bend - CoM (12.2%)	Fishermans Bend - CoM (12.2%)	Fishermans Bend - CoM (10.9%)	Fishermans Bend - CoM (12.6%)	Fishermans Bend - CoM (12.1%)	Fishermans Bend - CoM (12.6%)
3	Melbourne (8.1%)	Melbourne (8.6%)	Melbourne (8.6%)	Melbourne (8.3%)	Melbourne (9.2%)	Melbourne (8.8%)	Melbourne (8.9%)
4	Wyndham (7.6%)	Wyndham (7.2%)	Wyndham (7.3%)	Wyndham (7.6%)	Wyndham (6.7%)	Wyndham (6.9%)	Wyndham (6.7%)
5	Hobsons Bay (6.0%)	Hobsons Bay (6.0%)	Hobsons Bay (6.0%)	Hobsons Bay (6.1%)	Hobsons Bay (5.8%)	Hobsons Bay (5.9%)	Hobsons Bay (5.8%)

Note: Percentage in brackets denotes percentage of car trips to Fishermans Bend (e.g. 19.2% of all car trips in Project Case 1 are from Port Philip to Fishermans Bend in the AM peak.)

Table 4.7 Top five LGAs with the most PT trips to Fishermans Bend in the AM peak

	Reference Case Land Use					Vision Plus University Land use	
	Base Case	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
1	Fishermans Bend - CoM (15.2%)	Melbourne (10.9%)	Melbourne (11.0%)	Fishermans Bend - CoM (10.7%)	Wyndham (13.8%)	Wyndham (13.8%)	Wyndham (14.3%)
2	Melbourne (9.2%)	Wyndham (9.0%)	Wyndham (8.8%)	Melbourne (10.6%)	Melbourne (9.5%)	Melbourne (9.6%)	Melbourne (9.0%)
3	Port Phillip (8.3%)	Port Phillip (8.2%)	Port Phillip (8.4%)	Port Phillip (10.1%)	Port Phillip (6.1%)	Port Phillip (6.0%)	Whittlesea (6.0%)
4	Wyndham (7.4%)	Fishermans Bend - CoM (8.0%)	Fishermans Bend - CoM (8.3%)	Wyndham (8.4%)	Whittlesea (5.8%)	Whittlesea (5.7%)	Port Phillip (6.0%)
5	Fishermans Bend - CoPP (6.9%)	Moreland (4.1%)	Moreland (4.1%)	Moreland (3.8%)	Fishermans Bend - CoM (4.4%)	Fishermans Bend - CoM (4.9%)	Fishermans Bend - CoM (5.1%)

Note: Percentage in brackets denotes percentage of public transport trips to Fishermans Bend (e.g. 10.9% of all public transport trips in Project Case 1 are from Melbourne to Fishermans Bend in the AM peak.)

Table 4.8 Top five LGAs with the most car trips from Fishermans Bend in the AM peak

	Reference Case Land Use					Vision Plus University Land Use	
	Base Case	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
1	Port Phillip (21.3%)	Port Phillip (22.4%)	Port Phillip (22.3%)	Port Phillip (21.7%)	Port Phillip (22.7%)	Port Phillip (22.3%)	Port Phillip (22.4%)
2	Melbourne (20.3%)	Melbourne (20.6%)	Melbourne (20.6%)	Melbourne (20.4%)	Melbourne (20.8%)	Melbourne (20.8%)	Melbourne (20.8%)
3	Fishermans Bend - CoM (19.0%)	Fishermans Bend - CoM (20.0%)	Fishermans Bend - CoM (20.0%)	Fishermans Bend - CoM (19.2%)	Fishermans Bend - CoM (20.0%)	Fishermans Bend - CoM (19.3%)	Fishermans Bend - CoM (19.6%)
4	Fishermans Bend - CoPP (6.5%)	Yarra (5.2%)	Yarra (5.1%)	Fishermans Bend - CoPP (5.6%)	Yarra (5.3%)	Yarra (5.6%)	Yarra (5.5%)
5	Yarra (4.9%)	Fishermans Bend - CoPP (4.1%)	Fishermans Bend - CoPP (4.2%)	Yarra (5.1%)	Hobsons Bay (4.1%)	Fishermans Bend - CoPP (4.3%)	Hobsons Bay (4.1%)

Note: Percentage in brackets denotes percentage of car trips from Fishermans Bend (e.g. 22.4% of all car trips in Project Case 1 are from Fishermans Bend to Port Phillip in the AM peak.)

Table 4.9 Top five LGAs with the most PT trips from Fishermans Bend in the AM peak

	Reference Case Land Use					Vision Plus University Land Use	
	Base Case	**PC1**	**PC4**	**PC2**	**PC3**	**PC6**	**PC7**
1	Melbourne (49.0%)	Melbourne (54.8%)	Melbourne (54.7%)	Melbourne (52.7%)	Melbourne (53.7%)	Melbourne (53.6%)	Melbourne (53.8%)
2	Fishermans Bend - CoM (10.7%)	Fishermans Bend - CoM (8.3%)	Fishermans Bend - CoM (8.3%)	Fishermans Bend - CoM (9.3%)	Yarra (5.2%)	Fishermans Bend - CoM (5.6%)	Fishermans Bend - CoM (6.1%)
3	Fishermans Bend - CoPP (8.3%)	Port Phillip (5.4%)	Port Phillip (5.4%)	Port Phillip (5.8%)	Fishermans Bend - CoM (5.1%)	Yarra (5.1%)	Yarra (5.1%)
4	Port Phillip (5.0%)	Yarra (4.6%)	Yarra (4.5%)	Fishermans Bend - CoPP (4.7%)	Port Phillip (4.2%)	Port Phillip (4.2%)	Port Phillip (4.4%)
5	Yarra (5.0%)	Boroondara (3.9%)	Boroondara (3.9%)	Yarra (4.5%)	Boroondara (4.0%)	Boroondara (3.9%)	Boroondara (3.9%)

Note: Percentage in brackets denotes percentage of public transport trips from Fishermans Bend (e.g. 54.8% of all public transport trips in Project Case 1 are from Fishermans Bend to Melbourne LGA in the AM peak.)

5 PERFORMANCE OF OPTIONS MODELLED WITH REFERENCE CASE LAND USE

This section discussed how well each project case modelled with the Reference Case land use performs compared to the Base Case in terms of public transport patronage and service capacity. The performance of the Charles Grimes Bridge Variation, SmartBus Variation and New Rail Variation Options (i.e. Project Cases 4, 2 and 3) have also been compared to the Tram Extension Only Option (i.e. Project Case 1) to gain a better understanding of the assumptions and elements of the Tram Extension Only Option and thereby a better understanding of the transport requirements of this land use scenario.

It should be noted that more detailed load and volume capacity plots discussed in this section are provided in Appendix K. It should also be noted that any reference to AM peak and PM peak, implies a 2-hour peak period.

5.1 Tram Extension Only Option (Project Case 1 or PC1)

OVERVIEW

In the Tram Extension Option (Project Case 1), the AM peak public transport mode share by origin and destination increases for all precincts in Fishermans Bend when compared to the Base Case, with the most noticeable increase occurring in the Lorimer precinct. Furthermore, daily boardings on tram routes extending into Fishermans Bend increase by 71% (96,700) and daily bus boardings on buses servicing Fishermans Bend increase by 8% (3,900). This suggested that the Tram Extension Only Option performs better than the Base Case, as it encourages a higher level of public transport patronage, which is in line with the vision for Fishermans Bend. There are however some capacity issues with the new tram extension services, particularly as they approach the CBD.

PUBLIC TRANSPORT MODE SHARE

A summary of the public transport (PT) mode share for the Base Case and Tram Extension Only Option (Project Case 1) in the AM peak is shown in Table 5.1. The results focus on the precincts shown previously in Figure 2.1, covering Fishermans Bend and key surrounding precincts such as the CBD, Southbank and Docklands.

In general, the following observations were made:

- The AM peak PT mode share by origin and destination in Project Case 1 increases for all precincts in Fishermans Bend when compared to the Base Case.
- The Lorimer precinct experiences significant increase in PT mode share for both origin and destination trips in the AM peak when compared to the Base Case. This is generally because Lorimer is poorly serviced by public transport in the Base Case, but is well serviced by public transport in the Project Case 1.
- The employment precinct experiences significant increase in PT mode share for destination trips in the AM peak, which is expected since the employment precinct falls within the Turner Street corridor and are relatively poorly serviced by PT in the Base Case (i.e. serviced only by buses).
- In the CBD, Docklands and Southbank precincts, the AM peak PT mode share increases slightly for both origin and destination trips for Project Case 1 compared to the Base Case. This is likely due to the improvement in PT services overall.
- The AM peak PT mode share in the Port Phillip Precincts increases for both origin trips and destination trips. This may be a result of the Route 11 tram extension to Fishermans Bend South via Plummer Street which provides additional PT service in the Port Phillip precinct on top of the existing Route 86

(currently Route 109). Furthermore, the improved frequency of the complimentary bus services in the Project Case 1 may also be contributing to the increase in PT mode share, as many of the new bus routes service the Port Phillip precinct.

A summary of the Daily PT mode share for Project Case 1 is included in Appendix E and have similar patterns to AM peak PT mode share. A summary of the daily active trip productions by precinct is also included in Appendix E and shows the same results for Project Case 1 and the Base Case, since both options share the same land use assumptions.

Table 5.1 AM peak public transport mode share by origin and destination precinct (2046/51) – Project Case 1

PRECINCT	BY ORIGIN			BY DESTINATION		
	BASE CASE	PROJECT CASE 1	DIFFERENCE	BASE CASE	PROJECT CASE 1	DIFFERENCE
Wirraway West	39.3%	46.8%	7.6%	22.9%	31.4%	8.5%
Wirraway East	38.9%	47.5%	8.7%	18.3%	30.7%	12.5%
Sandridge North	45.3%	51.4%	6.1%	35.2%	44.9%	9.7%
Sandridge South	46.8%	50.3%	3.5%	38.8%	43.1%	4.4%
Lorimer	21.9%	46.1%	24.2%	10.8%	45.6%	34.7%
Montague	51.9%	53.2%	1.3%	45.1%	47.5%	2.5%
Employment Precinct - North	3.8%	15.4%	11.6%	12.8%	48.4%	35.6%
Employment Precinct - South	3.7%	15.2%	11.5%	14.2%	49.0%	34.8%
CBD	77.8%	78.0%	0.2%	92.0%	92.0%	0.0%
Docklands	72.6%	74.4%	1.9%	90.5%	91.4%	0.9%
Southbank	74.6%	75.2%	0.6%	88.8%	89.0%	0.3%
Port Phillip	29.0%	34.5%	5.5%	26.0%	29.1%	3.1%
Network-wide	19.8%	20.0%	0.2%	19.8%	20.0%	0.2%

TRAM FORECASTING RESULTS

Boardings

The tram forecasting results for entire tram routes servicing Fishermans bend and nearby areas are shown in Table 5.2 and Figure 5.1 for both the Base Case and the Tram Extension Option (Project Case 1). In general, daily tram boardings increases by 71% on both Routes 11 and 48, and decrease by 13% on Route 86. The reduction in boardings on Route 86 is possibly due to the improved public transport in Fishermans Bend (e.g. improve bus and new tram), which both offers a travel alternative and encourages some trips to Fishermans Bend instead of Port Phillip.

Table 5.2 Tram boardings by tram route servicing the study area in Project Case 1 and Base Case

PRECINCT	ROUTE 11		ROUTE 48		ROUTE 86		ALL	
	AM PEAK	DAILY	AM PEAK	DAILY	AM PEAK	DAILY	AM PEAK	DAILY
Base Case	13,324	73,817	11,900	62,532	29,388	156,756	54,612	293,105
Project Case 1	21,538	126,142	18,933	106,862	25,555	136,548	66,026	369,552
Difference	8,214	52,325	7,032	44,329	-3,833	-20,208	11,414	76,447
% Diff	62%	71%	59%	71%	13%	-13%	21%	26%

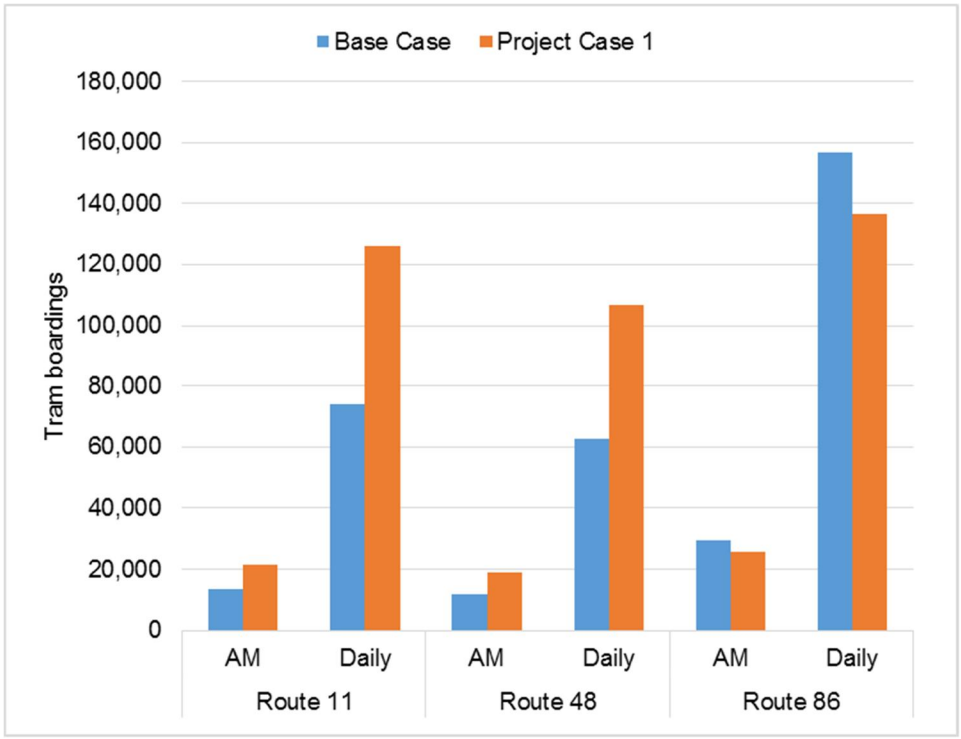

Figure 5.1 Comparison of AM peak and daily tram boardings in Project Case 1 to Base Case

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along Turner Street, Plummer Street and Collins Street are shown in Figure 5.2 and Figure 5.3 for Project Case 1 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red.

The peak tram loads shown in Figure 5.2 suggest that there is high demand for travel between the CBD and Fishermans Bend in the Tram Extension Only Option, where the loads are at their highest levels at the Lorimer and Sandridge precincts in the Fishermans Bend direction.

The V/C ratios in Figure 5.3 suggest that the levels of tram patronage from the CBD towards Fishermans Bend along Collins Street is exceeding the tram load standards at certain locations along the two tram corridors. This is particularly the case in the north corridor along Turner Street between Victoria Harbour and the Employment precinct North. In the south corridor along Plummer Street, the load levels exceed load standards between Victoria Harbour and the Sandridge precincts. This suggests that the trams alone may struggle to handle the additional demand created from the increase in population and employment.

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11, 48 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram loads over capacity ratio along Plummer Street, Turner Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

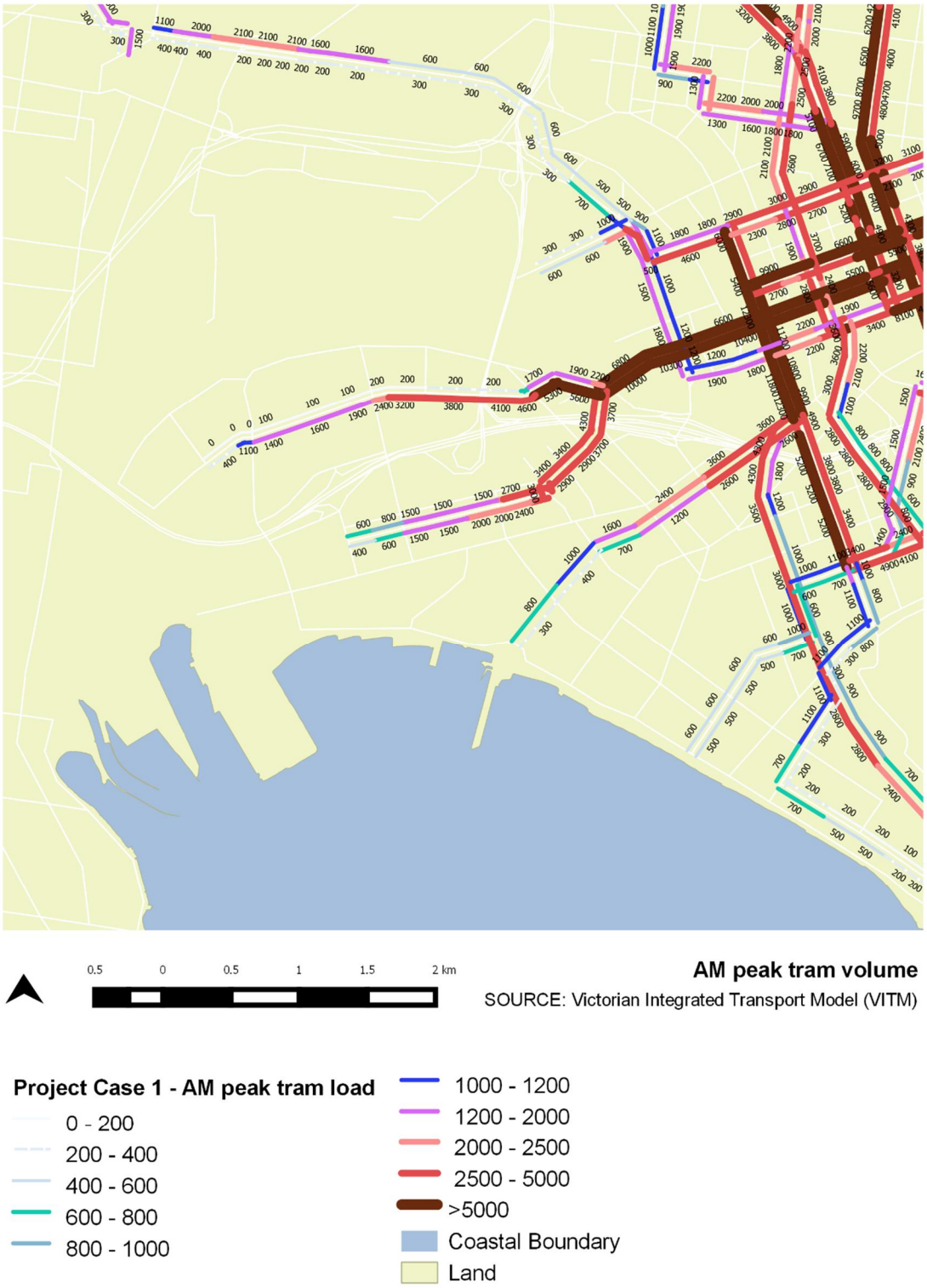

Figure 5.2 AM peak tram load in Fishermans Bend – Project Case 1

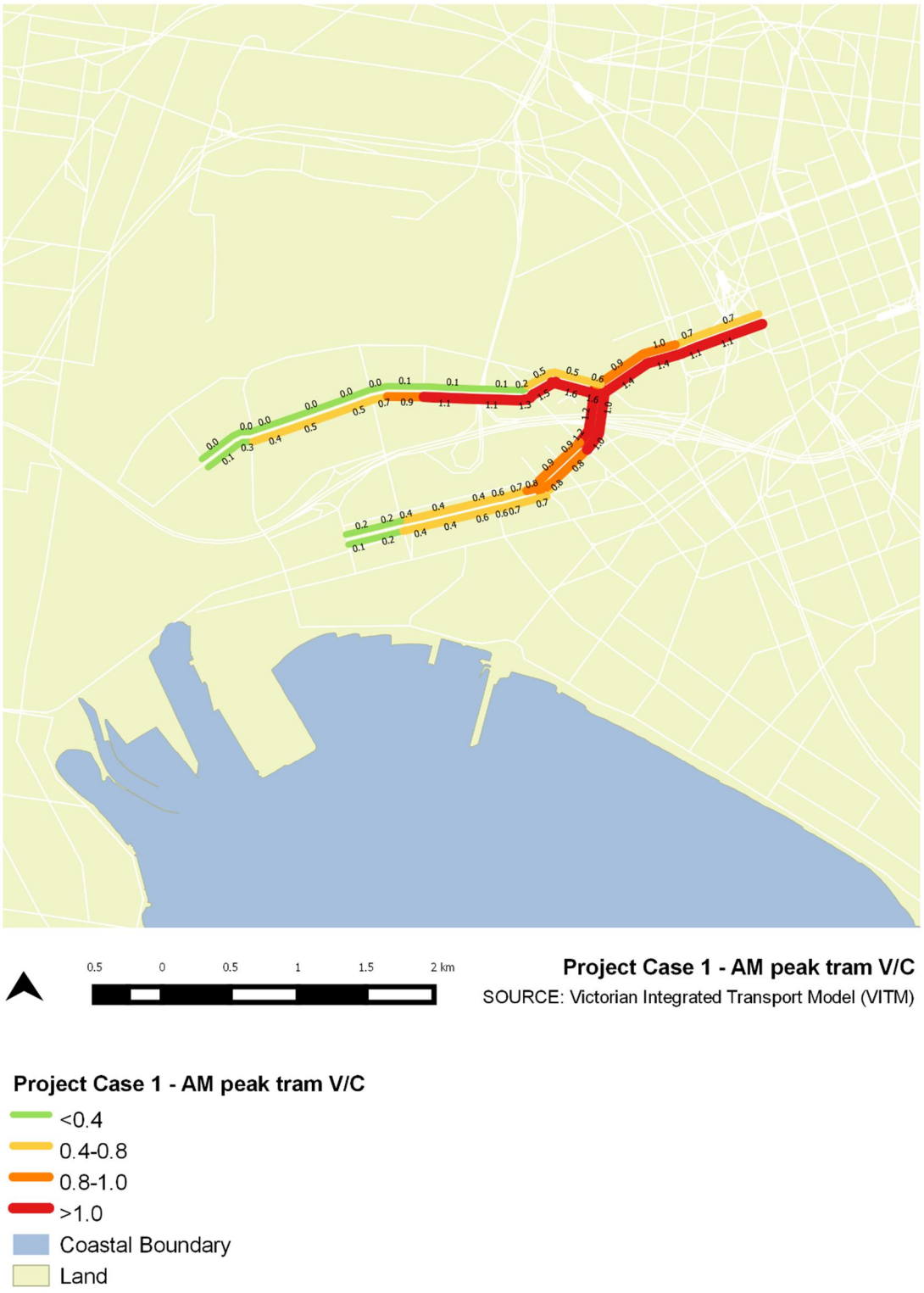

Figure 5.3 AM peak tram V/C in Fishermans Bend – Project Case 1

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the Base Case and the Tram Extension Only Option (Project Case 1) are shown in Table 5.3 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

In general, the total bus boardings in the AM peak increases by 39% in Project Case 1 compared to the Base Case, but only by 8% throughout the day. The greater increase in total bus boardings in the AM peak may possibly be due to a higher increase in bus services in the peak periods than in the off-peak periods for Project Case 1, when compared to the Base Case. If so, there may be latent demand for bus provision during the off-peak periods which is not currently being catered for due to the limited services provided outside of peak periods.

Table 5.3 Total bus boardings for buses servicing the study area in Project Case 1 and Base Case

TIME PERIOD	Base Case	Project Case 1	Difference	% Diff
AM Peak	7,477	10,358	2,881	39%
Daily	46,729	50,646	3,917	8%

Load and capacity

Seven bus routes service the Fishermans Bend study area in Project Case 1. To help understand the potential capacity issues, maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated for the Base Case and Project Case 1, and are provided in Appendix J. These results show that in the AM peak, all bus routes are over capacity in the Base Case supporting the argument that the existing 2046/51 bus network is inadequate for Fishermans Bend, while in Project Case 1, only the following three bus services are overcapacity:

- Garden City to Queen Victoria Market (both directions)
- Domain to Fishermans Bend (both direction)
- Southern Cross Station to Newport (both directions).

The Domain to Fishermans Bend and Southern Cross Station to Newport services are likely to be over capacity as they provide access to rail stations from Fishermans Bend, while in the Garden City to Queen Victoria Market is likely to be over capacity as it has a higher frequency compared to the Base Case, and provides access to Melbourne which is one of the key destination for trips from Fishermans Bend.

Figure 5.4 below shows the AM peak bus load on roads in Fishermans Bend. It can be observed that there is a high level of bus load to Lorimer and the Employment Precinct North along Ingles Street. There is also a large amount of bus users who board at Southern Cross Station and travel toward Fishermans Bend along Williamstown Road.

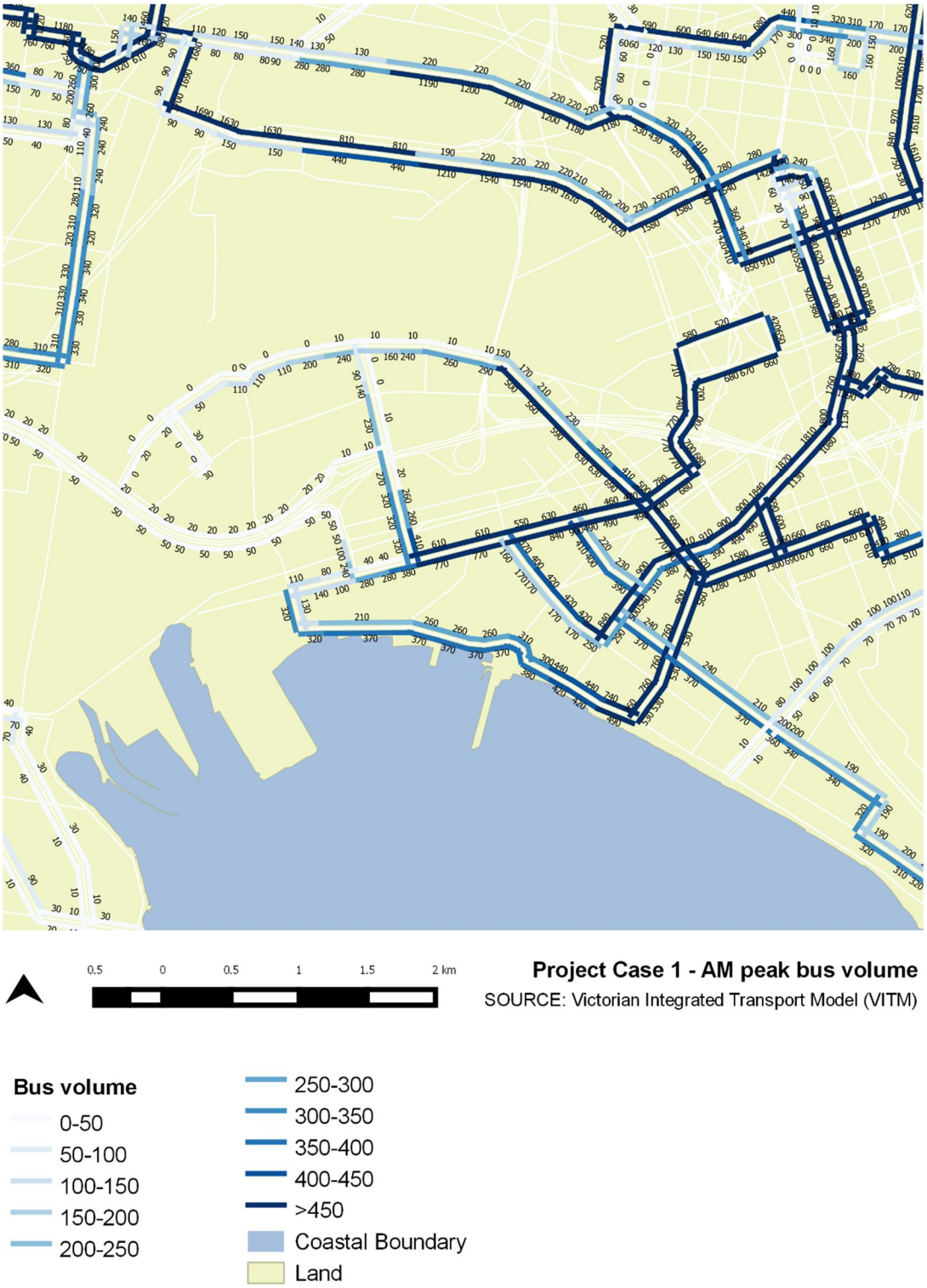

Figure 5.4 AM peak bus load in Fishermans Bend – Project Case 1

5.2 Charles Grimes Bridge Variation Option (Project Case 4 or PC4)

OVERVIEW

Charles Grimes Bridge Variation Option (Project Case 4) tested how well the transport network would perform if the Tram Extension Only Option (Project Case 1) consisted of an alternative river crossing – i.e. if the extension of tram routes 11 and 48 were via the existing Charles Grimes Bridge (with their own right of way), rather than the Collins Street Extension.

In general, this option would result in slightly longer travel time and similar boardings for tram, bus and train patronage as Project Case 1.

PUBLIC TRANSPORT MODE SHARE

Public transport mode share in the Charles Grime Bridge Variation Option (Project Case 4) is similar to that in the Tram Extension Only Option (Project Case 1) for all precincts, suggesting that the river crossing alignment does not have a great impact on public transport trips to any of the Fishermans Bend precincts.

A summary of the AM peak and Daily PT mode share for Project Case 4 is included in Appendix E. A summary of the daily active trip productions by precinct is also included in Appendix E and shows the same results for Project Case 4, Project Case 1 and the Base Case, since all options share the same land use assumptions.

TRAM FORECASTING RESULTS

Boardings

The tram forecasting results for the entire tram routes servicing Fishermans Bend and nearby areas in are shown in Figure 5.5 for the Base Case, the Tram Extension Only Option (Project Case 1) and the Charles Grime Bridge Variation Option (Project Case 4). In general, tram boardings for Route 11, 48 and 86 (currently Route 109) are similar to Project Case 1. This suggests that the alignment of the river crossing has little impact on tram patronage.

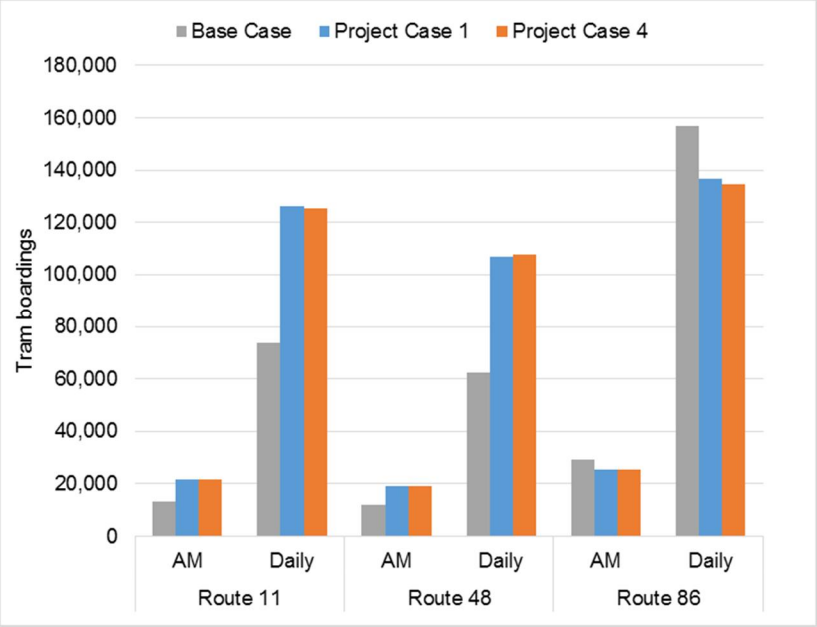

Figure 5.5 AM peak and daily tram boardings in the Base Case, Project Case 1 and Project 4

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along Turner Street, Plummer Street and Charles Grime Bridge/Collins Street are shown in Figure 5.6 and Figure 5.7 for Project Case 4 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red. From these figures, it can be seen that the demand and V/C ratio in Project Case 4 are similar to that in Project Case 1 (i.e. the two river crossing options are similar).

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11, 48 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram loads over capacity ratio along Plummer Street, Turner Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

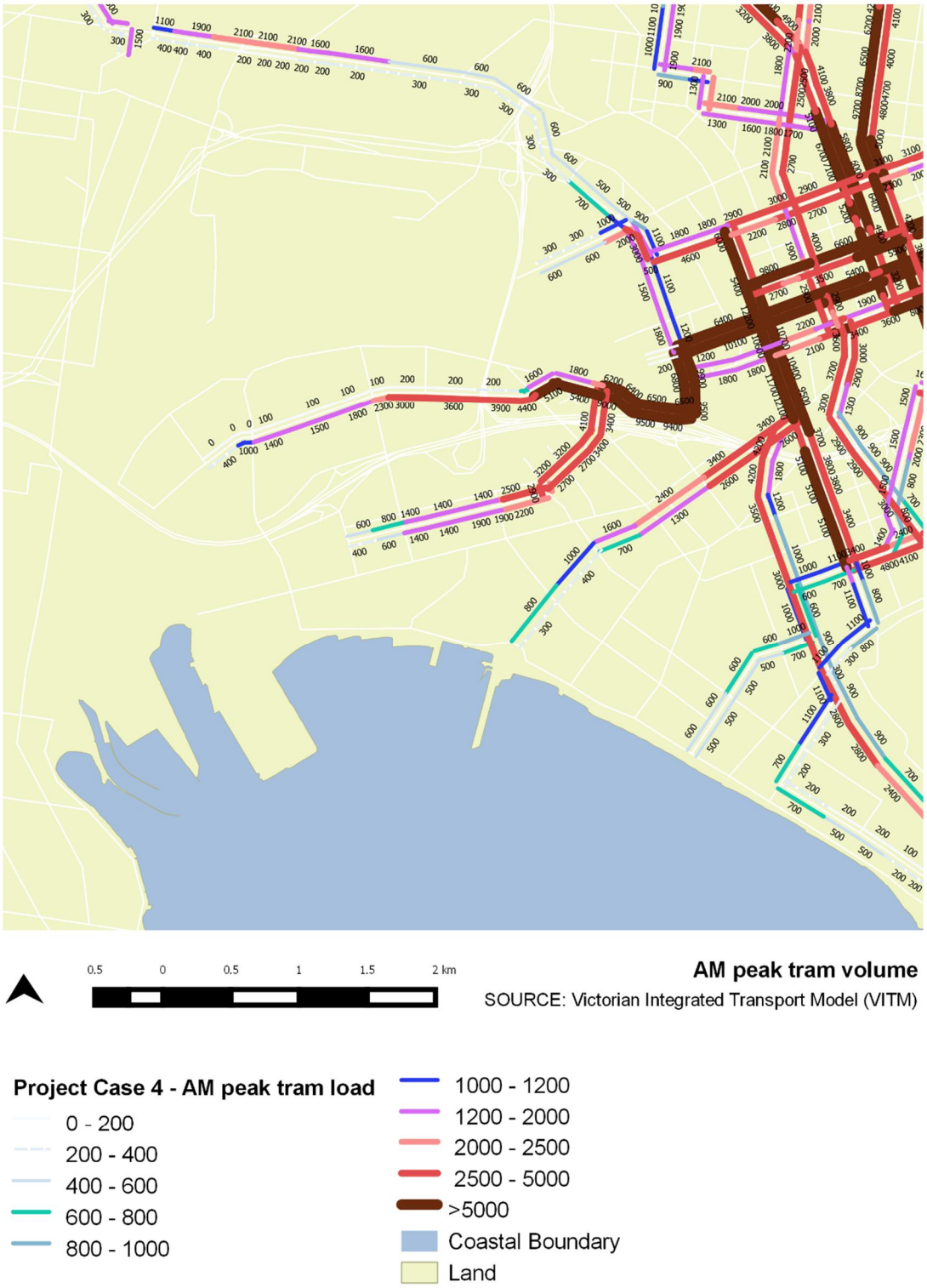

Figure 5.6 AM peak tram load in Fishermans Bend – Project Case 4

Figure 5.7 AM peak tram V/C in Fishermans Bend – Project Case 4

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the Base Case, the Tram Extension Only Option (Project Case 1) and the Charles Grime Bridge Variation Option (Project Case 4) are shown in Table 5.4 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

In general, results show that the total AM peak and daily bus boardings in Project Case 4 increase by 41% and 10% respectively, when compared to the Base Case. Bus boardings in Project Case 4 are therefore very similar to Project Case 1 (higher by only 2%).

Table 5.4 Total bus boardings for buses servicing the study area in the Base Case and Project Case 1 and 4

TIME PERIOD	Base Case	Project Case 1	Project Case 4	Diff (Base)	Diff (PC1)
AM Peak	7,477	10,358	10,543	41%	2%
Daily	46,729	50,646	51,611	10%	2%

Load and capacity

As per Project Case 1, seven bus routes service the Fishermans Bend study area in Project Case 4. The maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated and is provided in Appendix J. The results show that the same bus services are overcapacity in the AM peak for Project Case 4 and Project Case 1, namely:

- → Garden City to Queen Victoria Market (both directions)
- → Domain to Fishermans Bend (both directions)
- → Southern Cross Station to Newport (both directions).

5.3 SmartBus Variation Option (Project Case 2 or PC2)

OVERVIEW

The SmartBus Variation Option (Project Case 2) tested how well the transport network would perform if the proposed tram on the Turner Street in the Tram Extension Only Option (Project Case 1) was replaced with a premium SmartBus.

In general, this option has been found to have less tram patronage and more bus patronage than the Tram Extension Only Option, however the increase in bus patronage is not at the same level as reduction in tram patronage. The replacement of the Turner Street tram with the premium SmartBus also places additional strain on the Plummer Street tram, as it is the only tram service in the area. The option of a northern tram line appears to therefore perform better than the option of an on-road priority bus.

PUBLIC TRANSPORT MODE SHARE

Public transport mode share for the SmartBus Variation Option (Project Case 2) is similar to the Tram Extension Only Option (Project Case 1), with the following exceptions:

- Public transport mode share for Project Case 2 does not increase to the same degree as Project Case 1 for Lorimer precinct, suggesting that the SmartBus on Turner Street is not as attractive as the tram service (Tram 48) for this precinct.
- There is only a minor increase for origin trips and moderate increase for destination for the employment precincts. This is likely due to the reduced attractiveness of the SmartBus along Turner Street in this option, where the reduced frequency and increased boarding penalty and also lesser capacity for the bus compared to the tram option are contributing to the relatively low increase in PT mode share compared to Project Case 1.

A summary of the AM peak and Daily PT mode share for Project Case 2 is included in Appendix E. A summary of the daily active trip productions by precinct is also included in Appendix E and shows the same results for Project Case 2, Project Case 1 and the Base Case, since all options share the same land use assumptions.

TRAM FORECASTING RESULTS

The tram forecasting results for the entire tram routes servicing Fishermans Bend and nearby areas are shown in Figure 5.8 for the Base Case, the Tram Extension Only Option (Project Case 1) and the SmartBus Variation Option (Project Case 2).

In general, compared to Project Case 1, Project Case 2 has more tram boardings on Route 11 and similar boardings on Route 86 (currently Route 109), suggesting Route 11 becomes more attractive when it is the only tram route in the study area. Tram boardings on Route 48 however, revert to volumes similar to that of the Base Case, since both the Base Case and the SmartBus Variation Option do not have the tram extension into Fishermans Bend.

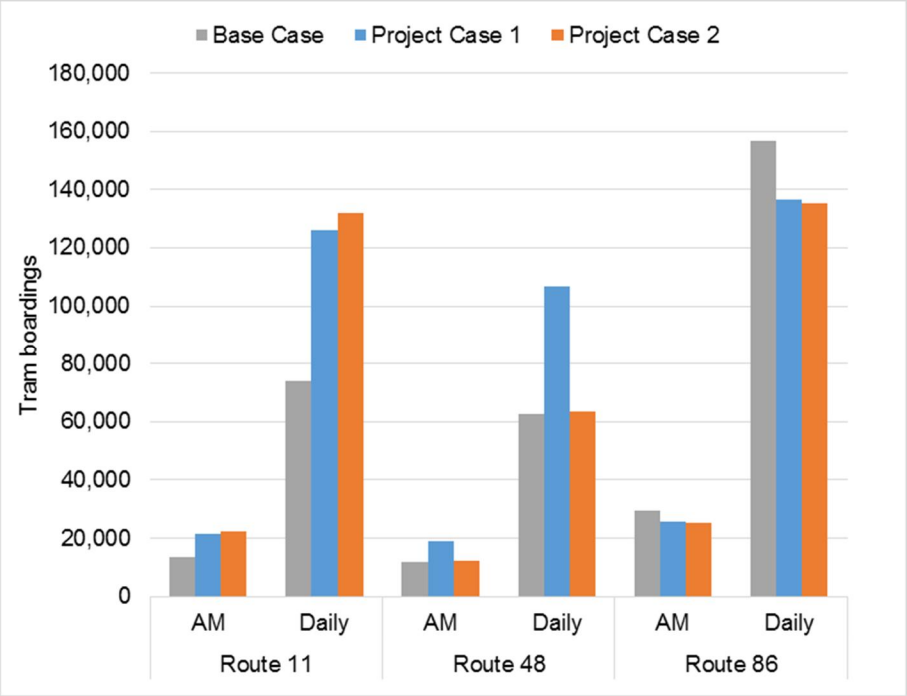

Figure 5.8 AM peak and daily tram boardings in the Base Case, Project Case 1 and Project Case 2

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along Plummer Street and Collins Street are shown in Figure 5.9 and Figure 5.10 for Project Case 2 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red.

In general, Figure 5.9 shows that there is similar demand for travel along Plummer Street in Project Case 2 compared to Project Case 1. Figure 5.10 however, shows that there is less available capacity on Collins Street (i.e. higher V/C ratio) compared to Project Case 1, suggesting that the SmartBus Variation Option places additional strain on this since there is only one tram service between Fishermans Bend and the CBD.

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram loads over capacity ratio along the Plummer Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

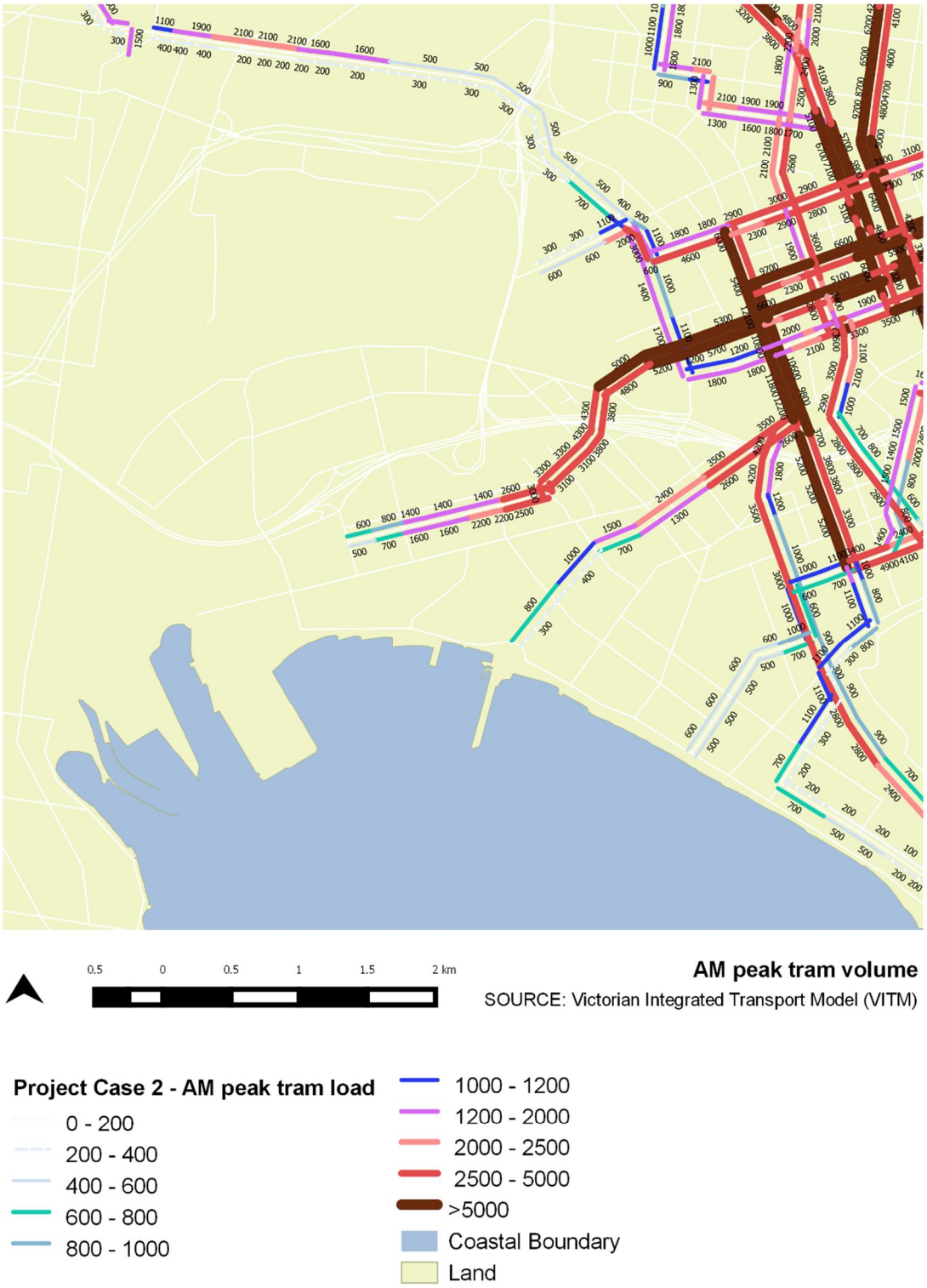

Figure 5.9 AM peak tram load in Fishermans Bend – Project Case 2

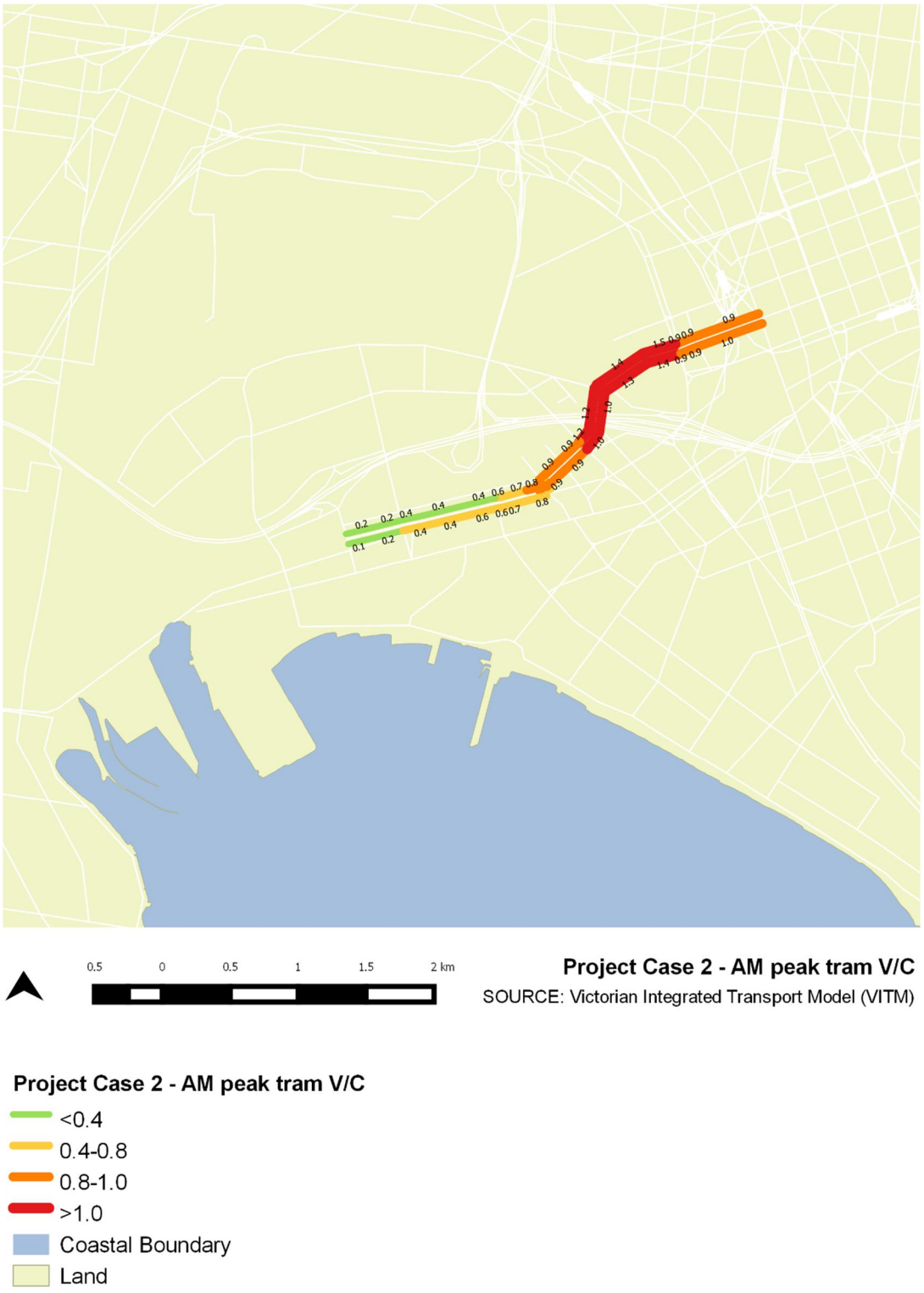

Figure 5.10 AM peak tram V/C in Fishermans Bend – Project Case 2

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the Base Case, the Tram Extension Only Option (Project Case 1) and the SmartBus Variation Option (Project Case 2) are shown in Table 5.5 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

In general, the total bus boardings in Project Case 2 increases significantly in the AM peak and across the day compared to the Base Case (by 71% in the AM and 42% across the day) and Project Case 1 (by 23% in the AM and 31% across the day). This increase in boardings is not unexpected, and is consistent with the addition of the premium SmartBus service along Turner Street (and lose of tram service along Turner Street).

Table 5.5 Total bus boardings for buses servicing the study area in the Base Case and Project Case 1 and 2

TIME PERIOD	Base Case	Project Case 1	Project Case 2	Diff (Base)	Diff (PC1)
AM Peak	7,477	10,358	12,786	71%	23%
Daily	46,729	50,646	66,363	42%	31%

Load and capacity

The AM peak bus load on roads in Fishermans Bend for Project Case 2 are also shown in Figure 5.11. Compared to Project Case 1, bus loads are higher along Turner Street due to the addition of the SmartBus service between Southern Cross and Fishermans Bend. In particular, the volume between Southern Cross Station and Lorimer Street is above 1,000, suggesting that that bus service is over capacity given that the load standard of a 2-hour bus service is typically 600 for a service of 10-minute frequency. The bus load is also higher along Williamstown Road coming from Southern Cross Station and along Ingles Street coming from Domain.

Eight bus routes service the Fishermans Bend study area in Project Case 2, including the premium SmartBus service between Fishermans Bend and Southern Cross Station. The maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated and is provided in Appendix J. The results show the same bus services are overcapacity in the AM peak for Project Case 4 as Project Case 1, as well as the new SmartBus service (as illustrated in Figure 5.12). Bus services overcapacity in the AM peak are listed below.

- Garden City to Queen Victoria Market (both directions)
- Domain to Fishermans Bend (both direction)
- Southern Cross Station to Fishermans Bend (SmartBus) along Turner Street (both directions)
- Southern Cross Station to Newport (both direction).

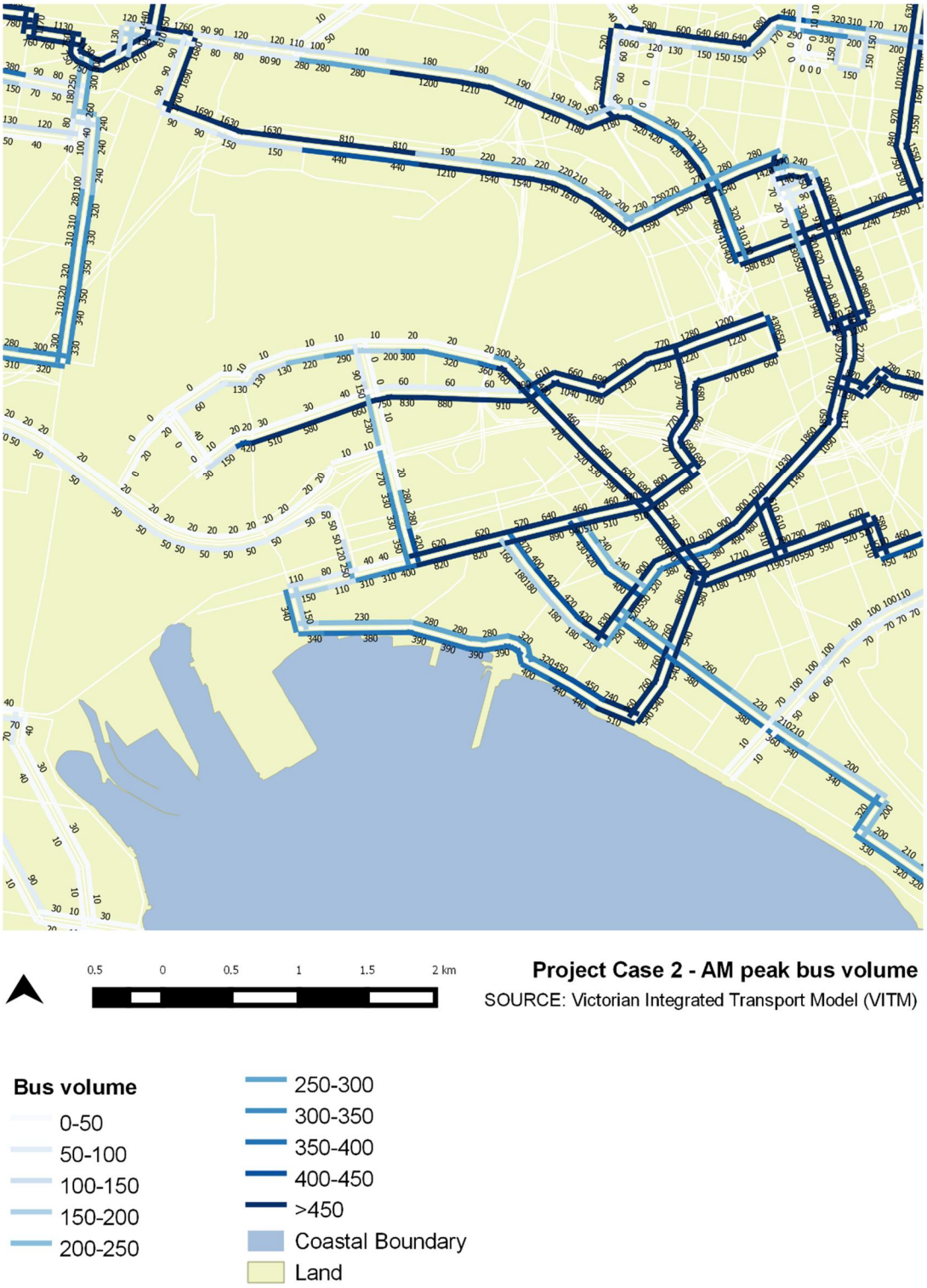

Figure 5.11 AM peak bus load in Fishermans Bend – Project Case 2

Figure 5.12 AM peak bus V/C in Fishermans Bend – Project Case 2

5.4 New Rail Variation Option (Project Case 3 or PC3)

OVERVIEW

The New Rail Variation Option (Project Case 3) tested how well the transport network would perform if Fishermans Bend was served by a new rail line between Clifton Hill and Newport via Plummer Street as part of the potential future stage of Melbourne Metro Rail (i.e. Melbourne Metro Design 2), in addition to public transport services included in the Tram Extension Only Option (Project Case 1).

In general, results show that Project Case 3 has less tram and bus patronage than Project Case 1, but significantly more train boardings. Overall, Project Case 3 appears to perform better than Project Case 1, as it attracts more public transport patronage, due to the additional rail services, and has less capacity issues for trams and buses.

PUBLIC TRANSPORT MODE SHARE

Public transport mode share for the Wirraway and Sandridge precincts are greater in the New Rail Variation Option (Project Case 3) than in the Tram Extension Only Option (Project Case 1), suggesting that the rail service is attracting more public transport trips to these precincts. Public transport mode shares for all other precincts are similar between Project Case 1 and 3.

A summary of the AM peak and Daily PT mode share for Project Case 3 is included in Appendix E. A summary of the daily active trip productions by precinct is also included in Appendix E and shows the same results for Project Case 3, Project Case 1 and the Base Case, since all options share the same land use assumptions.

TRAM FORECASTING RESULTS

Boardings

The tram forecasting results for the entire tram routes servicing Fishermans bend and nearby areas are shown in Figure 5.13 for the Base Case, the Tram Extension Option (Project Case 1) and the New Rail Variation Option (Project Case 3).

In general, tram boardings for Route 11 in the New Rail Variation Option are noticeably less than in the Tram Extension Only Option. This is most likely because the rail corridor runs along the same alignment as Route 11 (i.e. via Plummer Street), and therefore may be taking away some of the patronage from Route 11 as it provides a faster and more direct route between the Sandridge/Wirraway Precincts and the CBD. Tram boardings for Route 48 and Route 86 (currently Route 109) are very similar to Project Case 1, suggesting that the rail line does not affect the patronage on these tram routes.

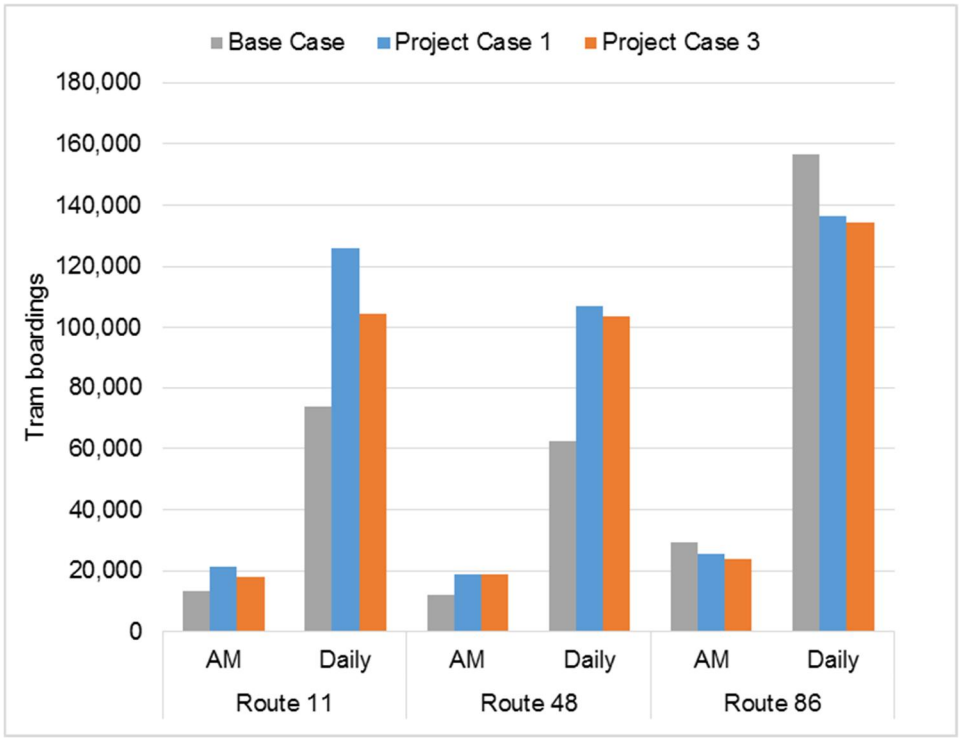

Figure 5.13 AM peak and daily tram boardings in the Base Case, Project Case 1 and Project Case 3

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along Turner Street, Plummer Street and Collins Street for Project Case 3 are shown in Figure 5.14 and Figure 5.15 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red.

In general, results show that there is similar demand for travel along Turner Street, but a lower demand for travel along Plummer Street in Project Case 3 compared to Project Case 1, now that there is also a new rail line servicing Fishermans Bend along Plummer Street. Furthermore, Figure 5.15 shows there is an increase in available capacity (i.e. lower V/C ratio) on Plummer Street, compared to Project Case 1, suggesting that the rail line relieves some of the overcrowding issues associated with the tram route on Plummer Street; however, there are still significant capacity issues for the tram route on Turner Street.

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11, 48 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram loads over capacity ratio along the Plummer Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

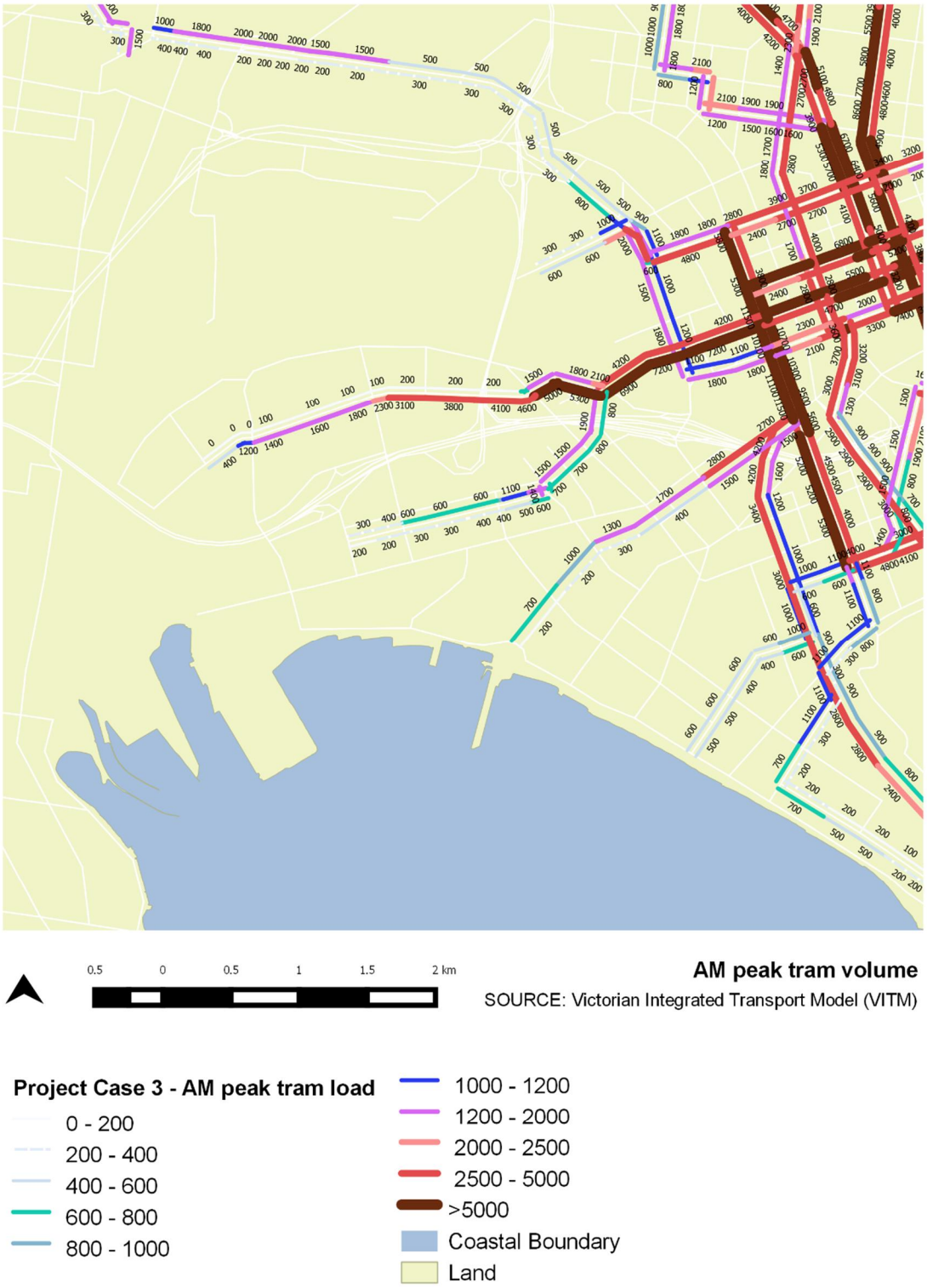

Figure 5.14 AM peak tram load in Fishermans Bend – Project Case 3

Figure 5.15 AM peak tram V/C in Fishermans Bend – Project Case 3

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the Base Case, the Tram Extension Only Option (Project Case 1) and the New Rail Variation Option (Project Case 3) are shown in Table 5.6 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

Overall, the total bus boardings in Project Case 3 compared to the Base Case increase in the AM peak, which could be due to more people using a combination of bus and rail. At the daily level however, the boardings decrease by 13%, which is likely due to the higher frequency of service across the day provided by the rail compared to the buses.

When compared to Project Case 1, the AM peak and daily boardings for services in Fishermans Bend decrease by 18% and 20%, respectively. This is likely due to the rail line through Fishermans Bend diverting trips away from the buses.

Table 5.6 Total bus boardings for buses servicing the study area in the Base Case and Project Case 1 and 3

TIME PERIOD	Base Case	Project Case 1	Project Case 3	Diff (Base)	Diff (PC1)
AM Peak	7,477	10,358	8,450	13%	-18%
Daily	46,729	50,646	40,652	-13%	-20%

Load and capacity

As per Project Case 1, seven bus routes service the Fishermans Bend study area in Project Case 3, though the Southern Cross Station to Newport service now runs between Southern Cross Station and Fishermans Bend due to the rail service. The maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated and is provided in Appendix J. The results show that similar bus services are overcapacity in the AM peak for Project Case 3 compared to Project Case 1, though only in the westbound direction. Bus services over capacity in Project Case 3 are:

- Garden City to Queen Victoria Market
- Domain to Fishermans Bend
- Southern Cross Station to Fishermans Bend.

Boardings

The total AM peak forecast train boardings for rail stations servicing Fishermans Bend in the New Rail Variation Option (Project Case 3) is 6,268 while the total daily forecast train boardings for rail stations servicing Fishermans Bend in Project Case 3 is 45,920. This is more than the reduction in total tram boardings between Project Case 3 and Project Case 1 (i.e. 5,410 in the AM peak and 26,879 daily), suggesting that the rail line not only takes some patronage away from the tram but encourages additional public transport trips.

Load and capacity

The AM peak train load along the rail line in Project Case 3 is shown in Figure 5.16, and indicates that the maximum train load in Fishermans Bend is 39,300 (eastbound). As the load standard capacity of the rail line is calculated to be 56,520 in the AM peak at this point, results suggest that there is still rail capacity in this option. Considering there are limited transport options linking the new rail stations on Plummer Street in the south of Fishermans Bend to the Employment Precinct in the north of Fishermans Bend (i.e. across the Westgate Freeway barrier), it may be possible that the rail service is underutilised in this option.

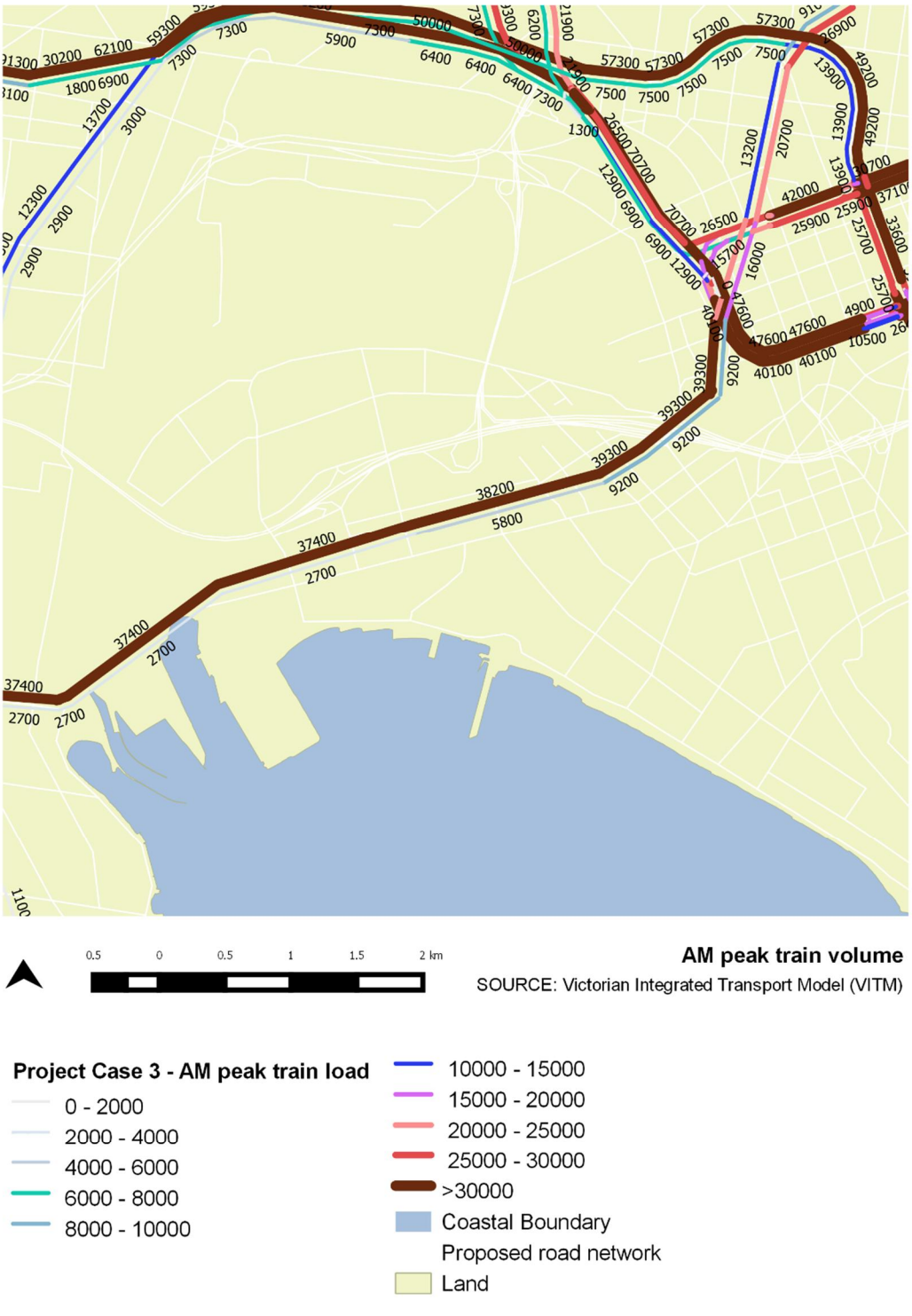

Figure 5.16 AM peak train load in Fishermans Bend – Project Case 3

6 PERFORMANCE OF OPTIONS MODELLED WITH THE VISION PLUS UNIVERSITY LAND USE

This section discussed how well each project case modelled with the Vision Plus University land use performs in terms of public transport patronage and service capacity, to gain a better understanding of the transport needs required under this land use scenario.

In particular, the New Rail with Extra Tram Option (Project Case 6) has been compared the New Rail Variation Option (Project Case 3) to help understand the impact of the third tram; while the Northern Rail Alignment Variation Option (Project Case 7) has been compared to both Project Case 3 and 6 to understand the impact of the alternative rail alignment through Fishermans Bend.

It should be noted that more detailed load and volume capacity plots discussed in this section are provided in Appendix K. It should also be noted that any reference to AM peak and PM peak, implies a 2-hour peak period.

6.1 New Rail with Extra Tram Option (Project Case 6 or PC6)

OVERVIEW

The New Rail with Extra Tram Option (Project Case 6) tested how well the transport network would perform with the new rail through Fishermans Bend (i.e. default alignment via Plummer Street, as per the New Rail Variation Option or PC3), and an alternative western rail alignment. This option also tested whether the demand for an additional tram service connecting North Melbourne Station to the Employment Precinct and Wirraway via Turner Street, due to the Craigieburn service not running via Southern Cross in Melbourne Metro Design 2.

Forecasting results show the new tram service is likely to attract approximately 5,000 boarding in the AM and 32,000 boardings across the day. Nevertheless, tram, bus and rail services in Fishermans Bend will still have spare capacity, despite an increase in land use development and hence travel demand compared to Project Case 3. This suggests that the proposed public transport network may be underutilised for this land use scenario, possibly because of lack of connection between Fishermans Bend and areas other than the CBD.

PUBLIC TRANSPORT MODE SHARE

Although the New Rail with Extra Tram Option (Project Case 6) have more trips than the New Rail Variation Option (Project Case 3), both options generally have the same public transport mode share for all precincts, as public transport services provided are similar in both options. Active transport trip productions for Project Case 6 however, are higher than that for Project Case 3, since active trips are based on population, and Project Case 6 assumes a higher population than Project Case 3.

A summary of the AM peak and Daily PT mode share for Project Case 6 is included in Appendix E. A summary of the daily active trip productions by precinct in Project Case 6 is also included in Appendix E.

TRAM FORECASTING RESULTS

The tram forecasting results for the entire tram routes servicing Fishermans Bend and nearby areas are shown in Figure 6.1 for the New Rail with Extra Tram Option (Project Case 6) and the New Rail Variation Option (Project Case 3).

In general, tram boardings for Route 11, 48 and 86 (currently Route 109) in Project Case 6 are almost the same as Project Case 3 in the AM and across the day, while tram boardings on the new tram route

(Route 46) caters for an additional 5,000 boarding in the AM and 32,000 boardings across the day. This suggests that the new tram route is not taking away patronage away from existing routes, but rather catering to new demand.

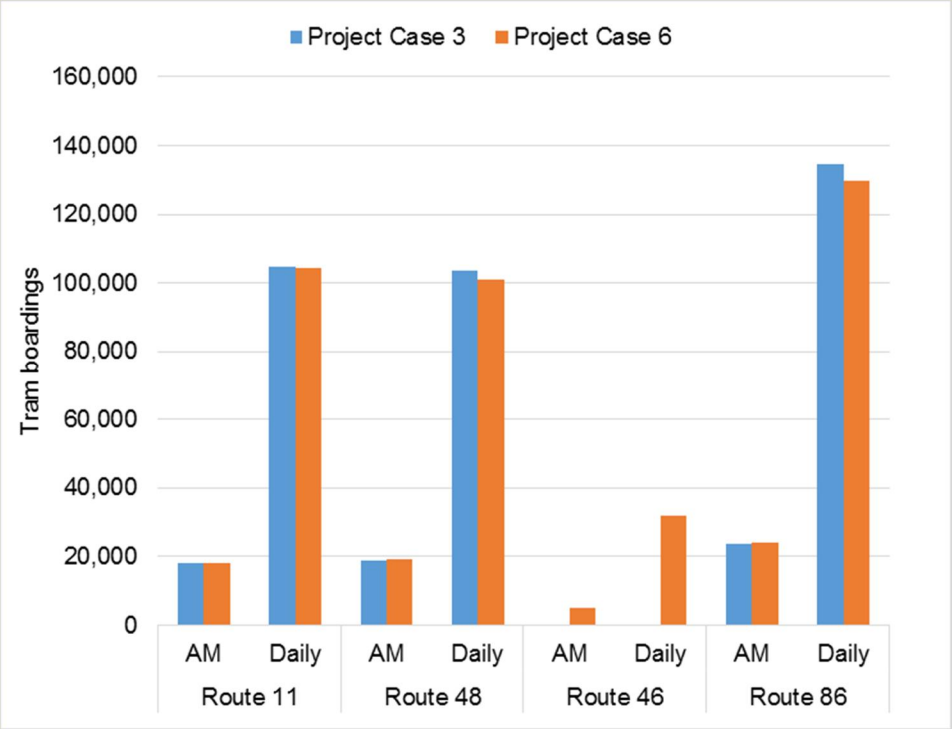

Figure 6.1 AM peak and daily tram boardings in Project Case 3 and Project Case 6

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along the Turner and Plummer Street corridors for Project Case 6 are shown in Figure 6.2 and Figure 6.3 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red.

These figures show that there is similar demand for travel along Plummer Street in Project Case 6 compared to Project Case 3, and higher demand along Turner Street due to the extra tram service. Nevertheless, there is still some available capacity along Turner Street in Project Case 6 compared to Project Case 3, as illustrated by the reduction V/C ratio shown in Figure 6.3.

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11, 46, 48 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram loads over capacity ratio along the Plummer Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

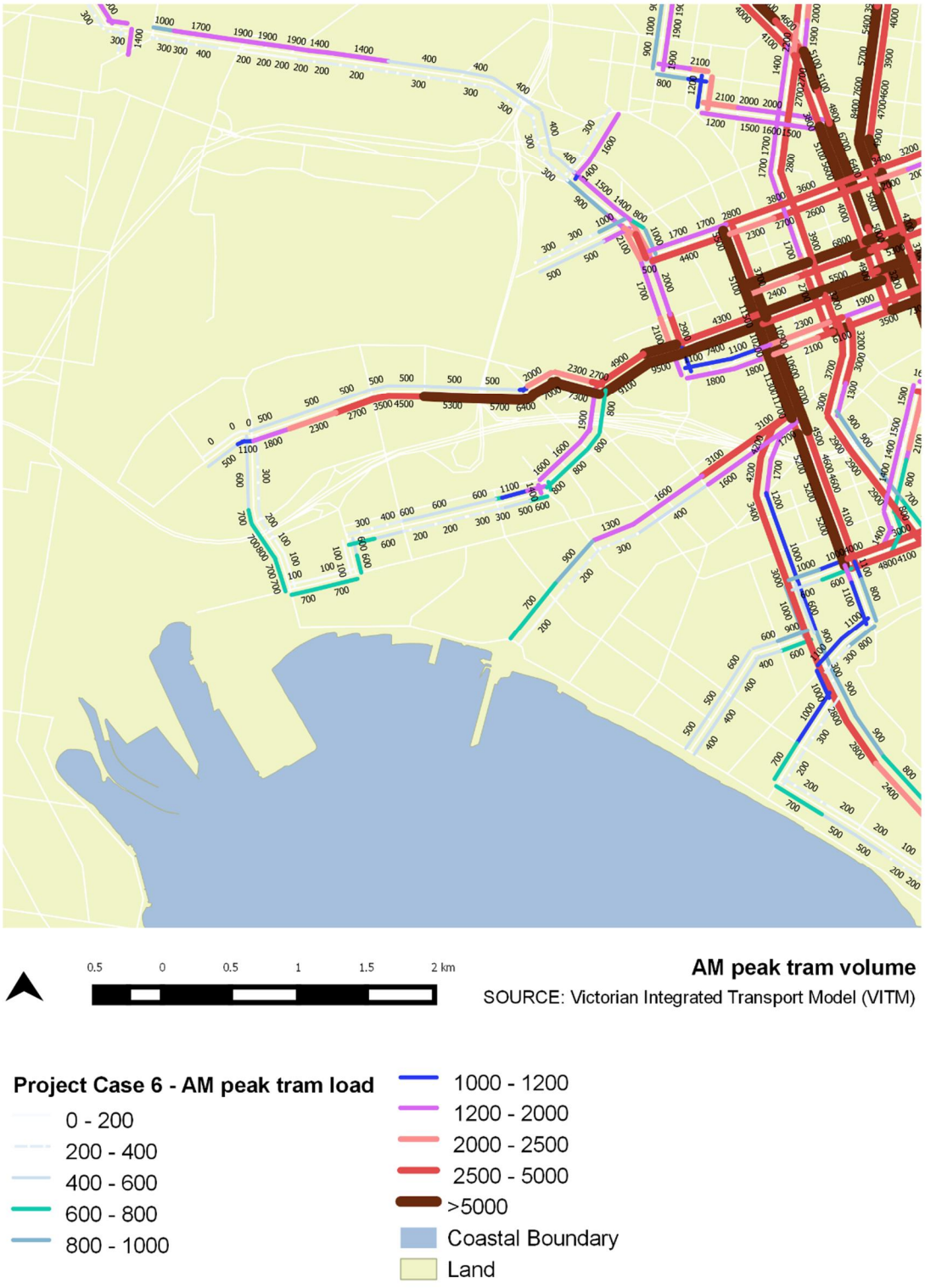

Figure 6.2 AM peak tram load in Fishermans Bend – Project Case 6

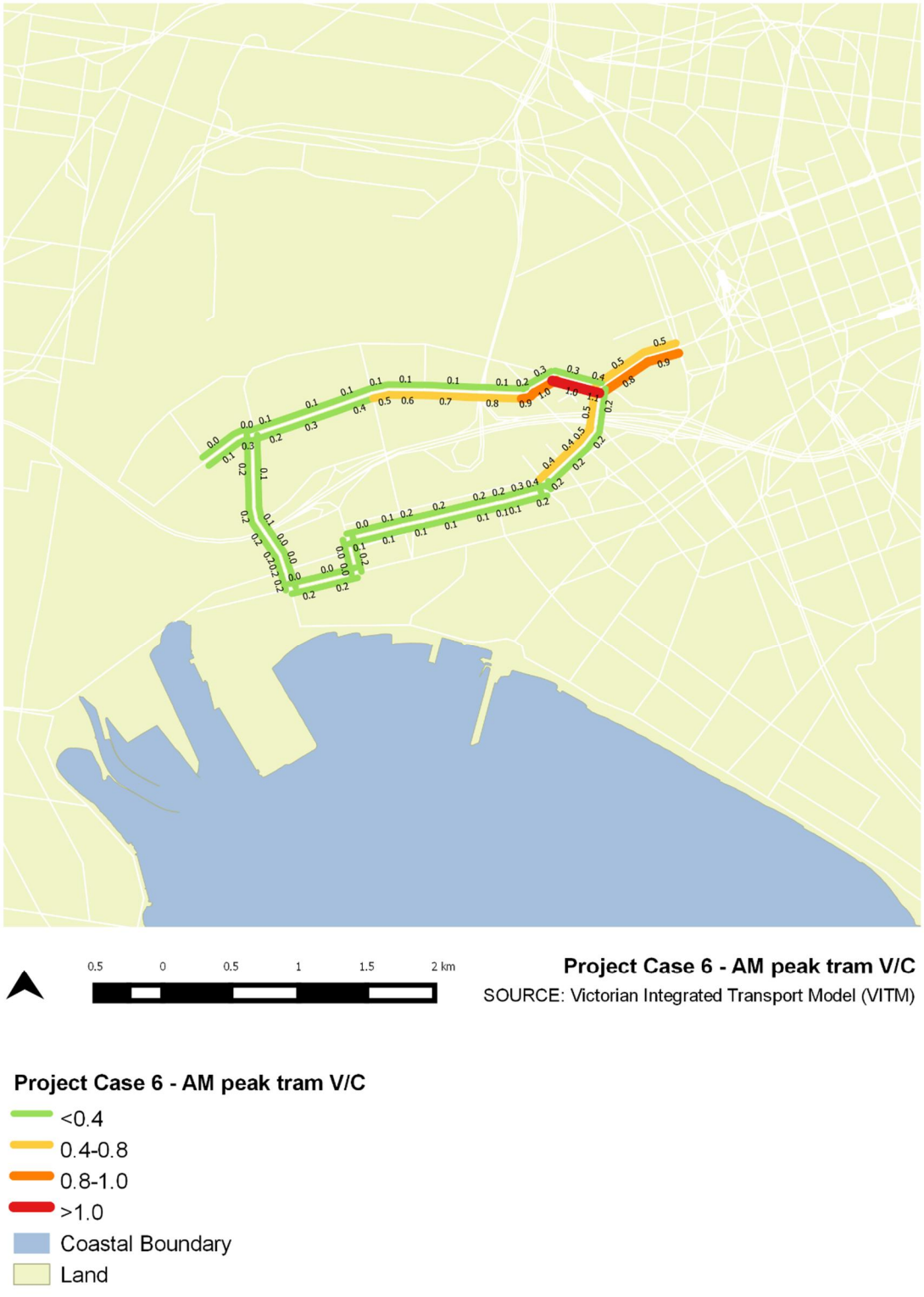

Figure 6.3 AM peak tram V/C in Fishermans Bend – Project Case 6

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the New Rail Variation Option (Project Case 3) and the New Rail with Extra Tram Option (Project Case 6) are shown in Table 6.1 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

In general, the total bus boardings in Project Case 6 are approximately 20% less than Project Case 3 in the AM peak and across the day. This result suggests that the increase in population and employment in Project Case 6 is not creating additional demand for bus, while the additional tram services may be encouraging a mode switch.

Table 6.1 Total bus boardings for buses servicing the study area in Project Case 3 and 6

TIME PERIOD	Project Case 3	Project Case 6	Difference	% Diff
AM Peak	10,358	8,396	-1,962	-19%
Daily	50,646	41,418	-9,228	-18%

Load and capacity

As per Project Case 3, seven bus routes service the Fishermans Bend study area in Project Case 6. The maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated and is provided in Appendix J. The results show that less bus services are overcapacity in the AM peak for Project Case 6 compared to Project Case 3, which is consistent with the reduction in bus boardings. The bus services in Project Case 6 that are overcapacity in the AM peak are:

→ Garden City to Queen Victoria Market.

Boardings

The total AM peak and total daily forecast train boardings for rail stations servicing Fishermans Bend in the New Rail Variation Option (Project Case 3) and the Southern Alignment with Extra Tram Option (Project Case 6) are shown in Table 6.2. In general, there is a slightly higher number of train boardings in Project Case 6 compared to Project Case 3. This suggests that the increase in population and employment in Project Case 6 is only creating slightly more rail demand.

Table 6.2 Total train boardings at Fishermans Bend rail stations in Project Case 3 and 6

TIME PERIOD	Project Case 3	Project Case 6	Difference	% Diff
AM Peak	6,268	6,532	264	4%
Daily	45,950	48,115	2,195	5%

Load and capacity

The AM peak train load along the rail line in Project Case 6 is shown in Figure 6.4, and indicates that the maximum train load in Fishermans Bend is 38,600 (eastbound), which is similar to Project Case 3. As the load standard capacity of the rail line is calculated to be 56,520 in the AM peak at this point, results suggest that there is still rail capacity in this option. Considering there are limited transport options linking the new rail stations on Plummer Street in the south of Fishermans Bend to the Employment Precinct in the north of Fishermans Bend (i.e. across the Westgate Freeway barrier), it may be possible that the rail service is underutilised in this option, as per Project Case 3.

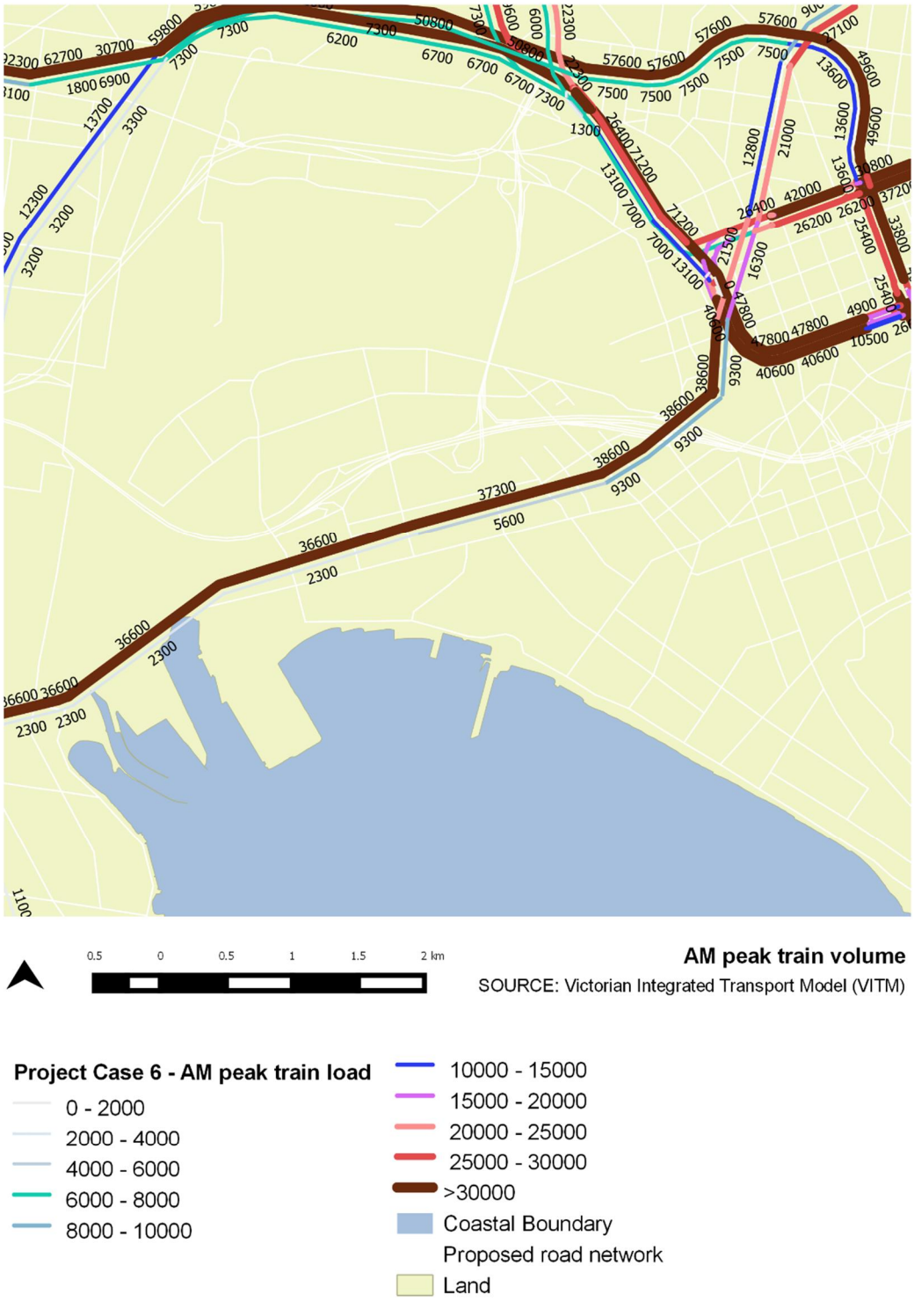

Figure 6.4 AM peak train load in Fishermans Bend – Project Case 6

6.2 Northern Rail Alignment Variation Option (Project Case 7 or PC7)

OVERVIEW

The Northern Rail Alignment Variation Option (Project Case 7) tested how well the transport network would perform with an alternative rail alignment through Fishermans Bend (i.e. where the rail alignment is via Fishermans Bend north (Employment Precinct) and Sandridge Precinct instead of via Plummer Street).

Forecasting results for this option are similar to the New Rail with Extra Tram Option (Project Case 6), and therefore suggest that the alignment of the new rail line has little impact on the network performance, though a northern rail alignment is likely to achieve higher PT mode share for the employment precinct which is more in line with the vision for Fishermans Bend. Both alignment option may however be underutilised due to limited north-south connections.

PUBLIC TRANSPORT MODE SHARE

Public transport (PT) mode share in the Employment Precincts is greater in Northern Rail Alignment Variation Option (Project Case 7) than in than New Rail with Extra Tram Option (Project Case 6), as the northern rail alignment in Project Case 7 provides better access to these precincts. On the other hand, there is a slight reduction in PT mode for Wirraway Precincts in the south of Fishermans Bend, as the rail alignment has now shifted north. The rail alignment does not appear to have a great impact on public transport trips for other precincts, as public transport mode share is comparable between Project Case 6 and 7.

A summary of the AM peak and Daily PT mode share for Project Case 7 is included in Appendix E. A summary of the daily active trip productions by precinct is also included in Appendix E and shows the same results for Project Case 7 and 6, since both options share the same land use assumptions.

TRAM FORECASTING RESULTS

The tram forecasting results for the entire tram routes servicing Fishermans bend and nearby areas in are shown in Figure 6.5 for the New Rail Line Variation Option (Project Case 3), New Rail with Extra Tram Option (Project Case 6) and the Northern Rail Alignment Variation Option (Project Case 7).

In general, tram boardings for Route 11, 48 and 86 (currently Route 109) are very similar between the project cases in the AM peak, however across the day, tram boardings are noticeably higher for Route 11 and slightly higher for Route 48 in Project Case 7 compared to Project Case 6 (as well as Project Case 3). This may be because Project Case 7 does not include Route 46, and therefore additional travel demand from this land use is required to use Route 11 and 48.

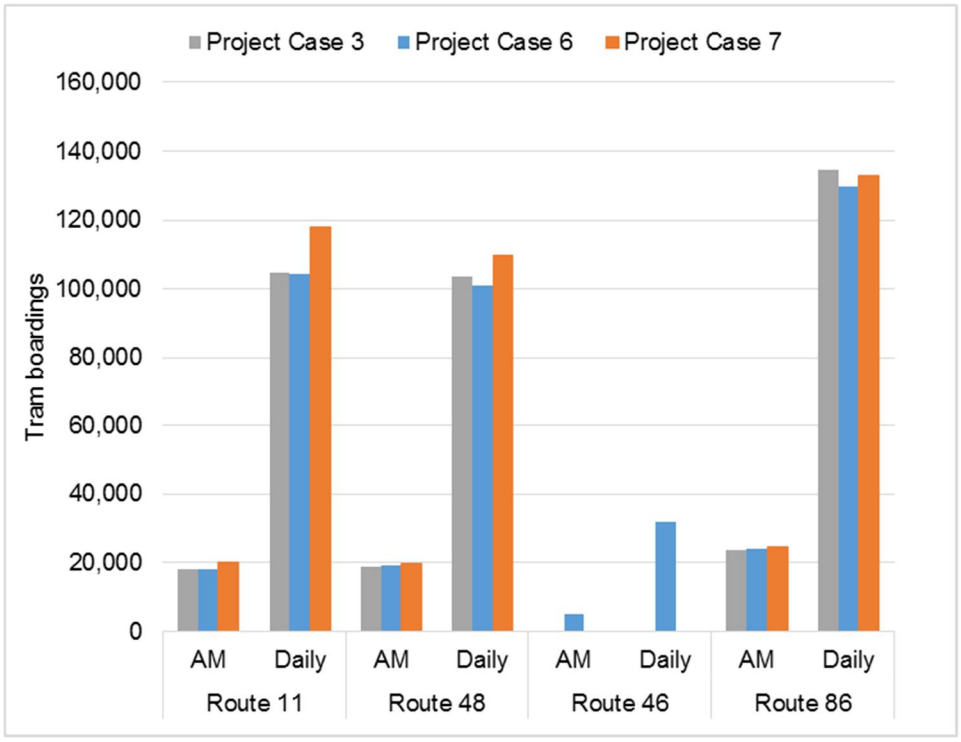

Figure 6.5 AM peak and daily tram boardings in Project Case 3, 6 and 7

Load and capacity

The AM peak tram load and volume over capacity (V/C) ratios along Turner Street, Plummer Street and Collins Street for Project Case 7 are shown in Figure 6.6 and Figure 6.7 respectively, where the load standard was used to calculate the V/C ratios and locations where load levels exceed the load standard are shown in red.

When compared to Project Case 3 and 6, these results suggest that there is more demand for travel along Plummer Street in Project Case 7 and hence less capacity (i.e. higher V/C ratio), which is consistent with the fact that Route 11 no longer competes with the rail alignment which has moved to the north. On the other hand, there is more capacity on Turner Street in Project Case 7 when compared to Project Case 3 due to the northern alignment, but slightly less capacity when compared to Project Case 6 due to the extra tram (though some capacity is still available).

A summary of the maximum tram load for tram routes in Fishermans Bend (Routes 11, 48 and 86), as well as the average maximum load per service are also provided in Appendix G for all time periods. The maximum tram load over capacity ratio along the Plummer Street and Collins Street, by direction is also included in Appendix H, for the AM and PM peaks for further information.

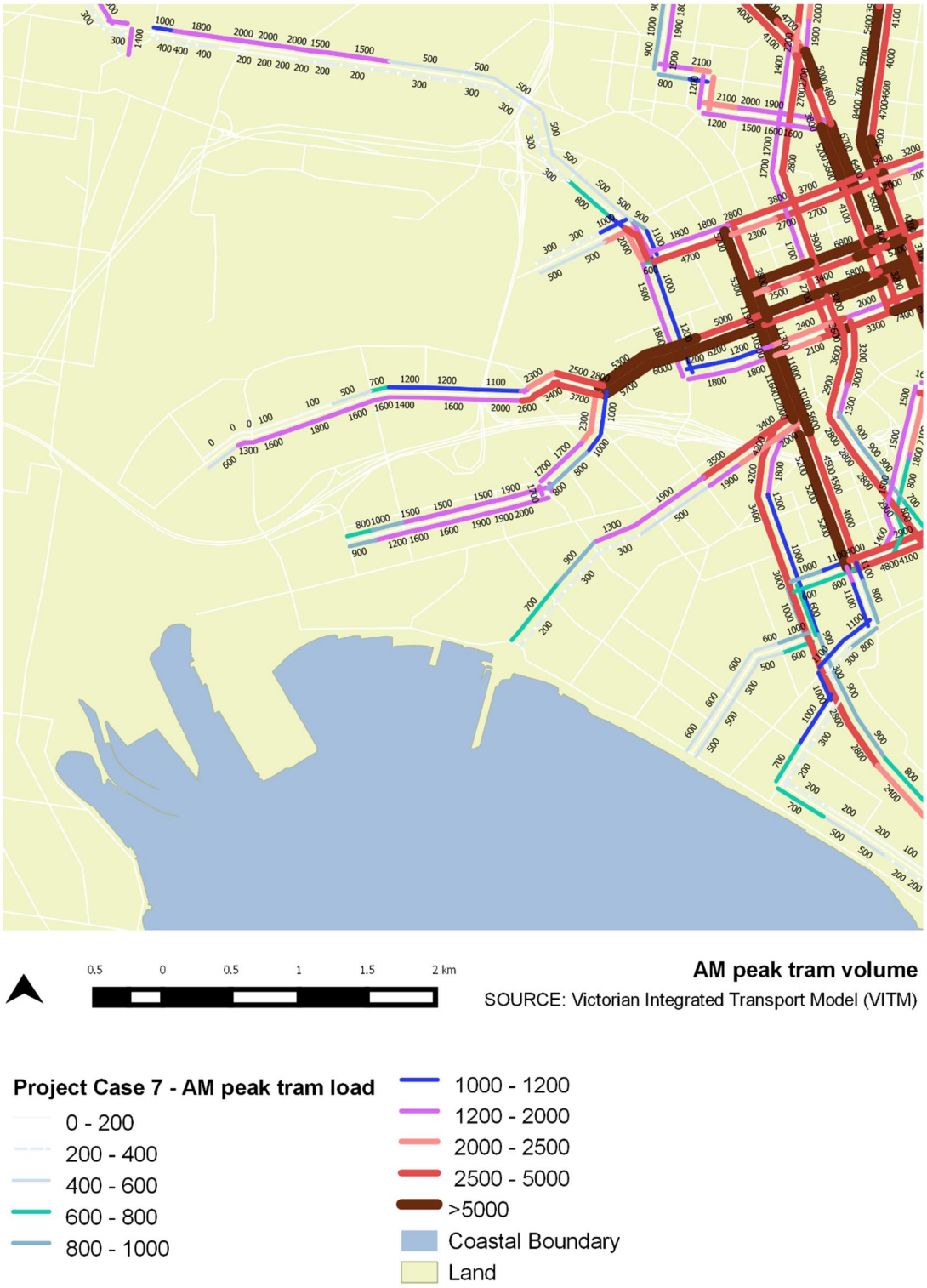

Figure 6.6 AM peak tram load in Fishermans Bend – Project Case 7

Figure 6.7 AM peak tram V/C in Fishermans Bend – Project Case 7

BUS FORECASTING RESULTS

Boardings

The total AM peak and daily forecast bus boardings for bus routes servicing Fishermans Bend in the New Rail Variation Option (Project Case 3), the Southern Alignment with Extra Tram Option (Project Case 6) and the Northern Alignment Variation Option (Project Case 7) are shown in Table 6.3 below, while a full summary of the bus boardings by individual bus route for the AM peak and daily is provided in Appendix I.

In general, the total bus boardings in the AM peak and across the day in Project Case 7 are only slightly higher than Project 6 (i.e. by approximately 5%), suggesting the rail alignment does not have a great impact on bus boardings.

Table 6.3 Total bus boardings for buses servicing the study area in Project Case 3, 6 and 7

TIME PERIOD	Project Case 3	Project Case 6	Project Case 7	%Diff (PC3)	%Diff (PC6)
AM Peak	10,358	8,396	8,882	-14%	5%
Daily	50,646	41,418	44,074	-13%	6%

Load and capacity

As per Project Case 3 and Project Case 6, seven bus routes service the Fishermans Bend study area in Project Case 7. The maximum bus load vs load standard capacity (V/C ratio) in the AM peak for each route has been calculated and is provided in Appendix J. Results show that the same bus services are overcapacity in the AM peak for Project Case 7 compared to Project Case 3, namely:

- Garden City to Queen Victoria Market.
- Domain to Fishermans Bend.

TRAIN FORECASTING RESULTS

Boardings

The total AM peak and total daily forecast train boardings for rail stations servicing Fishermans Bend in the New Rail Variation Option (Project Case 3), the Southern Alignment with Extra Tram Option (Project Case 6) and the Northern Rail Alignment Variation (Project Case 7) are shown in Table 6.4. In general, there is approximately 20% less train boarding in Project Case 7 compared to Project Case 3 and 6 in the AM peak, while across the day the train boardings in all three project cases are similar. This suggests that there may be a shift in the time when people board the rail service with a northern rail alignment, e.g. less boardings in the AM because a northern station is not easily accessible for population in the south of Fishermans Bend (as per the reduction in PT mode share in the Wirraway Precincts); and more boardings in the PM when those travelling into the Employment Precinct from outside Fishermans Bend return home (as per the increase in PT mode share for the Employment Precinct).

As there are limited north-south public transport services in Fishermans Bend, these results suggest that both rail alignments may not be used to their full potential, i.e. a northern alignment does not meet all the needs of the population in the south wanting to leave Fishermans Bend and the default southern alignment does not meet all the needs of the people wanting to enter Fishermans Bend to access employment in the north.

Table 6.4 Total train boardings at Fishermans Bend rail stations in Project Case 3, 6 and 7

TIME PERIOD	Project Case 3	Project Case 6	Project Case 7	%Diff (PC3)	%Diff (PC6)
AM Peak	6,268	6,532	5,233	-17%	-20%
Daily	45,950	48,115	47,431	3%	-1%

Load and capacity

The AM peak train load along the rail line in Project Case 7 is shown in Figure 6.8, and indicates that the maximum load train load in Fishermans Bend is 36,400 (eastbound), which is slightly less than Project Case 3 and 6. As the load standard capacity of the rail line is calculated to be 56,520 in the AM peak at this point, results suggest that there is still rail capacity in this option.

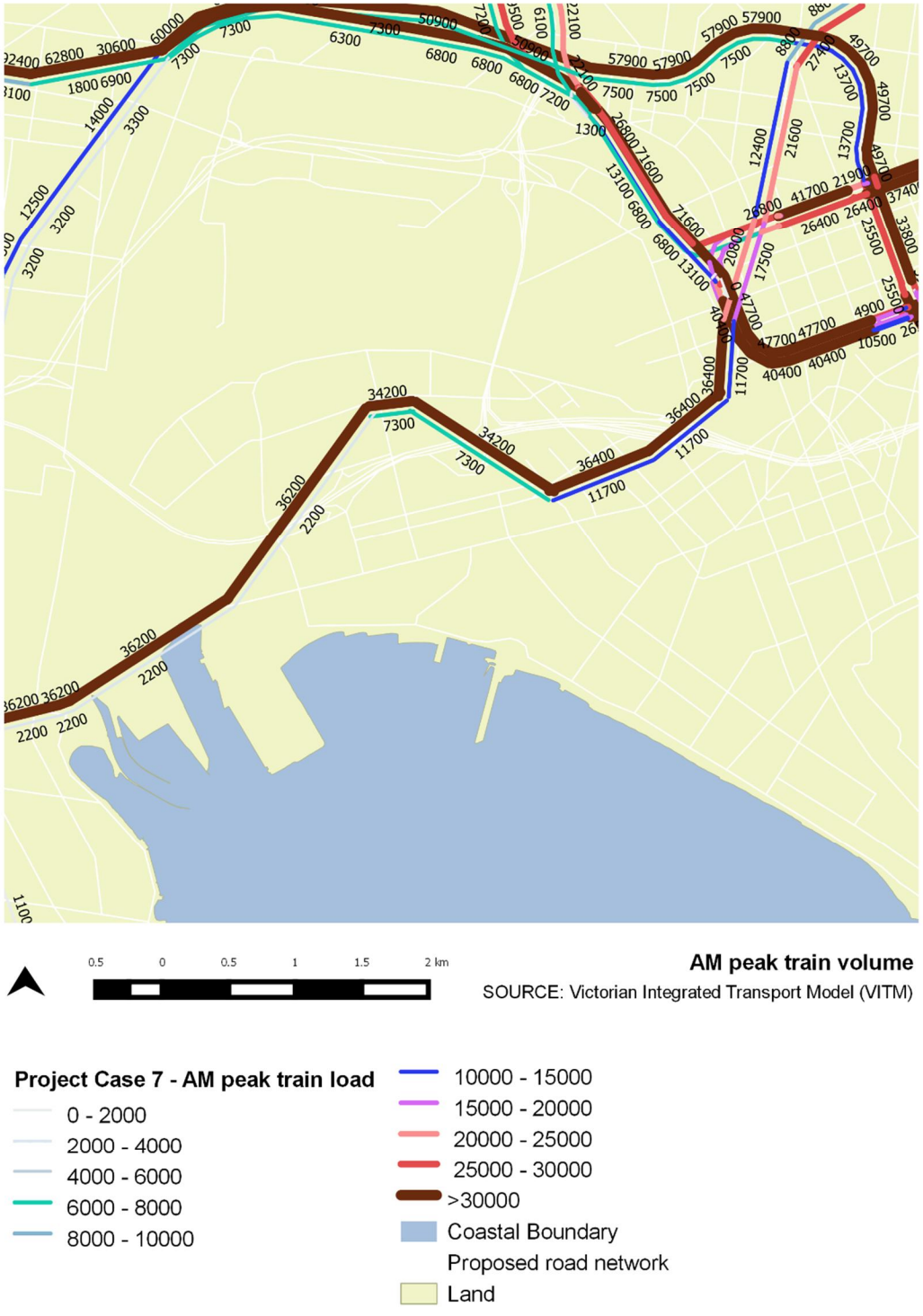

Figure 6.8 AM peak train load in Fishermans Bend – Project Case 7

7 CONCLUSION

Following the validation of a base year model and development of a future year, a 2046/51 Base Case and five project cases have been tested using the Reference Case land use scenario, while two further project cases have been tested using the Vision Plus University land use scenario for Fishermans Bend to inform the assessment of different public transport network options that will support the planned land use development in 2046/51. It should be noted that the VITM modelling is only one tool in the overall options assessment, and does not consider other important aspects such as environmental impact, social impact, and economic viability of each option (e.g. the cost of Project Case 3 could be significantly higher than the cost of Project Case 1).

Under the Reference Case land use scenario in 2046, travel demand in the Base Case is unable to be adequately catered for, with all buses serving Fishermans Bend reaching capacity. By comparison, the Tram Extension Option (Project Case 1), which assumes a new crossing over the river and trams along Plummer Street and Turner Street, offers a better outcome than the Base Case as it provides more public transport options and capacity, resulting in higher public transport patronage and mode share.

If the new crossing over the river was to be replaced with the existing Charles Grime Bridge however (as in Project Case 4), this would result in less patronage and longer travel time, though the difference would not be significant. On the other hand, if the Turner Street tram was replaced with a priority SmartBus (as in Project Case 2) there would be a noticeable reducing in public transport patronage and greater capacity issues for trams on Plummer Street. As such, modelling suggests that the Tram Extension Option (Project Case 1) is the most preferable option of all options without heavy rail.

Nevertheless, as there are some capacity constraints on both Turner Street and Plummer Street near Collins Street in Project Case 1, if the opportunity for heavy rail exists, a better outcome will be achieved with less congestion, higher PT patronage and higher PT mode share, as is the case in the New Rail Line Variation Option (Project Case 3), though running trams at a higher frequency may also be an option to consider.

Under Vision Plus University land use, (higher population and employment supported by heavy rail), a southern and northern rail alignment would result in similar public transport patronage, though a southern alignment is likely to achieve higher PT mode share for the Wirraway Precincts in the south of Fishermans Bend and a northern rail alignment is likely to achieve higher PT mode share for the employment precinct. The inclusion of a north-south connection may therefore improve both options. Compared to the Reference Case land use scenario, the Vision Plus University land use scenario also resulted in 15% more person trips entering Fishermans Bend, and 11% more person trips leaving Fishermans Bend across the day, due to the higher population and employment.

In general, demand results show that with little improvement to tram or train, public transport trips to Fishermans Bend are likely to be internal (as is the case for the Base Case and Project Case 2); while with the inclusion of two tram services, most public transport trips to Fishermans Bend will come from Melbourne as the CBD becomes more accessible (as is the case for Project Case 1 and 4). Furthermore, with the addition of Melbourne Metro Design 2, public transport trips from Wyndham and Whittlesea become more popular, as these LGAs become easier to access (i.e. in Project Case 3, 6 and 7).

As discussed previously, the VITM demand modelling only informs the performance of the options relative to travel demand. Careful consideration should be taken into account when assessing the options presented in this report, and ideally should be combined with other assessments to determine the overall preferred option and to inform the Transport Plan and Infrastructure Plan for Fishermans Bend.

Appendix A

DETAILED VALIDATION RESULTS

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NETWORK-WIDE PUBLIC TRANSPORT VALIDATION

The most recent version of 2011 VITM was used as the base year model for the Fishermans Bend project. This model was initially run and checked against the 2011 public transport validation spreadsheet (project specific guidance provided by PTV) to show how well the model was currently performing, particularly in regards to the tram validation performance. As a result of this check, it was found that the existing 2011 VITM underestimated tram boardings across the network.

As the main factor influencing tram boardings was identified to be the tram boarding penalty factor, where a higher factor discourages tram boardings and a lower factor encourages tram boardings. Two alternative tram boarding penalties were tested in the VITM in the hope of improving the validation results:

- Test 1 – reducing tram boarding penalties by 90 seconds
- Test 2 – reducing tram boarding penalties by 72 seconds.

From these tests, it was found that reducing the tram boarding penalties by 72 seconds (i.e. Test 2) across all iterations provided the best validation results for tram without adversely affecting other modes, as shown by the before and after results in tables and figures included hereafter.

Once the tram boarding penalties had been adjusted based on Test 2, the 2011 highway validation performance was also checked to ensure that no major changes had occurred to the traffic results as a result of the boarding penalty change. It was confirmed that the impacts were minimal.

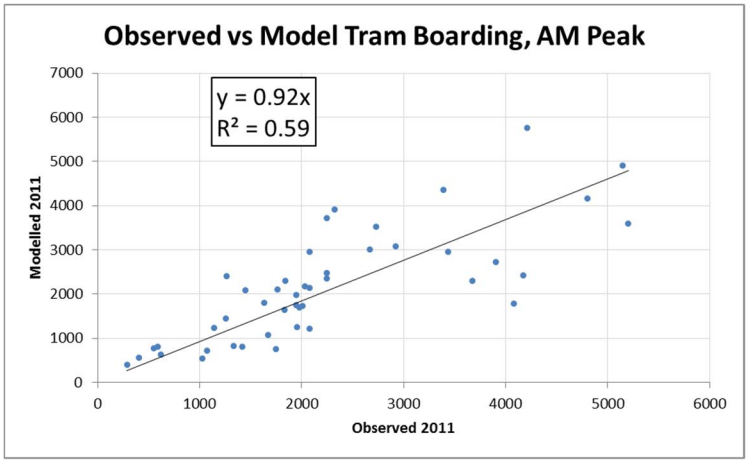
NETWORK-WIDE PUBLIC TRANSPORT STATISTICS

Existing	PT Boardings	Train Boardings	Tram Boardings	Bus Boardings	V/Line Boardings
AM	0.6%	-5.4%	-1.0%	19.3%	5.1%
IP	-3.5%	11.6%	-8.8%	-16.5%	-2.5%
PM	-5.1%	-4.1%	-18.4%	13.9%	39.8%
OP	-13.5%	-16.7%	-13.7%	-2.9%	-5.5%
24hr	**-5.1%**	**-3.4%**	**-11.3%**	**1.7%**	**9.5%**

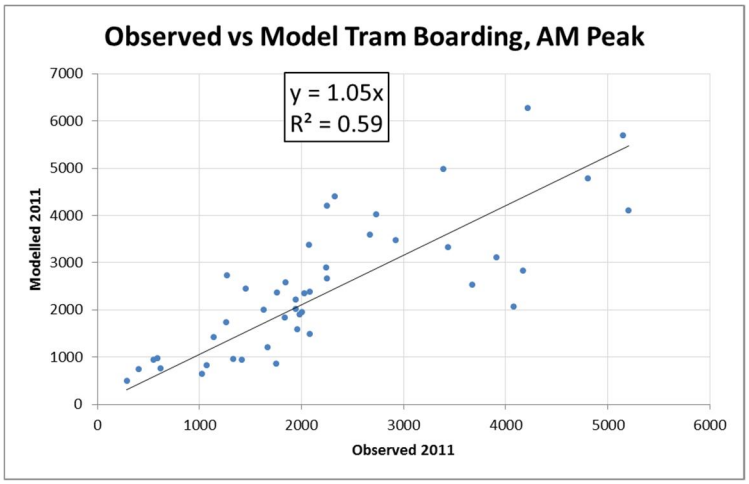
Test 1	PT Boardings	Train Boardings	Tram Boardings	Bus Boardings	V/Line Boardings
AM	3.8%	-6.3%	13.5%	16.8%	5.3%
IP	0.5%	9.7%	4.9%	-19.1%	-1.6%
PM	-2.2%	-5.2%	-6.4%	11.2%	41.4%
OP	-9.7%	-18.1%	-0.1%	-6.6%	-3.4%
24hr	**-1.6%**	**-4.7%**	**2.0%**	**-1.1%**	**10.6%**

Test 2	PT Boardings	Train Boardings	Tram Boardings	Bus Boardings	V/Line Boardings
AM	3.1%	-6.1%	10.3%	17.2%	5.3%
IP	-0.4%	10.1%	2.0%	-18.6%	-1.7%
PM	-2.8%	-5.0%	-8.9%	11.9%	40.2%
OP	-10.5%	-17.9%	-2.9%	-5.9%	-4.0%
24hr	**-2.3%**	**-4.4%**	**-0.8%**	**-0.5%**	**10.1%**

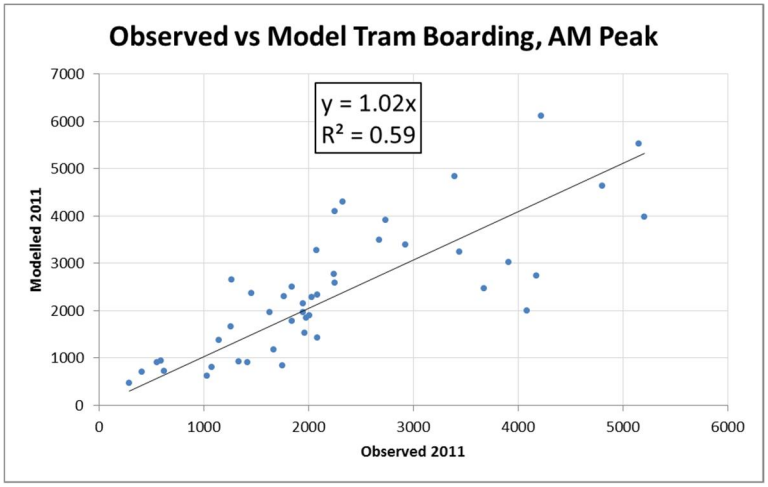
Note: Percentages are comparison to observed data, where a positive value indicates the model results are higher than the observed data.



Existing



Test 1



Test 2

VALIDATION WITHIN FISHERMANS BEND

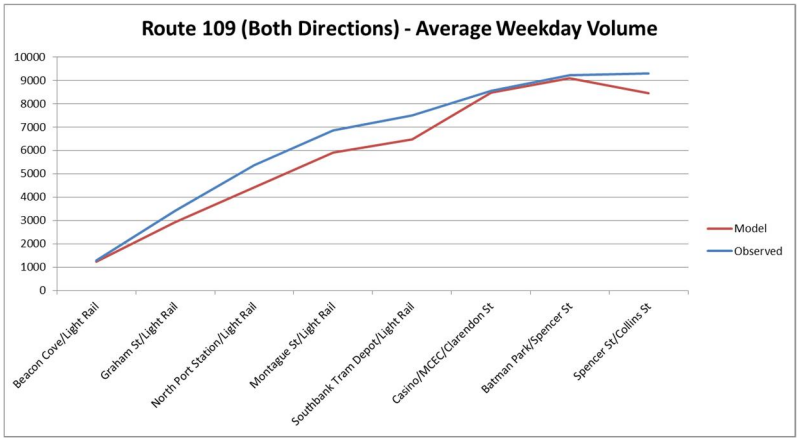
The updated 2011 VITM was also validated within the Fishermans Bend study area by comparing the model results for tram, bus and traffic with other available survey data as described in table below. In general, it was found that:

- Average weekday tram volumes from the model on Route 109 (to Port Melbourne), and along Collins Street compare well with the survey data.
- On some bus routes the model is matching well with the survey data, while on other routes the model is overestimating. Load profiles from the model do however, compare well with the survey data.
- Travel time on local routes compare well with observed data in some instances, but are greater or less than observed data in other instances, this is not uncommon as the road network in VITM does not include details such as intersections which affect travel time.
- In general, VITM matched the observed traffic volumes on the nominated roads reasonably well at the strategic level. VITM does however, tends to overestimate local intersection movements, though this is not uncommon as VITM is a strategic model and is not calibrated to such fine level of detail.

Full public transport and traffic validation results are included figures hereafter.

TYPE OF VALIDATION	OBS. YEAR	SURVEY DATA
Tram validation	2009/10	Tram patronage for the following: - Average weekday volumes on Route 109 (between City and Port Melbourne) - Average weekday volumes on Collins Street (between Spencer/King and Exhibition/Spring)
Bus validation	2010/11	Bus patronage on routes 232, 235, 237, 238 and 606
Traffic validation	2010	Travel time for the following routes: - Todd Rd (southbound) – from Cook Street to Williamstown Road - West Gate Fwy on/off Ramp (westbound) – from Prohasky St to Cook St - West Gate Fwy on/Off Ramp (eastbound)- Cook St to Prohasky St - Todd Rd and Cook St (north/eastbound) - Williamstown Rd to Cook St - Cook St and Todd Rd (west/southbound) – Cook St to Williamstown Rd
		Traffic volumes on the following roads: - Lorimer Street - West Gate Freeway - Wurundjeri Way - Cook Street - Todd Road - Montague Street - Normanby Roads
		Traffic volumes at the following intersections: - Todd/ Williamstown - Todd/ West Gate - Todd/Cook - Prohasky/ West Gate

TRAM CORRIDOR VALIDATION – ROUTE 109



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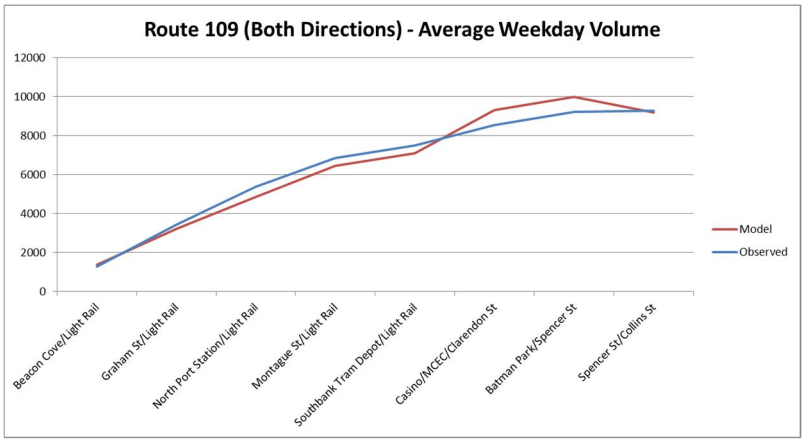
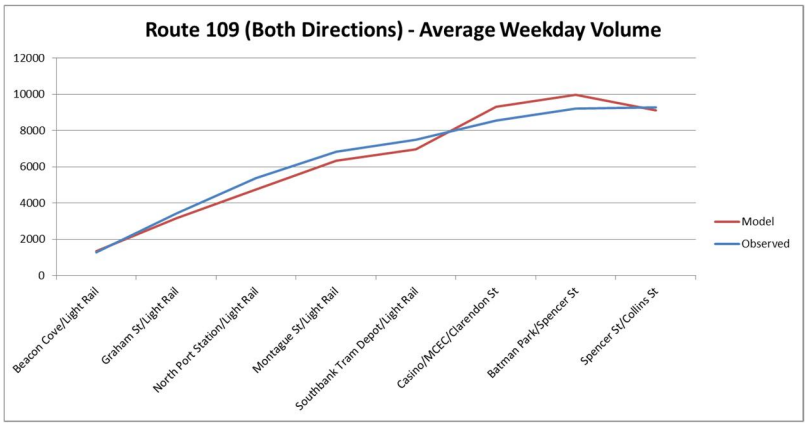
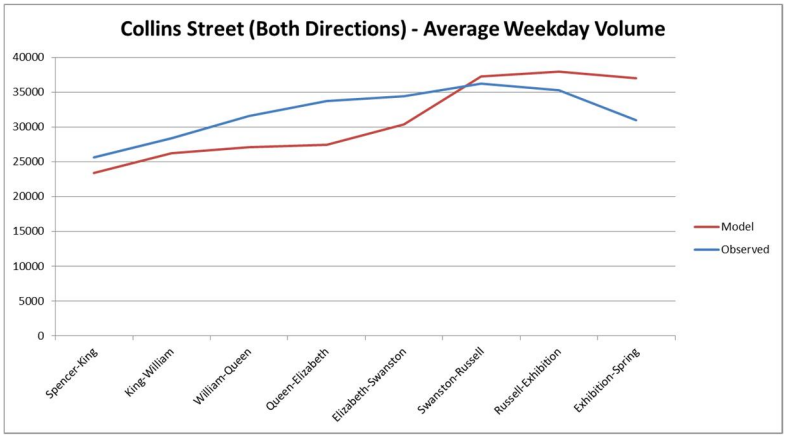


Test 1



Test 2

TRAM CORRIDOR VALIDATION – COLLINS STREET



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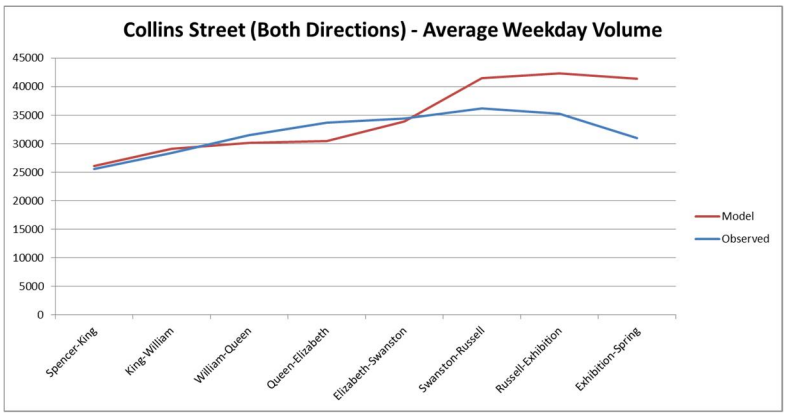
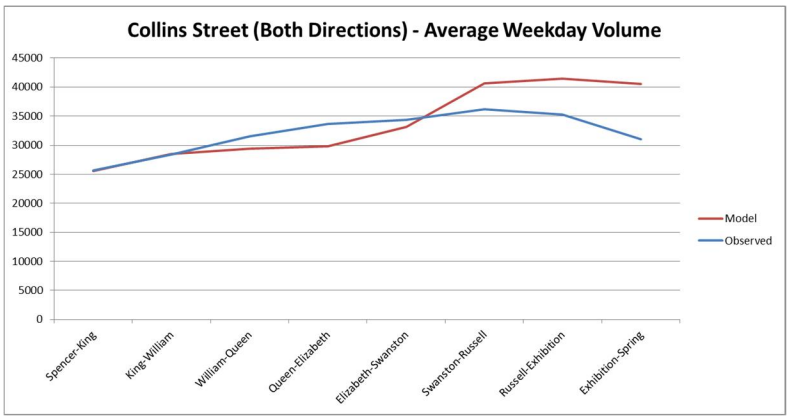


Test 1



Test 2

BUS PATRONAGE VALIDATION

Route	Observed daily boardings (2010/11)	VITM Existing	Test 1	Test 2
232	941	1,481	1,350	1,377
235	793	468	478	476
237	513	1,398	1,387	1,406
606	162	58	62	64
Total	2,409	4,044	3,895	3,950

TRAFFIC VALIDATION

Screenline Summary, All Vehicles	Test 2			
Time Period	**Direction**	**VicRoads**	**MITM**	**Difference**
AM	In	942,104	918,998	-2.45%
	Out	619,254	642,371	3.73%
IP	In	1,809,800	1,779,530	-1.67%
	Out	1,736,860	1,639,029	-5.63%
PM	In	1,056,534	1,078,155	2.05%
	Out	1,423,374	1,390,037	-2.34%
OP	In	1,540,429	1,172,933	-23.86%
	Out	1,600,730	1,233,482	-22.94%
24hr	In	5,348,867	4,949,616	-7.46%
	Out	5,380,218	4,904,920	-8.83%

Screenline Summary, Trucks	Test 2			
Time Period	**Direction**	**VicRoads**	**MITM**	**Difference**
AM	In	61,918	65,958	6.53%
	Out	55,387	55,571	0.33%
IP	In	187,214	204,846	9.42%
	Out	193,543	205,237	6.04%
PM	In	61,990	66,457	7.21%
	Out	76,153	80,737	6.02%
OP	In	94,932	104,785	10.38%
	Out	84,941	106,134	24.95%
24hr	In	406,054	442,047	8.86%
	Out	410,024	447,678	9.18%

Test 2 - 1.2 min reduction in tram boarding penalty		Observed		VITM	
LOCATION	DIRECTION	All Vehs (AADT)	CVs (AADT)	All Veh	CVs
LORIMER STREET E Bd btwn INGLES STREET & WEST GATE FREEWAY Offra	E BD	6,200	560	5,622	834
LORIMER STREET W Bd btwn WEST GATE FREEWAY Offramp & INGLES ST	W BD	6,100	990	6,492	918
WEST GATE FWY E BD BTWN WILLIAMSTOWN RD & TODD RD/COOK ST	E BD	***85,517***	***11,604***	97,516	14,802
WEST GATE FWY W BD BTWN TODD RD & WILLIAMSTOWN RD	W BD	***90,385***	***12,726***	94,390	14,417
WEST GATE FWY E BD BTWN TODD RD/COOK ST & WESTERN LINK TOLLW	E BD	75,000	8,200	91,657	14,837
WEST GATE FWY NW BD BTWN KINGS WAY & WESTERN LINK TOLLWAY	W BD	83,000	8,900	65,760	12,070
WURUNDJERI WAY S BD BTWN DUDLEY ST & BOURKE ST	S BD	17,000	1,400	20,416	2,072
WURUNDJERI WAY N BD BTWN BOURKE ST & DUDLEY ST	N BD	15,000	1,300	18,807	2,090
WURUNDJERI WAY SW BD BTWN FLINDERS ST & LORIMER ST/WESTGATE	SW BD	***31,103***	***1,712***	28,434	2,646
WURUNDJERI WAY NE BD BTWN MONTAGUE ST & FLINDERS ST	NE BD	***27,445***	***1,453***	31,955	3,050
COOK ST NE BD BTWN WEST GATE FWY & SALMON ST	E BD	2,300	180	1,856	532
COOK ST SW BD BTWN SALMON ST & WEST GATE FWY	W BD	2,300	180	2,617	435
TODD ROAD N Bd btwn COOK STREET & LORIMER STREET	N BD	3,700	430	4,393	753
TODD ROAD S Bd btwn LORIMER STREET & COOK STREET	S BD	4,200	590	5,268	875
MONTAGUE ST SE BD BTWN WEST GATE FWY & NORMANBY RD	SE BD	18,000	1,300	16,518	1,377
MONTAGUE ST NW BD BTWN NORMANBY RD & WEST GATE FREEWAY	NW BD	21,000	1,600	20,695	1,938
NORMANBY ROAD NEBd btwn WILLIAMSTOWN ROAD & MONTAGUE STR	NE BD	10,000	1,100	8,756	883
NORMANBY ROAD SWBd btwn MONTAGUE STREET & WILLIAMSTOWN R	SW BD	7,500	900	7,982	570
Total		**505,750**	**55,125**	**529,136**	**75,098**

Route	AM Average Travel Time in seconds (2010 Observed)	AM Modelled Travel Time in seconds	Diff	%Diff
1	53.7	58.5	4.8	9%
2	75.8	59.5	-16.3	-22%
3	67.9	76.7	8.7	13%
4	52.8	75.7	22.9	43%
5	74.7	73.3	-1.4	-2%
6	83.4	78.8	-4.6	-6%

Route	PM Average Travel Time in seconds (2010 Observed)	PM Modelled Travel Time in seconds	Diff	%Diff
1	45.3	57.8	12.50	28%
2	72.2	59.3	-12.94	-18%
3	57.1	75.7	18.59	33%
4	56.1	76.7	20.68	37%
5	64.9	73.1	8.20	13%
6	86.3	74.4	-11.89	-14%

Int	Link	2010 AM Observed	AM Modelled	Diff	%Diff	2010 PM Observed	PM Modelled	Diff	%Diff
Todd/ Williamstown	Todd Rd (N)	887	376	-511	-58%	916	109	-807	-88%
	Williamstown Rd (E)	281	57	-224	-80%	262	27	-235	-90%
	Todd Rd (S)	531	139	-392	-74%	328	32	-296	-90%
	Williamstown Rd (W)	99	143	44	45%	201	185	-16	-8%
Todd/ West Gate	Todd Rd (N)	953	641	-312	-33%	1148	834	-314	-27%
	West Gate Freeway On/Off Ramp (E)	407	503	96	24%	216	205	-11	-5%
	Todd Rd (S)	778	200	-578	-74%	646	242	-404	-63%
Todd/Cook	Todd Rd (N)	177	236	59	33%	594	786	192	32%
	Cook Street (E)	994	739	-255	-26%	778	227	-551	-71%
	Todd Rd (S)	752	543	-209	-28%	369	291	-78	-21%
Prohasky/ West Gate	West Gate Freeway On/Off Ramp (E)	938	728	-200	-21%	455	334	-121	-27%
	Prohasky St (S)	529	1286	757	143%	523	1420	897	171%
	West Gate Freeway On/Off Ramp (W)	498	31	-467	-94%	715	3	-712	-100%
Total		7,828	5,630	-2,194	-28%	7,151	4,696	-2,455	-34%

COMPARISON WITH 2016 SURVEY DATA

A comparison between an interim version of 2015 VITM and available 2016 tram and bus data was also made as described in table below. This was undertaken in order to gain an understanding of how well VITM is forecasting future year patronage. In general, it was found that:

- The 2015 VITM tram patronages at the nominated stops in both the AM and PM peaks are significantly higher than the 2016 scan-on data. This comparison is not very useful however, for the following reasons:
  - The tram scan-on data is not reliable. For stops within free tram zone, passengers do not need to scan their myki. Even for stops outside free tram zone, passengers who just got off another tram/train/bus have the tendency of not scanning their myki passes again.
  - As a strategic model, VITM is not suitable for patronage forecast at stop level. For example, one stop in VITM may represent multiple stops that are close to each other.
- The model is generally overestimating daily bus boardings when compared to 2016 survey data. This is consistent with the observations from the 2011 model validation.

Full public transport comparison results are included include hereafter.

TYPE OF COMPARISON	SURVEY DATA
Tram	Tram patronage at the following stops: → Spencer St/Collins St Melbourne → Spencer St/Flinders St Melbourne → Clarendon St; South Bank → City Rd/Sth Melb Market → Clarendon St; South Melbourne → Port Melbourne Light Rail → Albert Park.
Bus	Bus patronage on route 232, 235, 237 and 606

BUS PATRONAGE COMPARISON USING 2016 DATA

Route	2016 Observed Average Daily Scan-On	2015 Model Daily boardings	Diff	%Diff
232	601	1990	1389	231%
235	1147	2048	902	79%
237	902	3089	2187	243%
606	344	345	2	1%
Total	2993	7473	4480	150%

Route	2016 Observed Average AM Peak Scan-On	2015 Model AM boardings	Diff	%Diff
232	145	412	267	185%
235	350	425	75	22%
237	328	784	457	139%
606	103	74	-29	-28%
Total	924	1695	771	83%

Tram patronage comparison using 2016 data

Stop location	2016 Observed Average Daily Scan-On	2015 Model Daily boardings	Diff	%Diff
Spencer St/Collins St Melbourne	3027	12067	9040	299%
Spencer St/Flinders St Melbourne	1197	5224	4026	336%
Clarendon St; South Bank	2708	2130	-577	-21%
City Rd/Sth Melb Market	642	1349	707	110%
Clarendon St; South Melbourne	1077	53	-1024	-95%
Port Melbourne Light Rail	2606	348	-2258	-87%
Albert Park	511	1101	590	115%
Total	11768	22272	10504	89%

Stop location	2016 Observed Average AM Peak Scan-On	2015 Model AM boardings	Diff	%Diff
Spencer St/Collins St Melbourne	666	3800	3134	471%
Spencer St/Flinders St Melbourne	127	753	626	492%
Clarendon St; South Bank	266	77	-189	-71%
City Rd/Sth Melb Market	71	158	87	122%
Clarendon St; South Melbourne	73	3	-70	-96%
Port Melbourne Light Rail	840	70	-771	-92%
Albert Park	106	57	-50	-47%
Total	2149	4917	2767	129%

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Appendix B

FUTURE YEAR MODEL DEVELOPMENT DETAILS

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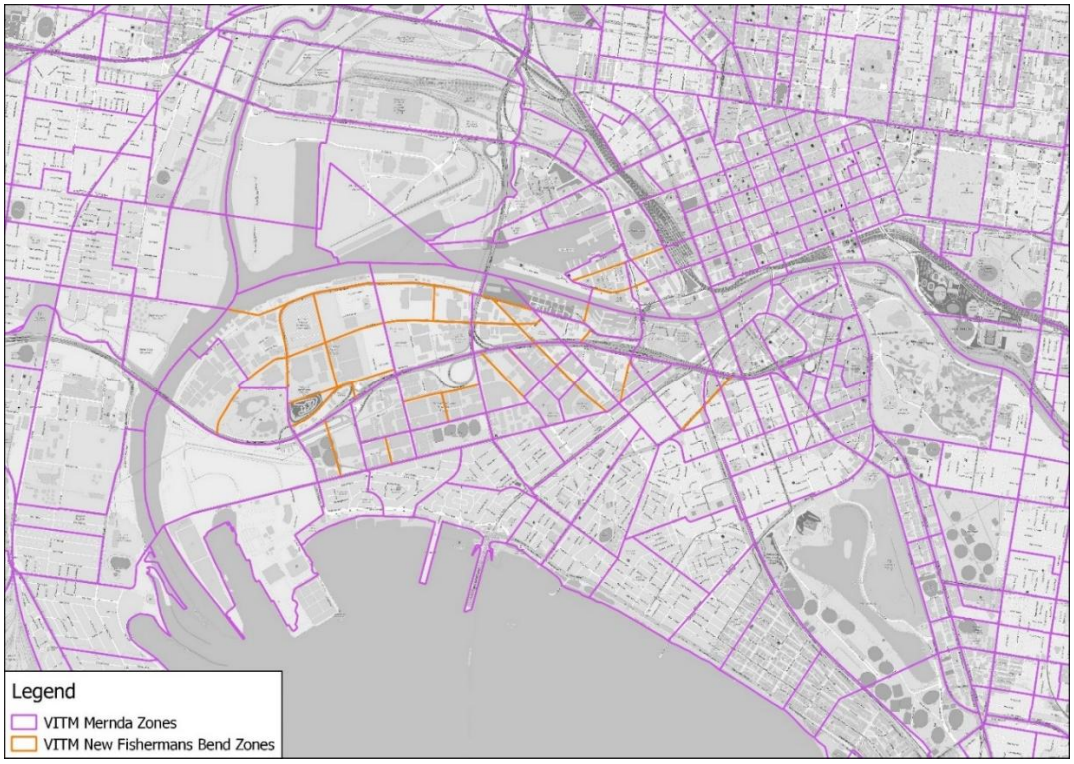
APPENDIX B1: MODEL PARAMETERS

Car ownership assumptions and car parking charges for Fishermans Bend were applied in such a way as to discourage car use and encourage active transport (e.g. walking and cycling):

- Car ownership assumptions applied to the two new SLAs were the average cars per household of the Melbourne Inner and Melbourne Remainder SLAs which is somewhere between 0.4 and 0.9.
- Car parking charges for the two new SLAs were the same as Melbourne Remainder ($4.30 for work, $1.10 for everything else in 2008$, growing 2008-2014 by 4.0% CAGR and 2014-2046 1.5% CAGR).
- The two new LGAs used the same parameters and assumptions adopted for the City of Melbourne.

These parameters and assumptions applied to the future year Base Case and all project cases tested.

APPENDIX B2: ZONE DISAGGREGATION



APPENDIX B3: HIGHWAY NETWORK

Local road network from 2046/51 Fishermans Bend model

APPENDIX B4: PUBLIC TRANSPORT NETWORK

The future year base case public transport network was based on the Stage B Melbourne Metro Design 1 public transport network (PT line file). This was considered the most appropriate PT line file as the starting point, as it was consistent with the Melbourne Metro business case modelling and assumed:

- No Doncaster line
- New Rowville line
- New east –west connections:
  - Pakenham to Sydenham
  - Pakenham to Sunbury
  - Clyde to Sydenham
  - Clyde to Melbourne Airport
  - Pakenham to Melbourne Airport
  - Rowville to Melton
  - Pakenham to Melton.

Specifications for the train, tram and bus were provided by PTV and the PT line file was checked and updated as per the table below.

MODE	CHANGES MADE TO STARTING PT LINE FILE (I.E. 2046 STAGE B MM DESIGN 1)
Train	The Mernda line was incorrectly coded with two outbound services in all time periods and no inbound services. As such, one of the outbound services was changed to an inbound service. All other train services were found to correspond with the specifications provided.
Tram	All tram routes were checked against the specifications provided and updated where required. In particular: → Route 11, 48 and 109 were checked to ensure that they terminated at Victoria Harbour Docklands instead of Fishermans Bend, such that: ▪ Route 11 = Reservoir - Victoria Harbour Docklands ▪ Route 48 = Doncaster Park and Ride - Victoria Harbour Docklands ▪ Route 109 = Box Hill - Victoria Harbour Docklands → Route 86 was checked to ensure it ran between Bundoora and Port Melbourne. Route 11, 48, 86 and 109 were also ensured to have the equivalent of E Class tram capacities (seating capacity 64, Crush capacity 290), as model inputs.
Bus	Routes 232, 234, 235, 236, 237 and 606 were replaced with those from the 2015/16 Fishermans Bend bus network: → Route 232 = Altona North - City → Route 234 = Garden City – Queen Vic Market → Route 235 = Fishermans Bend - City → Route 236 = Garden City – Queen Vic Market → Route 237 = Fishermans Bend - City → Route 606 = Fishermans Bend - Elsternwick

Melbourne Metro Design 2: Assumes a Mernda to Wyndham Vale east-west connection, in addition to Melbourne Metro Design 1 assumption described above. Preston to City Loop service also included in the Melbourne Metro Design 2 in place of Doncaster rail service.

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Appendix C

FULL NETWORK WIDE STATISTICS

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Key road network statistics by mode and by time period (Project Case minus Base Case)

MODE	PERIOD	BASE CASE	DIFFERENCE TO BASE					
			PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
Number Vehicle of Trips	AM Peak	2,039,359	-7,284	-4,315	-13,446	-6,760	-4,531	-4,425
	Inter Peak	5,195,492	-10,810	-6,982	-21,914	-10,194	-7,954	-7,426
	PM Peak	3,736,268	-9,604	-6,200	-19,094	-8,966	-5,115	-4,668
	Off Peak	2,732,394	-11,346	-6,918	-20,454	-10,782	-7,859	-7,556
	Daily	***13,703,512***	***-39,043***	***-24,414***	***-74,907***	***-36,701***	***-25,458***	***-24,074***
Vehicle Kilometres Travelled	AM Peak	20,025,160	-86,459	-39,946	-157,361	-75,219	-68,399	-64,641
	Inter Peak	46,643,533	-60,634	-31,124	-151,580	-54,929	-43,852	-38,054
	PM Peak	35,983,144	-110,526	-66,130	-198,221	-86,030	-62,687	-61,066
	Off Peak	30,704,602	-112,507	-47,885	-225,896	-96,786	-87,889	-82,827
	Daily	***133,356,439***	***-370,125***	***-185,086***	***-733,056***	***-312,964***	***-262,827***	***-246,587***
Vehicle Hours Travelled	AM Peak	583,254	-9,354	-4,081	-17,645	-8,606	-11,209	-11,584
	Inter Peak	1,053,688	-2,726	-1,482	-5,421	-2,521	-2,001	-1,533
	PM Peak	1,157,057	-11,158	-5,751	-23,303	-9,500	-11,935	-11,209
	Off Peak	584,648	-2,877	-1,480	-5,213	-2,929	-2,404	-2,384
	Daily	***3,378,647***	***-26,115***	***-12,793***	***-51,581***	***-23,556***	***-27,550***	***-26,710***

PT boardings by mode and by time period (Project Case minus Base Case)

MODE	PERIOD	DIFFERENCE TO BASE						
		BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
PT boardings (incl. V/Line)	AM Peak	1,078,800	18,990	10,916	24,877	17,881	28,927	28,085
	Inter Peak	1,566,854	31,691	19,189	35,292	28,986	39,541	38,648
	PM Peak	1,527,286	28,624	17,482	29,941	26,663	35,801	35,602
	Off Peak	972,805	21,072	12,714	26,457	20,239	32,152	32,397
	Daily	***5,145,745***	***100,377***	***60,301***	***116,567***	***93,768***	***136,422***	***134,732***
Metro Rail	AM Peak	505,120	2,938	1,571	23,204	2,481	24,228	23,590
	Inter Peak	647,848	4,230	2,630	37,197	3,500	35,709	33,340
	PM Peak	698,954	3,968	2,157	31,698	3,633	33,307	31,440
	Off Peak	417,461	3,254	1,453	22,030	2,933	23,459	22,055
	Daily	***2,269,383***	***14,390***	***7,811***	***114,129***	***12,548***	***116,703***	***110,425***
Tram	AM Peak	279,109	11,742	3,912	4,276	11,476	7,759	7,219
	Inter Peak	535,609	30,237	14,296	10,498	28,234	17,112	16,824
	PM Peak	421,365	18,502	6,757	-726	17,435	4,429	5,853
	Off Peak	341,120	17,516	8,544	9,889	17,001	14,222	14,911
	Daily	***1,577,203***	***77,998***	***33,508***	***23,937***	***74,147***	***43,522***	***44,807***
Bus	AM Peak	244,352	3,829	5,306	3,370	3,513	2,371	2,756
	Inter Peak	327,699	-3,184	2,104	-5,078	-3,020	-6,647	-5,395
	PM Peak	361,180	5,493	8,237	4,409	5,053	3,219	3,232
	Off Peak	185,472	-77	2,560	-562	-25	-1,111	-445
	Daily	***1,118,702***	***6,062***	***18,207***	***2,139***	***5,522***	***-2,167***	***149***

Appendix D

FISHERMANS BEND TRIP GENERATION AND DISTRIBUTION BY LGA AND MODE

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Total Person Trips to Fishermans Bend by Origin LGA	Car							Public transport						
	Base	PC1	PC2	PC3	PC4	PC6	PC7	Base	PC1	PC2	PC3	PC4	PC6	PC7
Banyule	363	268	324	228	272	262	255	130	244	181	345	235	408	432
Bayside	747	569	667	486	577	567	557	127	232	169	267	223	312	324
Boroondarah	769	583	689	503	590	588	575	295	571	398	618	556	735	736
Brimbank	972	708	862	600	721	678	648	215	468	336	544	451	587	610
Cardinia	24	14	20	11	15	13	12	42	83	59	91	81	118	113
Casey	90	60	77	47	62	55	53	241	525	356	524	523	615	594
Darebin	582	432	519	358	439	409	396	292	544	406	862	524	994	1,060
Frankston	35	24	31	20	25	22	22	62	114	78	129	112	146	149
Glen Eira	975	741	868	631	751	732	723	204	444	309	482	435	566	572
Greater Dandenong	105	73	91	60	74	67	65	145	343	224	336	341	391	379
Hobsons Bay	1,749	1,344	1,577	1,125	1,365	1,290	1,246	218	407	307	738	394	819	854
Hume	283	198	247	165	203	185	178	249	531	386	615	510	759	759
Kingston	331	245	293	206	248	236	232	154	322	217	359	315	418	429
Knox	93	65	81	53	66	62	60	88	172	120	189	168	224	227
Manningham	351	258	312	219	261	255	247	76	144	105	168	139	203	210
Maribyrnong	1,383	1,052	1,241	905	1,068	1,024	991	283	583	427	695	564	764	772
Maroondah	74	53	65	44	54	51	49	90	167	121	193	160	226	236
Melbourne	2,378	1,938	2,147	1,789	1,952	1,923	1,908	912	1,818	1,410	1,871	1,796	2,237	2,138
Melton	1,082	776	953	647	795	730	699	247	525	395	573	507	659	671
Monash	283	207	249	174	210	203	198	216	457	316	494	448	587	585
Moonee Valley	709	534	633	463	543	534	519	236	467	337	557	450	690	673
Moreland	1,032	762	922	653	775	756	735	357	686	500	775	665	907	906
Mornington Peninsula	22	14	19	12	15	14	13	9	19	12	21	19	40	42
Nillumbik	93	68	82	56	69	66	63	48	89	65	123	86	149	158
Port Phillip	5,454	4,323	4,785	3,825	4,366	4,125	4,107	825	1,373	1,341	1,200	1,377	1,394	1,415
Stonnington	1,216	956	1,095	829	966	956	947	282	565	420	635	550	736	754
Whitehorse	251	184	223	156	187	182	177	221	401	292	460	389	535	553
Whittlesea	222	154	194	123	158	139	134	306	584	428	1,146	562	1,321	1,416
Wyndham	2,224	1,627	1,975	1,303	1,664	1,508	1,445	732	1,504	1,115	2,715	1,451	3,229	3,400
Yarra	982	781	897	681	789	786	772	304	583	425	698	571	827	844
Yarra Ranges	40	28	35	23	28	26	25	101	181	135	205	175	243	248
Fishermans Bend - CoPP	1,220	720	915	672	730	819	782	680	240	438	213	260	330	303
Fishermans Bend - CoM	3,210	2,755	2,829	2,463	2,772	2,659	2,713	1,500	1,329	1,422	862	1,357	1,152	1,208
Total	**29,342**	**22,514**	**25,919**	**19,530**	**22,810**	**21,923**	**21,549**	**9,887**	**16,713**	**13,252**	**19,702**	**16,395**	**23,323**	**23,772**

Total Person Trips from Fishermans Bend to Destination LGA	Car							Public transport						
	Base	PC1	PC2	PC3	PC4	PC6	PC7	Base	PC1	PC2	PC3	PC4	PC6	PC7
Banyule	81	64	70	58	65	65	65	99	117	112	186	115	210	205
Bayside	370	309	323	278	311	324	329	112	131	126	150	129	169	166
Boroondarah	282	233	246	214	233	244	244	421	531	503	570	528	647	628
Brimbank	242	206	217	193	208	214	215	46	63	60	82	61	88	85
Cardinia	3	2	3	2	2	2	2	6	8	6	8	7	9	9
Casey	17	12	14	10	12	11	11	28	60	47	62	60	69	66
Darebin	147	117	125	105	117	117	117	137	162	156	273	160	303	295
Frankston	8	6	7	5	6	6	6	17	21	18	27	21	30	29
Glen Eira	560	453	471	408	454	469	478	169	233	226	261	232	294	285
Greater Dandenong	23	17	20	15	17	16	17	38	76	75	86	76	96	91
Hobsons Bay	675	575	590	535	581	599	609	91	92	89	217	92	211	194
Hume	55	42	48	37	43	41	41	59	70	67	91	68	101	96
Kingston	81	64	69	56	64	62	63	84	103	97	128	100	144	137
Knox	18	14	16	12	14	13	13	32	37	36	43	36	49	47
Manningham	76	60	65	53	60	60	60	44	49	47	60	48	67	65
Maribyrnong	461	384	400	353	386	397	398	108	133	126	163	130	175	168
Maroondah	14	11	13	10	12	11	11	58	60	58	73	59	82	80
Melbourne	3,534	2,953	3,077	2,737	2,972	3,059	3,089	5,627	7,426	7,007	7,620	7,383	8,785	8,744
Melton	144	112	127	96	114	105	103	24	32	30	38	31	40	39
Monash	69	54	58	47	54	53	53	124	188	182	215	185	242	234
Moonee Valley	195	157	167	143	159	161	162	114	131	125	172	127	197	186
Moreland	274	230	245	213	231	247	246	129	139	133	170	135	191	185
Mornington Peninsula	4	3	4	3	3	3	3	3	4	4	6	4	7	7
Nillumbik	16	13	14	11	13	12	12	12	13	13	22	13	25	24
Port Phillip	3,709	3,215	3,275	2,989	3,227	3,286	3,330	575	726	770	597	733	681	715
Stonnington	608	493	514	441	495	504	513	241	389	385	444	386	503	487
Whitehorse	57	44	48	39	45	44	44	172	187	180	218	183	247	241
Whittlesea	36	28	32	24	28	26	26	48	54	53	123	53	134	130
Wyndham	340	276	304	238	280	260	260	73	92	89	221	90	236	220
Yarra	848	740	767	698	743	822	822	574	620	594	744	609	845	832
Yarra Ranges	8	6	7	6	7	6	6	31	37	33	44	36	49	49
Fishermans Bend - CoPP	1,123	596	849	504	611	636	585	952	447	626	348	490	566	522
Fishermans Bend - CoM	3,307	2,878	2,896	2,631	2,892	2,843	2,910	1,228	1,122	1,234	727	1,128	916	989
Total	**17,383**	**14,368**	**15,081**	**13,165**	**14,457**	**14,718**	**14,844**	**11,475**	**13,553**	**13,303**	**14,187**	**13,508**	**16,404**	**16,251**

% Person Trips to Fishermans Bend by Origin LGA	Car							Public transport						
	Base	PC1	PC2	PC3	PC4	PC6	PC7	Base	PC1	PC2	PC3	PC4	PC6	PC7
Banyule	1.2%	1.2%	1.3%	1.2%	1.2%	1.2%	1.2%	1.3%	1.5%	1.4%	1.8%	1.4%	1.8%	1.8%
Bayside	2.5%	2.5%	2.6%	2.5%	2.5%	2.6%	2.6%	1.3%	1.4%	1.3%	1.4%	1.4%	1.3%	1.4%
Boroondarah	2.6%	2.6%	2.7%	2.6%	2.6%	2.7%	2.7%	3.0%	3.4%	3.0%	3.1%	3.4%	3.2%	3.1%
Brimbank	3.3%	3.1%	3.3%	3.1%	3.2%	3.1%	3.0%	2.2%	2.8%	2.5%	2.8%	2.8%	2.5%	2.6%
Cardinia	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.4%	0.5%	0.4%	0.5%	0.5%	0.5%	0.5%
Casey	0.3%	0.3%	0.3%	0.2%	0.3%	0.3%	0.2%	2.4%	3.1%	2.7%	2.7%	3.2%	2.6%	2.5%
Darebin	2.0%	1.9%	2.0%	1.8%	1.9%	1.9%	1.8%	3.0%	3.3%	3.1%	4.4%	3.2%	4.3%	4.5%
Frankston	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.6%	0.7%	0.6%	0.7%	0.7%	0.6%	0.6%
Glen Eira	3.3%	3.3%	3.3%	3.2%	3.3%	3.3%	3.4%	2.1%	2.7%	2.3%	2.4%	2.7%	2.4%	2.4%
Greater Dandenong	0.4%	0.3%	0.4%	0.3%	0.3%	0.3%	0.3%	1.5%	2.1%	1.7%	1.7%	2.1%	1.7%	1.6%
Hobsons Bay	6.0%	6.0%	6.1%	5.8%	6.0%	5.9%	5.8%	2.2%	2.4%	2.3%	3.7%	2.4%	3.5%	3.6%
Hume	1.0%	0.9%	1.0%	0.8%	0.9%	0.8%	0.8%	2.5%	3.2%	2.9%	3.1%	3.1%	3.3%	3.2%
Kingston	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.6%	1.9%	1.6%	1.8%	1.9%	1.8%	1.8%
Knox	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.9%	1.0%	0.9%	1.0%	1.0%	1.0%	1.0%
Manningham	1.2%	1.1%	1.2%	1.1%	1.1%	1.2%	1.1%	0.8%	0.9%	0.8%	0.9%	0.8%	0.9%	0.9%
Maribyrnong	4.7%	4.7%	4.8%	4.6%	4.7%	4.7%	4.6%	2.9%	3.5%	3.2%	3.5%	3.4%	3.3%	3.2%
Maroondah	0.3%	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%	0.9%	1.0%	0.9%	1.0%	1.0%	1.0%	1.0%
Melbourne	8.1%	8.6%	8.3%	9.2%	8.6%	8.8%	8.9%	9.2%	10.9%	10.6%	9.5%	11.0%	9.6%	9.0%
Melton	3.7%	3.4%	3.7%	3.3%	3.5%	3.3%	3.2%	2.5%	3.1%	3.0%	2.9%	3.1%	2.8%	2.8%
Monash	1.0%	0.9%	1.0%	0.9%	0.9%	0.9%	0.9%	2.2%	2.7%	2.4%	2.5%	2.7%	2.5%	2.5%
Moonee Valley	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.8%	2.5%	2.8%	2.7%	3.0%	2.8%
Moreland	3.5%	3.4%	3.6%	3.3%	3.4%	3.4%	3.4%	3.6%	4.1%	3.8%	3.9%	4.1%	3.9%	3.8%
Mornington Peninsula	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Nillumbik	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.5%	0.5%	0.5%	0.6%	0.5%	0.6%	0.7%
Port Phillip	18.6%	19.2%	18.5%	19.6%	19.1%	18.8%	19.1%	8.3%	8.2%	10.1%	6.1%	8.4%	6.0%	6.0%
Stonnington	4.1%	4.2%	4.2%	4.2%	4.2%	4.4%	4.4%	2.8%	3.4%	3.2%	3.2%	3.4%	3.2%	3.2%
Whitehorse	0.9%	0.8%	0.9%	0.8%	0.8%	0.8%	0.8%	2.2%	2.4%	2.2%	2.3%	2.4%	2.3%	2.3%
Whittlesea	0.8%	0.7%	0.7%	0.6%	0.7%	0.6%	0.6%	3.1%	3.5%	3.2%	5.8%	3.4%	5.7%	6.0%
Wyndham	7.6%	7.2%	7.6%	6.7%	7.3%	6.9%	6.7%	7.4%	9.0%	8.4%	13.8%	8.8%	13.8%	14.3%
Yarra	3.3%	3.5%	3.5%	3.5%	3.5%	3.6%	3.6%	3.1%	3.5%	3.2%	3.5%	3.5%	3.5%	3.5%
Yarra Ranges	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	1.0%	1.1%	1.0%	1.0%	1.1%	1.0%	1.0%
Fishermans Bend - CoPP	4.2%	3.2%	3.5%	3.4%	3.2%	3.7%	3.6%	6.9%	1.4%	3.3%	1.1%	1.6%	1.4%	1.3%
Fishermans Bend - CoM	10.9%	12.2%	10.9%	12.6%	12.2%	12.1%	12.6%	15.2%	8.0%	10.7%	4.4%	8.3%	4.9%	5.1%

% Person Trips from Fishermans Bend to Destination LGA	Car							Public transport						
	Base	PC1	PC2	PC3	PC4	PC6	PC7	Base	PC1	PC2	PC3	PC4	PC6	PC7
Banyule	0.5%	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%	0.9%	0.9%	0.8%	1.3%	0.8%	1.3%	1.3%
Bayside	2.1%	2.2%	2.1%	2.1%	2.1%	2.2%	2.2%	1.0%	1.0%	0.9%	1.1%	1.0%	1.0%	1.0%
Boroondarah	1.6%	1.6%	1.6%	1.6%	1.6%	1.7%	1.6%	3.7%	3.9%	3.8%	4.0%	3.9%	3.9%	3.9%
Brimbank	1.4%	1.4%	1.4%	1.5%	1.4%	1.5%	1.4%	0.4%	0.5%	0.5%	0.6%	0.5%	0.5%	0.5%
Cardinia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%
Casey	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.4%	0.3%	0.4%	0.4%	0.4%	0.4%
Darebin	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	1.2%	1.2%	1.2%	1.9%	1.2%	1.8%	1.8%
Frankston	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%
Glen Eira	3.2%	3.2%	3.1%	3.1%	3.1%	3.2%	3.2%	1.5%	1.7%	1.7%	1.8%	1.7%	1.8%	1.8%
Greater Dandenong	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
Hobsons Bay	3.9%	4.0%	3.9%	4.1%	4.0%	4.1%	4.1%	0.8%	0.7%	0.7%	1.5%	0.7%	1.3%	1.2%
Hume	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.5%	0.5%	0.5%	0.6%	0.5%	0.6%	0.6%
Kingston	0.5%	0.4%	0.5%	0.4%	0.4%	0.4%	0.4%	0.7%	0.8%	0.7%	0.9%	0.7%	0.9%	0.8%
Knox	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Manningham	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Maribyrnong	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	0.9%	1.0%	0.9%	1.1%	1.0%	1.1%	1.0%
Maroondah	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.5%	0.4%	0.4%	0.5%	0.4%	0.5%	0.5%
Melbourne	20.3%	20.6%	20.4%	20.8%	20.6%	20.8%	20.8%	49.0%	54.8%	52.7%	53.7%	54.7%	53.6%	53.8%
Melton	0.8%	0.8%	0.8%	0.7%	0.8%	0.7%	0.7%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%	0.2%
Monash	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	1.1%	1.4%	1.4%	1.5%	1.4%	1.5%	1.4%
Moonee Valley	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	0.9%	1.2%	0.9%	1.2%	1.1%
Moreland	1.6%	1.6%	1.6%	1.6%	1.6%	1.7%	1.7%	1.1%	1.0%	1.0%	1.2%	1.0%	1.2%	1.1%
Mornington Peninsula	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Nillumbik	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Port Phillip	21.3%	22.4%	21.7%	22.7%	22.3%	22.3%	22.4%	5.0%	5.4%	5.8%	4.2%	5.4%	4.2%	4.4%
Stonnington	3.5%	3.4%	3.4%	3.3%	3.4%	3.4%	3.5%	2.1%	2.9%	2.9%	3.1%	2.9%	3.1%	3.0%
Whitehorse	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	1.5%	1.4%	1.4%	1.5%	1.4%	1.5%	1.5%
Whittlesea	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.9%	0.4%	0.8%	0.8%
Wyndham	2.0%	1.9%	2.0%	1.8%	1.9%	1.8%	1.7%	0.6%	0.7%	0.7%	1.6%	0.7%	1.4%	1.4%
Yarra	4.9%	5.2%	5.1%	5.3%	5.1%	5.6%	5.5%	5.0%	4.6%	4.5%	5.2%	4.5%	5.1%	5.1%
Yarra Ranges	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%
Fishermans Bend - CoPP	6.5%	4.1%	5.6%	3.8%	4.2%	4.3%	3.9%	8.3%	3.3%	4.7%	2.5%	3.6%	3.5%	3.2%
Fishermans Bend - CoM	19.0%	20.0%	19.2%	20.0%	20.0%	19.3%	19.6%	10.7%	8.3%	9.3%	5.1%	8.3%	5.6%	6.1%

Appendix E

FULL MODE SHARE RESULTS

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AM peak public transport mode share by origin precincts (2046/51)

PRECINCT	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7	DIFFERENCE TO BASE					
								PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
Wirraway West	39.3%	46.8%	46.7%	51.9%	46.6%	52.7%	50.9%	7.6%	7.5%	12.6%	7.3%	13.4%	11.6%
Wirraway East	38.9%	47.5%	47.5%	53.6%	47.3%	54.0%	52.0%	8.7%	8.6%	14.7%	8.4%	15.1%	13.1%
Sandridge North	45.3%	51.4%	51.3%	55.2%	51.0%	56.1%	57.3%	6.1%	6.0%	10.0%	5.7%	10.8%	12.0%
Sandridge South	46.8%	50.3%	50.4%	55.0%	50.1%	56.2%	54.6%	3.5%	3.6%	8.2%	3.3%	9.4%	7.8%
Lorimer	21.9%	46.1%	41.0%	46.7%	45.8%	47.5%	47.3%	24.2%	19.1%	24.8%	23.9%	25.6%	25.4%
Montague	51.9%	53.2%	53.2%	53.7%	53.3%	55.1%	54.9%	1.3%	1.3%	1.8%	1.4%	3.2%	3.0%
Employment Precinct - North	3.8%	15.4%	5.0%	17.4%	14.7%	18.5%	22.4%	11.6%	1.3%	13.7%	10.9%	14.7%	18.6%
Employment Precinct - South	3.7%	15.2%	3.9%	17.5%	14.5%	19.4%	23.9%	11.5%	0.3%	13.9%	10.8%	15.7%	20.2%
CBD	77.8%	78.0%	77.9%	78.1%	78.0%	78.0%	78.0%	0.2%	0.1%	0.3%	0.2%	0.2%	0.2%
Docklands	72.6%	74.4%	73.4%	74.5%	74.5%	74.7%	74.6%	1.9%	0.8%	2.0%	1.9%	2.1%	2.0%
Southbank	74.6%	75.2%	75.1%	75.3%	75.2%	75.3%	75.3%	0.6%	0.5%	0.6%	0.6%	0.7%	0.7%
Port Phillip	29.0%	34.5%	34.0%	36.1%	34.3%	35.9%	35.5%	5.5%	5.1%	7.1%	5.3%	6.9%	6.5%
Network-wide	19.8%	20.0%	20.0%	20.2%	20.1%	20.3%	20.3%	0.2%	0.1%	0.4%	0.3%	0.5%	0.5%

AM peak public transport mode share by destination precinct (2046/51)

PRECINCT	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7	DIFFERENCE TO BASE					
								PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
Wirraway West	22.9%	31.4%	32.0%	41.4%	31.1%	41.8%	38.2%	8.5%	9.1%	18.5%	8.2%	18.9%	15.3%
Wirraway East	18.3%	30.7%	31.4%	43.0%	30.2%	43.6%	39.2%	12.5%	13.1%	24.7%	11.9%	25.3%	20.9%
Sandridge North	35.2%	44.9%	45.7%	55.0%	44.0%	55.1%	58.0%	9.7%	10.6%	19.8%	8.8%	19.9%	22.8%
Sandridge South	38.8%	43.1%	44.1%	55.3%	42.8%	55.4%	51.8%	4.4%	5.3%	16.5%	4.0%	16.6%	13.0%
Lorimer	10.8%	45.6%	29.1%	49.9%	44.6%	51.7%	52.4%	34.7%	18.3%	39.1%	33.8%	40.9%	41.6%
Montague	45.1%	47.5%	47.7%	49.3%	47.4%	49.0%	47.9%	2.5%	2.6%	4.3%	2.3%	3.9%	2.8%
Employment Precinct - North	12.8%	48.4%	20.9%	54.4%	46.7%	56.2%	63.5%	35.6%	8.1%	41.6%	33.9%	43.4%	50.7%
Employment Precinct - South	14.2%	49.0%	17.9%	55.3%	47.3%	59.9%	67.9%	34.8%	3.7%	41.1%	33.1%	45.7%	53.7%
CBD	92.0%	92.0%	92.0%	92.1%	92.0%	92.1%	92.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%
Docklands	90.5%	91.4%	91.3%	91.5%	91.4%	91.7%	91.6%	0.9%	0.8%	1.1%	0.9%	1.2%	1.1%
Southbank	88.8%	89.0%	89.2%	89.1%	89.0%	89.2%	89.3%	0.3%	0.4%	0.3%	0.2%	0.4%	0.5%
Port Phillip	26.0%	29.1%	29.4%	30.6%	29.1%	30.7%	30.3%	3.1%	3.3%	4.6%	3.1%	4.7%	4.3%
Network-wide	19.8%	20.0%	20.0%	20.2%	20.1%	20.3%	20.3%	0.2%	0.1%	0.4%	0.3%	0.5%	0.5%

Daily public transport mode share by origin precinct (2046/51)

PRECINCT	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7	DIFFERENCE TO BASE CASE					
								PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
Wirraway West	51.8%	58.9%	59.0%	63.7%	58.7%	64.6%	62.8%	7.1%	7.1%	11.9%	6.9%	12.8%	11.0%
Wirraway East	51.2%	59.7%	59.7%	65.4%	59.5%	65.8%	63.8%	8.5%	8.6%	14.2%	8.3%	14.6%	12.6%
Sandridge North	57.8%	64.0%	64.1%	67.6%	63.7%	68.0%	69.1%	6.3%	6.4%	9.8%	5.9%	10.2%	11.3%
Sandridge South	59.2%	62.9%	63.1%	67.3%	62.8%	67.8%	66.3%	3.7%	3.8%	8.1%	3.6%	8.6%	7.1%
Lorimer	29.3%	56.2%	49.1%	57.0%	55.9%	58.3%	58.1%	26.9%	19.9%	27.7%	26.6%	29.0%	28.8%
Montague	63.0%	64.4%	64.5%	64.8%	64.5%	66.2%	66.0%	1.4%	1.4%	1.8%	1.5%	3.2%	3.0%
Employment Precinct - North	4.4%	17.6%	6.5%	20.6%	16.8%	22.3%	27.5%	13.2%	2.1%	16.2%	12.4%	17.9%	23.1%
Employment Precinct - South	4.5%	17.6%	5.1%	20.9%	16.8%	24.9%	31.1%	13.2%	0.6%	16.4%	12.3%	20.4%	26.6%
CBD	74.6%	74.7%	74.7%	74.9%	74.7%	74.8%	74.8%	0.1%	0.1%	0.3%	0.1%	0.2%	0.2%
Docklands	69.4%	71.6%	70.3%	71.8%	71.7%	72.0%	71.8%	2.2%	0.9%	2.4%	2.3%	2.6%	2.4%
Southbank	69.6%	70.3%	70.3%	70.4%	70.3%	70.4%	70.4%	0.7%	0.7%	0.8%	0.7%	0.8%	0.8%
Port Phillip	23.8%	28.6%	28.3%	30.1%	28.5%	29.9%	29.5%	4.9%	4.6%	6.3%	4.7%	6.1%	5.7%
Network-wide	15.7%	15.9%	15.8%	16.1%	15.9%	16.1%	16.1%	0.2%	0.1%	0.4%	0.2%	0.4%	0.4%

Daily active trip productions by precinct (2046/51)

PRECINCT	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7	DIFFERENCE TO BASE					
							PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
Wirraway West	10,931	10,931	10,931	10,931	10,931	12,047	0	0	0	0	10%	10%
Wirraway East	11,879	11,879	11,879	11,879	11,879	12,567	0	0	0	0	6%	6%
Sandridge North	12,706	12,706	12,706	12,706	12,706	13,402	0	0	0	0	5%	5%
Sandridge South	21,302	21,302	21,302	21,302	21,302	22,688	0	0	0	0	7%	7%
Lorimer	21,919	21,919	21,919	21,919	21,919	26,329	0	0	0	0	20%	20%
Montague	20,106	20,106	20,106	20,106	20,106	24,841	0	0	0	0	24%	24%
Employment Precinct - North	0	0	0	0	0	0	0	0	0	0	0	0
Employment Precinct - South	0	0	0	0	0	0	0	0	0	0	0	0
CBD	117,475	117,475	117,475	117,475	117,475	114,618	0	0	0	0	-2%	-2%
Docklands	31,963	31,963	31,963	31,963	31,963	31,234	0	0	0	0	-2%	-2%
Southbank	53,586	53,586	53,586	53,586	53,586	52,782	0	0	0	0	-2%	-2%
Port Phillip	34,524	34,524	34,524	34,524	34,524	33,743	0	0	0	0	-2%	-2%

Appendix F

FULL TRAM BOARDING RESULTS

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Tram boardings by tram route and time period servicing the study area – both directions (2046/51)

ROUTE	TRAM BOARDINGS							DIFFERENCE TO BASE CASE					
	Base Case	Project Case 1	Project Case 2	Project Case 3	Project Case 4	Project Case 6	Project Case 7	Project Case 1	Project Case 2	Project Case 3	Project Case 4	Project Case 6	Project Case 7
Route 11													
AM Peak	13,324	21,538	22,373	18,037	21,425	17,974	20,268	8,214	9,049	4,713	8,101	4,650	6,944
Inter Peak	24,952	43,725	45,345	35,258	43,508	34,914	39,819	18,773	20,393	10,307	18,556	9,962	14,867
PM Peak	18,814	32,754	34,281	26,258	32,442	26,636	29,979	13,940	15,467	7,444	13,628	7,822	11,165
Off Peak	16,727	28,125	29,818	25,018	28,065	24,863	27,752	11,398	13,090	8,291	11,338	8,136	11,025
Daily	***73,817***	***126,142***	***131,816***	***104,572***	***125,439***	***104,387***	***117,818***	***52,325***	***57,999***	***30,755***	***51,622***	***30,570***	***44,001***
Route 46													
AM Peak	0	0	0	0	0	4,945	0	0	0	0	0	4,945	0
Inter Peak	0	0	0	0	0	12,703	0	0	0	0	0	12,703	0
PM Peak	0	0	0	0	0	6,911	0	0	0	0	0	6,911	0
Off Peak	0	0	0	0	0	7,512	0	0	0	0	0	7,512	0
Daily	***0***	***0***	***0***	***0***	***0***	***32,072***	***0***	***0***	***0***	***0***	***0***	***32,072***	***0***
Route 48													
AM Peak	11,900	18,933	12,142	18,875	18,969	19,117	19,782	7,032	242	6,975	7,069	7,217	7,882
Inter Peak	20,584	35,618	20,899	34,526	36,065	32,635	36,910	15,033	315	13,941	15,481	12,051	16,326
PM Peak	16,854	29,093	17,401	27,545	29,288	27,642	28,884	12,240	547	10,692	12,434	10,788	12,030
Off Peak	13,194	23,218	13,218	22,681	23,275	21,611	24,043	10,024	24	9,487	10,081	8,417	10,849
Daily	***62,532***	***106,862***	***63,660***	***103,627***	***107,598***	***101,005***	***109,619***	***44,329***	***1,128***	***41,095***	***45,066***	***38,473***	***47,087***
Route 86													

ROUTE	TRAM BOARDINGS							DIFFERENCE TO BASE CASE					
	Base Case	Project Case 1	Project Case 2	Project Case 3	Project Case 4	Project Case 6	Project Case 7	Project Case 1	Project Case 2	Project Case 3	Project Case 4	Project Case 6	Project Case 7
AM Peak	29,388	25,555	25,378	23,704	25,371	24,204	24,629	- 3,833	- 4,010	- 5,684	-4,017	-5,184	-4,759
Inter Peak	49,731	44,511	43,997	41,120	43,426	42,313	43,584	- 5,220	- 5,734	- 8,611	-6,305	-7,418	-6,147
PM Peak	46,343	39,830	39,510	35,940	39,420	36,915	37,850	- 6,513	- 6,833	- 10,404	-6,923	-9,428	-8,493
Off Peak	31,294	26,652	26,525	25,310	26,257	26,177	26,923	- 4,642	- 4,769	- 5,984	-5,037	-5,117	-4,371
Daily	***156,756***	***136,548***	***135,410***	***126,074***	***134,474***	***129,609***	***132,986***	***- 20,208***	***- 21,346***	***- 30,682***	***-22,282***	***-27,147***	***-23,770***
All routes													
AM Peak	54,612	66,026	59,893	60,616	65,765	66,240	64,679	11,414	5,281	6,004	11,153	11,628	10,067
Inter Peak	95,267	123,854	110,241	110,904	122,999	122,565	120,313	28,587	14,974	15,637	27,732	27,298	25,046
PM Peak	82,011	101,677	91,192	89,743	101,150	98,104	96,713	19,666	9,181	7,732	19,139	16,093	14,702
Off Peak	61,215	77,995	69,561	73,009	77,597	80,163	78,718	16,780	8,346	11,794	16,382	18,948	17,503
Daily	***293,105***	***369,552***	***330,886***	***334,273***	***367,511***	***367,073***	***360,423***	***76,447***	***37,781***	***41,168***	***74,406***	***73,968***	***67,318***

Appendix G

FULL DETAILS OF TRAM CAPACITY

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Maximum tram load on tram routes servicing the study area – towards Fishermans Bend/Port Melbourne (load greater than load standard highlighted in red)

ROUTE/ TIME PERIOD	BASE CASE		PROJECT CASE 1		PROJECT CASE 2		PROJECT CASE 3		PROJECT CASE 4		PROJECT CASE 6		PROJECT CASE 7	
	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service	Max Tram Load	Avg Load / service
Route 11														
AM Peak	2,579	129	4,250	213	4,808	240	3,501	175	4,174	209	3,492	175	3,465	173
Inter Peak	4,387	73	8,670	145	9,937	166	4,865	81	8,271	138	4,916	82	5,002	83
PM Peak	4,413	147	8,103	270	9,022	301	4,440	148	7,825	261	4,611	154	4,807	160
Off Peak	3,937	66	6,180	103	7,022	117	4,002	67	7,825	130	4,611	77	4,807	80
Route 46														
AM Peak	0	0	0	0	0	0	0	0	0	0	2,043	170	0	0
Inter Peak	0	0	0	0	0	0	0	0	0	0	4,183	116	0	0
PM Peak	0	0	0	0	0	0	0	0	0	0	1,433	80	0	0
Off Peak	0	0	0	0	0	0	0	0	0	0	1,433	40	0	0
Route 48														
AM Peak	2,535	127	5,836	292	2,557	128	5,569	278	5,776	289	5,905	295	4,174	209
Inter Peak	4,043	67	9,079	151	4,075	68	8,367	139	9,403	157	7,495	125	7,730	129
PM Peak	2,923	97	5,103	170	3,035	101	4,832	161	5,231	174	4,634	154	5,423	181
Off Peak	2,471	41	3,958	66	2,483	41	3,816	64	5,231	87	4,634	77	5,423	90
Route 86														
AM Peak	4,144	173	3,588	150	3,528	147	3,311	138	3,568	149	3,346	139	3,341	139
Inter Peak	7,902	110	5,714	79	5,726	80	5,527	77	5,677	79	5,621	78	5,698	79
PM Peak	9,826	273	7,510	209	7,459	207	7,345	204	7,434	207	7,524	209	7,713	214
Off Peak	6,853	95	4,869	68	4,842	67	4,982	69	7,434	103	7,524	105	7,713	107

Maximum tram load on tram routes servicing the study area – from Fishermans Bend/Port Melb (load greater than load standard highlighted in red)

ROUTE/ TIME PERIOD	BASE CASE		PROJECT CASE 1		PROJECT CASE 2		PROJECT CASE 3		PROJECT CASE 4		PROJECT CASE 6		PROJECT CASE 7	
	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service	Max Tram Load	Avg Load/ service
Route 11														
AM Peak	3,552	178	4,400	220	5,015	251	3,194	160	4,216	211	3,199	160	3,251	163
Inter Peak	4,387	73	8,670	145	9,937	166	4,865	81	9,611	160	5,626	94	5,857	98
PM Peak	4,413	147	8,103	270	9,022	301	4,440	148	6,049	202	4,694	156	4,680	156
Off Peak	3,937	66	6,180	103	7,022	117	4,002	67	6,049	101	4,694	78	4,680	78
Route 46														
AM Peak	0	0	0	0	0	0	0	0	0	0	756	63	0	0
Inter Peak	0	0	0	0	0	0	0	0	0	0	2,816	78	0	0
PM Peak	0	0	0	0	0	0	0	0	0	0	2,197	122	0	0
Off Peak	0	0	0	0	0	0	0	0	0	0	2,197	61	0	0
Route 48														
AM Peak	2,420	121	2,638	132	2,496	125	2,922	146	2,670	134	2,994	150	3,139	157
Inter Peak	4,137	69	6,895	115	4,314	72	6,641	111	7,006	117	6,195	103	7,671	128
PM Peak	3,251	108	8,357	279	3,340	111	7,213	240	8,343	278	7,722	257	6,376	213
Off Peak	2,810	47	6,710	112	2,860	48	6,114	102	8,343	139	7,722	129	6,376	106
Route 86														
AM Peak	6,321	263	5,134	214	5,056	211	5,339	222	5,087	212	5,427	226	5,405	225
Inter Peak	10,456	145	7,745	108	7,682	107	7,796	108	7,585	105	8,015	111	8,086	112
PM Peak	7,340	204	5,638	157	5,575	155	4,889	136	5,608	156	4,892	136	4,870	135
Off Peak	5,401	75	4,729	66	4,721	66	4,461	62	5,608	78	4,892	68	4,870	68

Appendix H

TRAM CORRIDOR LOAD VERSUS CAPACITY

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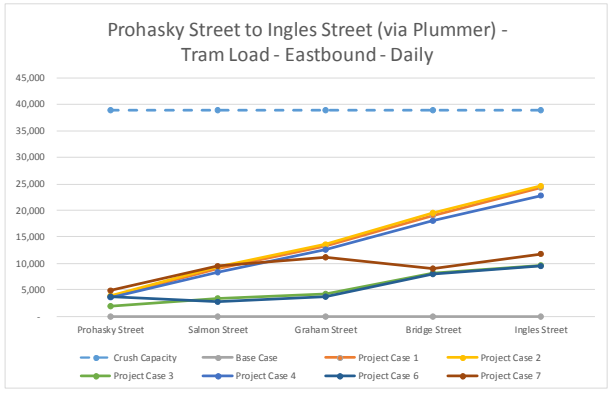
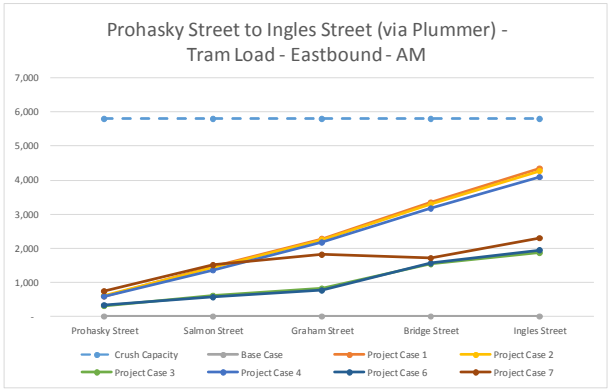
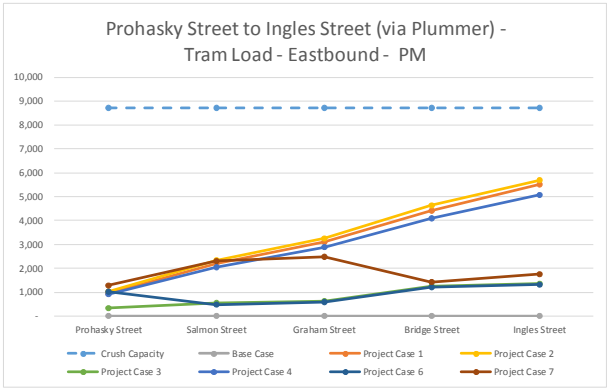
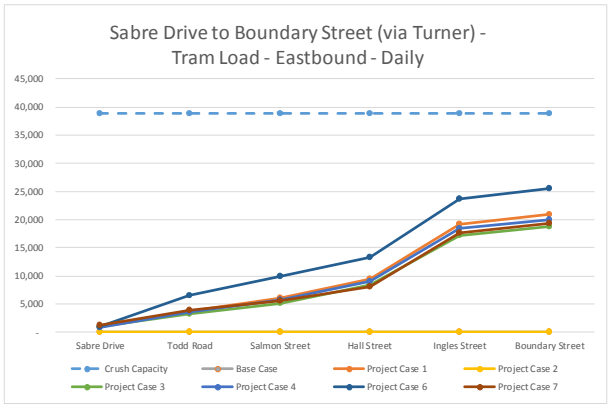
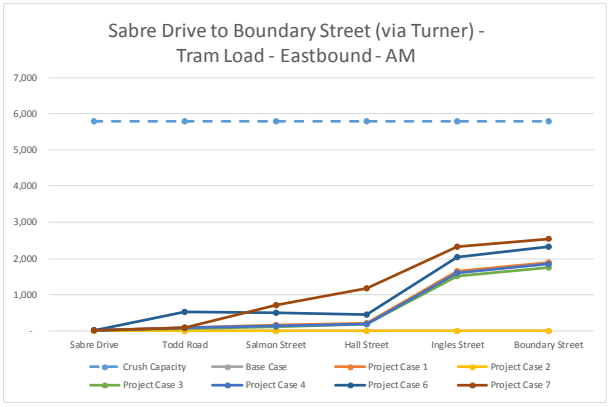
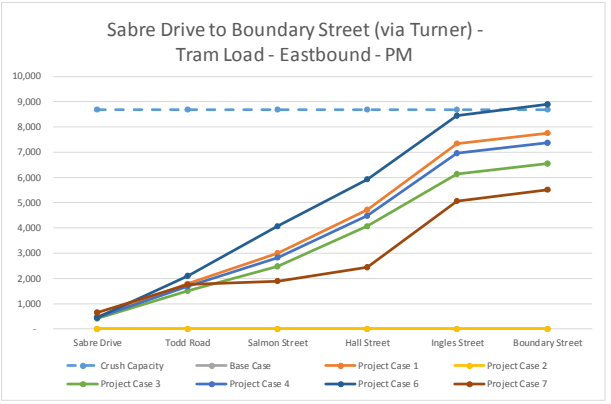


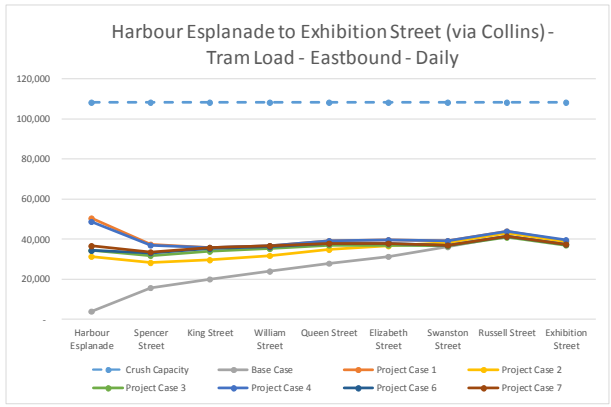


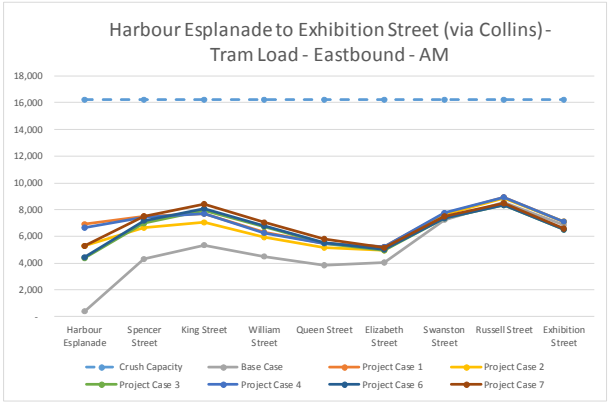


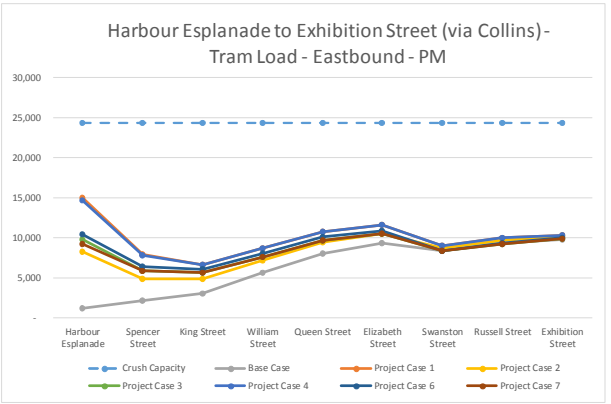




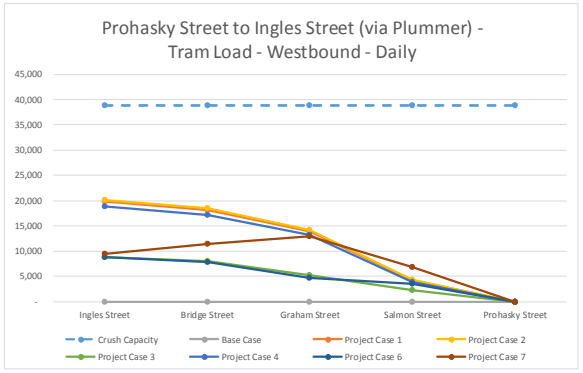


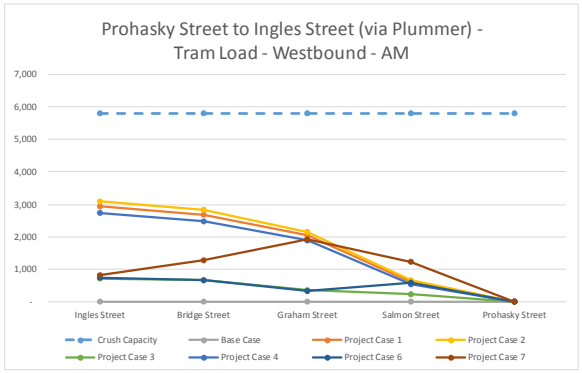


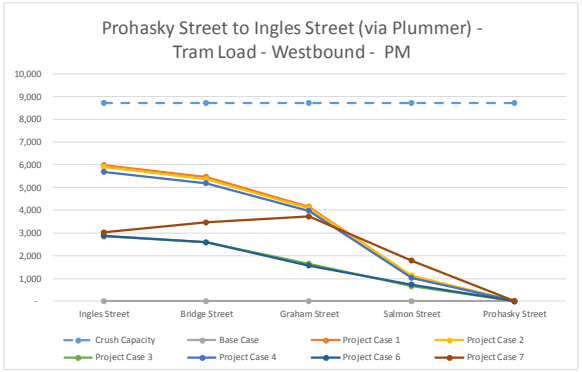


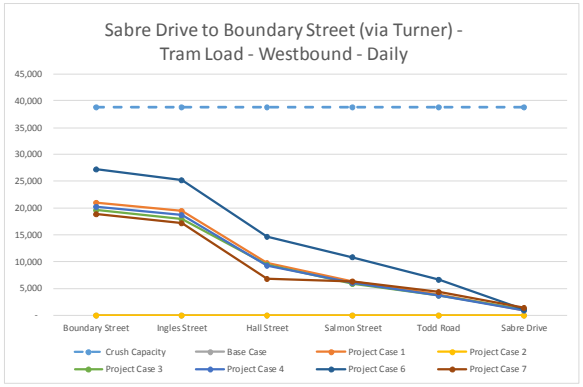


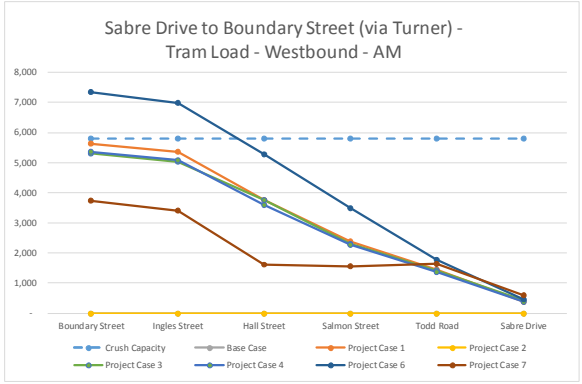
Tram load profiles - eastbound

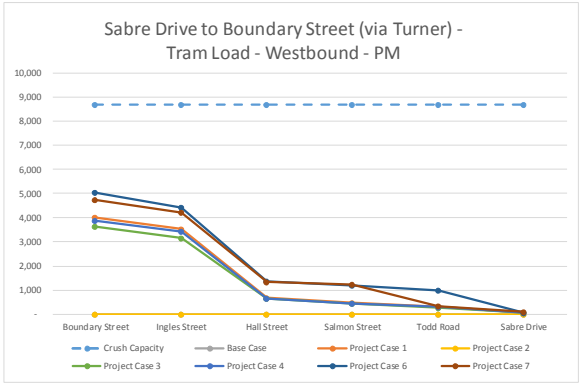


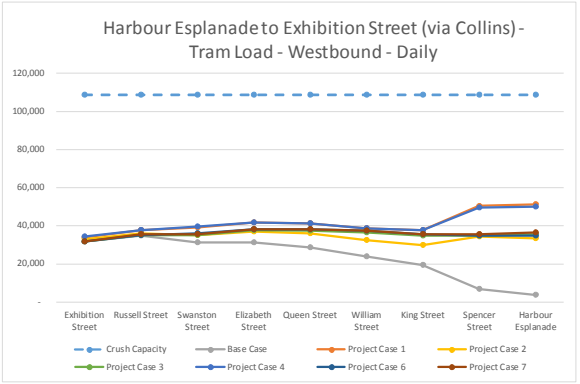


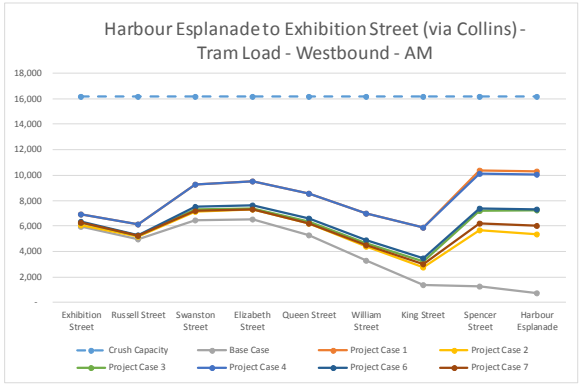


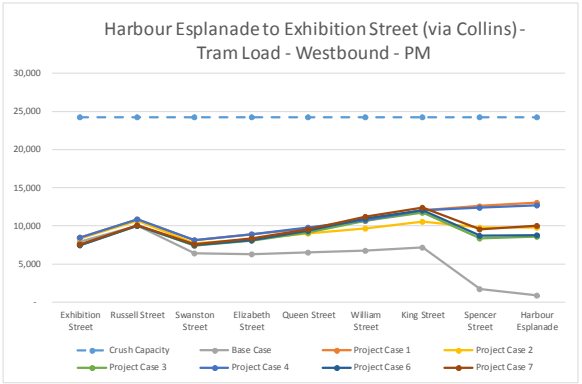












Tram load profiles - westbound

Appendix I

FULL BUS BOARDING RESULTS

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Bus boardings by bus route and time period servicing the study area – AM peak (total)

AM PEAK (Both directions)	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
232 - Altona North to Queen Victoria Market	1,662	n/a	n/a	n/a	n/a	n/a	n/a
234 - Garden City to Queen Victoria Market	1,963	n/a	n/a	n/a	n/a	n/a	n/a
235 - Fishermans Bend to City	1,825	n/a	n/a	n/a	n/a	n/a	n/a
236 - Garden City to Queen Victoria Market	371	n/a	n/a	n/a	n/a	n/a	n/a
237 - Fishermans Bend to City	1,064	n/a	n/a	n/a	n/a	n/a	n/a
606 - Fishermans Bend to St Kilda	593	n/a	n/a	n/a	n/a	n/a	n/a
FB-B1 Elsternwick to Fishermans Bend	n/a	1,554	1,574	1,476	1,606	1,407	1,344
FB-B2 Garden City to Queen Vic Market	n/a	2,276	2,343	2,134	2,351	2,226	2,218
FB-B3 Domain to Fishermans Bend	n/a	1,811	2,037	1,494	1,892	1,410	1,568
FB-B4 Gardenvale to Albert Park	n/a	773	768	755	774	747	748
FB-B5 Southern Cross Station to Fishermans Bend	n/a	n/a	2,110	n/a	n/a	n/a	n/a
FB-B6 Southern Cross Station to Newport	n/a	1,800	1,785	n/a	1,786	n/a	n/a
FB-B6 Southern Cross Station to Fishermans Bend	n/a	n/a	n/a	638	n/a	695	1,117
FB-B7 Garden City to Queen Vic Market	n/a	2,145	2,171	1,952	2,134	1,911	1,887
Total	***7,477***	***10,358***	***12,786***	***8,450***	***10,543***	***8,396***	***8,882***

Bus boardings by bus route and time period servicing the study area – Daily (total)

DAILY (Both directions)	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
232 - Altona North to Queen Victoria Market	9,635	n/a	n/a	n/a	n/a	n/a	n/a
234 - Garden City to Queen Victoria Market	13,938	n/a	n/a	n/a	n/a	n/a	n/a
235 - Fishermans Bend to City	10,964	n/a	n/a	n/a	n/a	n/a	n/a
236 - Garden City to Queen Victoria Market	2,381	n/a	n/a	n/a	n/a	n/a	n/a
237 - Fishermans Bend to City	6,102	n/a	n/a	n/a	n/a	n/a	n/a
606 - Fishermans Bend to St Kilda	3,709	n/a	n/a	n/a	n/a	n/a	n/a
FB-B1 Elsternwick to Fishermans Bend	n/a	7,204	7,483	6,527	7,452	6,432	6,129
FB-B2 Garden City to Queen Vic Market	n/a	11,210	11,402	10,649	11,455	10,926	10,776
FB-B3 Domain to Fishermans Bend	n/a	8,897	12,153	7,175	9,365	7,329	8,000
FB-B4 Gardenvale to Albert Park	n/a	2,795	2,819	2,711	2,822	2,716	2,721
FB-B5 Southern Cross Station to Fishermans Bend	n/a	n/a	11,597	n/a	n/a	n/a	n/a
FB-B6 Southern Cross Station to Newport	n/a	9,889	9,934	n/a	9,696	n/a	n/a
FB-B6 Southern Cross Station to Fishermans Bend	n/a	n/a	n/a	3,482	n/a	4,171	6,499
FB-B7 Garden City to Queen Vic Market	n/a	10,651	10,976	10,108	10,820	9,845	9,949
Total	***46,729***	***50,646***	***66,363***	***40,652***	***51,611***	***41,418***	***44,074***

Appendix J

FULL BUS CAPACITY RESULTS

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Maximum bus load versus capacity on bus routes servicing the study area – AM peak (load greater than load standard in bold) – Base Case

MAXIMUM LOAD/CAPACITY – DIRECTION 1	BASE CASE
232 - Altona North to Queen Victoria Market	1.86
234 - Garden City to Queen Victoria Market	1.54
235 - Fishermans Bend to City	1.69
236 - Garden City to Queen Victoria Market	1.50
237 - Fishermans Bend to City	1.50
606 - Fishermans Bend to St Kilda	0.92
MAXIMUM LOAD/CAPACITY – DIECTION 2	**BASE CASE**
232R - Queen Victoria Market to Altona North	1.56
234R - Queen Victoria Market to Garden City	1.62
235R - City to Fishermans Bend	1.65
236R - Queen Victoria Market to Garden City	1.26
237R - City to Fishermans Bend	1.41
606R - St Kilda to Fishermans Bend	1.22

Maximum bus load versus capacity on bus routes servicing the study area – AM peak (load greater than load standard in bold) – Project Cases

MAXIMUM LOAD/CAPACITY – DIRECTION 1	BASE CASE	PROJECT CASE 1	PROJECT CASE 2	PROJECT CASE 3	PROJECT CASE 4	PROJECT CASE 6	PROJECT CASE 7
FB-B1 Elsternwick to Fishermans Bend	n/a	0.69	0.73	0.67	0.73	0.55	0.49
FB-B2 Garden City to Queen Vic Market	n/a	**1.63**	**1.73**	**1.64**	**1.78**	**1.77**	**1.80**
FB-B3 Domain to Fishermans Bend	n/a	**1.31**	**1.11**	**1.12**	**1.40**	0.91	**1.04**
FB-B4 Gardenvale to Albert Park	n/a	0.29	0.29	0.27	0.30	0.26	0.27
FB-B5 Southern Cross Station to Fishermans Bend	n/a	-	**2.06**	-	-	-	-
FB-B6 Southern Cross Station to Newport	n/a	**1.16**	**1.14**	n/a	**1.19**	n/a	n/a
FB-B6 Southern Cross Station to Fishermans Bend	n/a	n/a	n/a	0.39	n/a	0.28	0.36
FB-B7 Garden City to Queen Vic Market	n/a	**1.51**	**1.51**	**1.50**	**1.52**	**1.50**	**1.50**
MAXIMUM LOAD/CAPACITY – DIECTION 2	**BASE CASE**	**PROJECT CASE 1**	**PROJECT CASE 2**	**PROJECT CASE 3**	**PROJECT CASE 4**	**PROJECT CASE 6**	**PROJECT CASE 7**
FB-B1R Fishermans Bend to Elsternwick	n/a	0.47	0.47	0.44	0.47	0.43	0.43
FB-B2R Queen Vic Market to Garden City	n/a	0.98	0.99	0.72	0.98	0.74	0.77
FB-B3R Fishermans Bend to Domain	n/a	**1.12**	**1.35**	0.80	**1.18**	0.83	0.98
FB-B4R Albert Park to Gardenvale	n/a	0.20	0.20	0.20	0.20	0.19	0.19
FB-B5R Fishermans Bend to Southern Cross Station	n/a	-	**1.31**	-	-	-	-
FB-B6R Newport to Southern Cross Station	n/a	**1.30**	**1.33**	n/a	**1.30**	n/a	n/a
FB-B6R Fishermans Bend to Southern Cross Station	n/a	n/a	n/a	0.30	n/a	0.42	0.87
FB-B7R Queen Vic to Market Garden City	n/a	**1.10**	**1.12**	0.62	**1.06**	0.60	0.77

Appendix K

DETAILED PUBLIC TRANSPORT LOAD AND VC PLOTS

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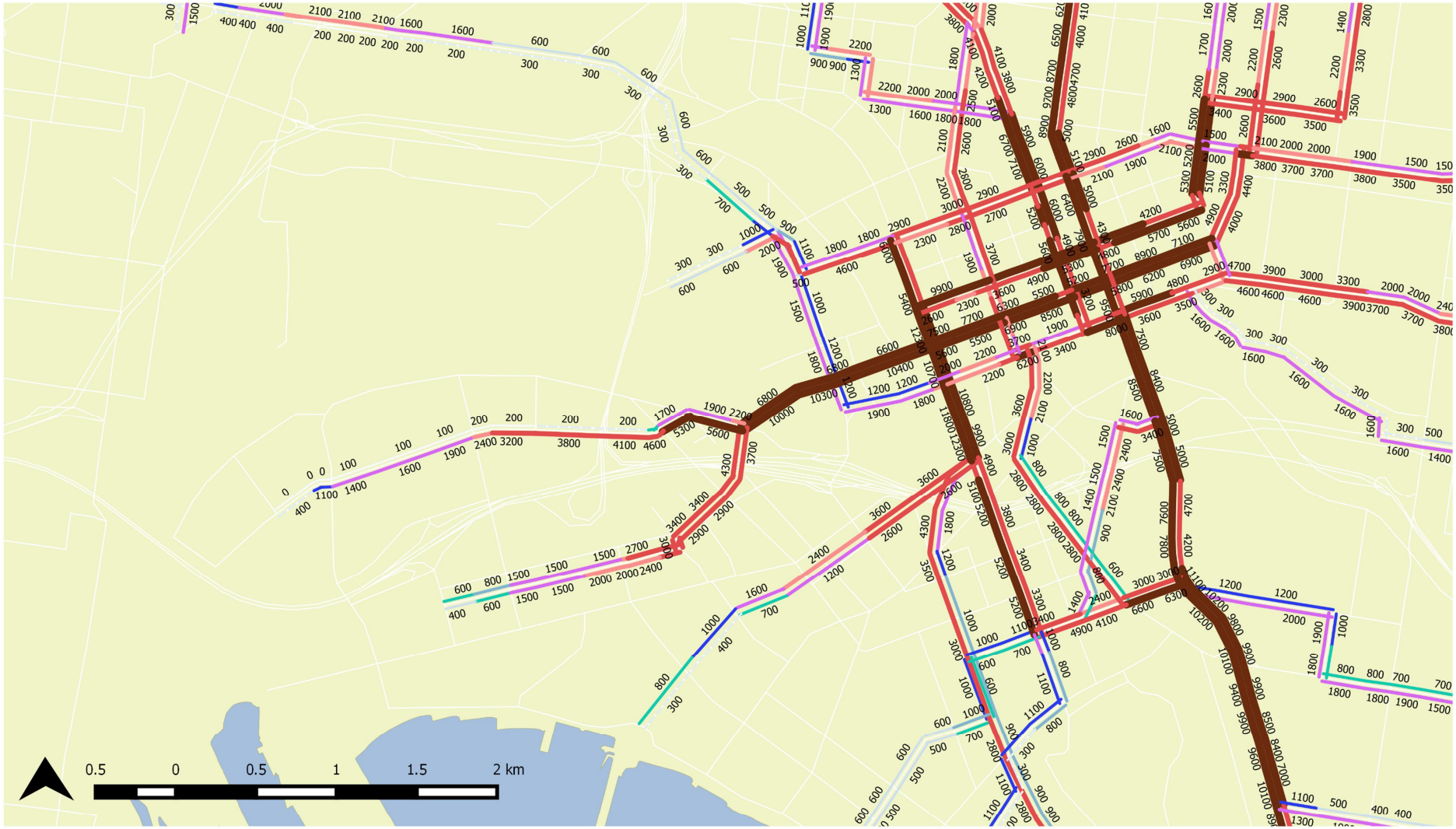
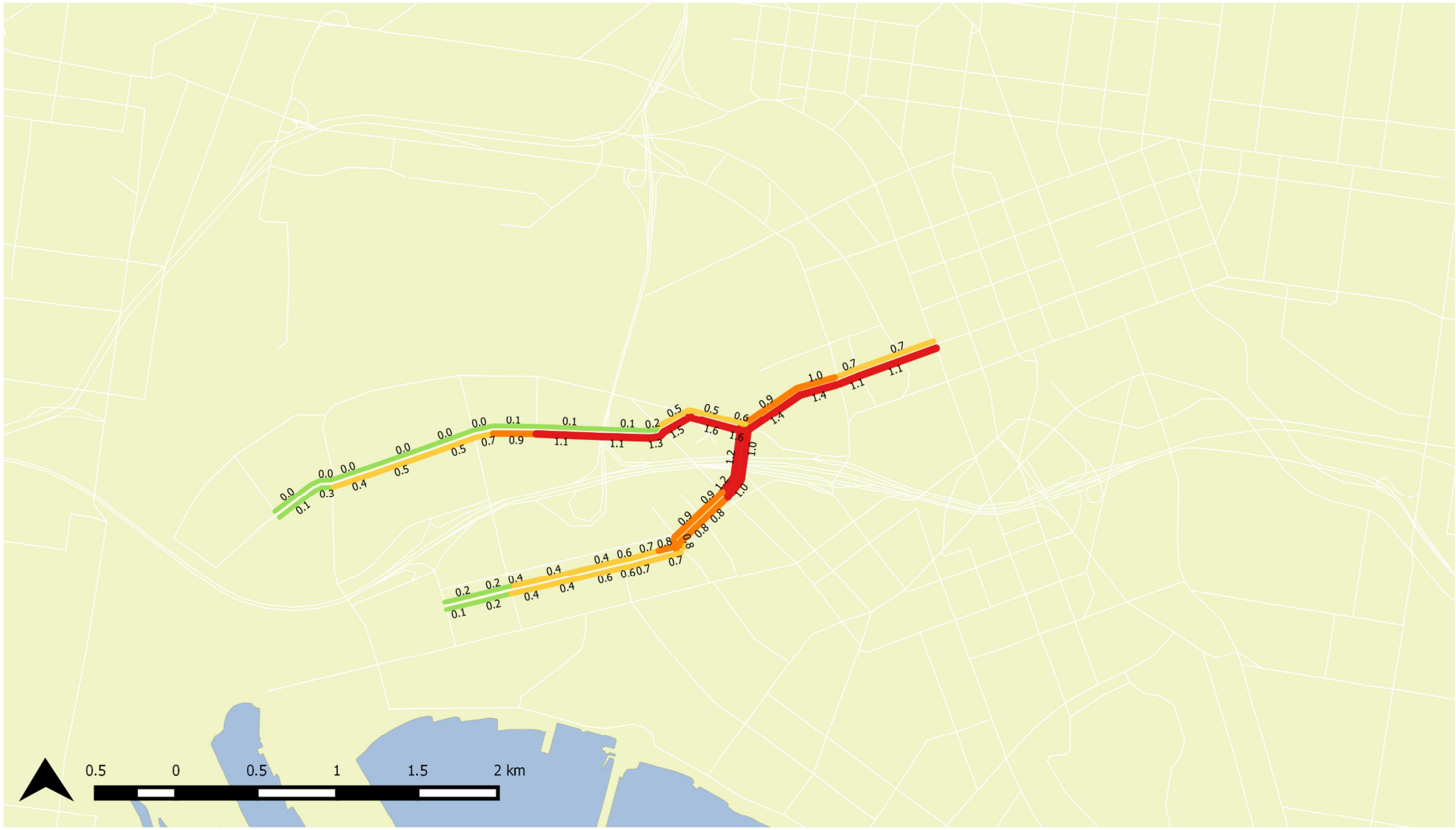


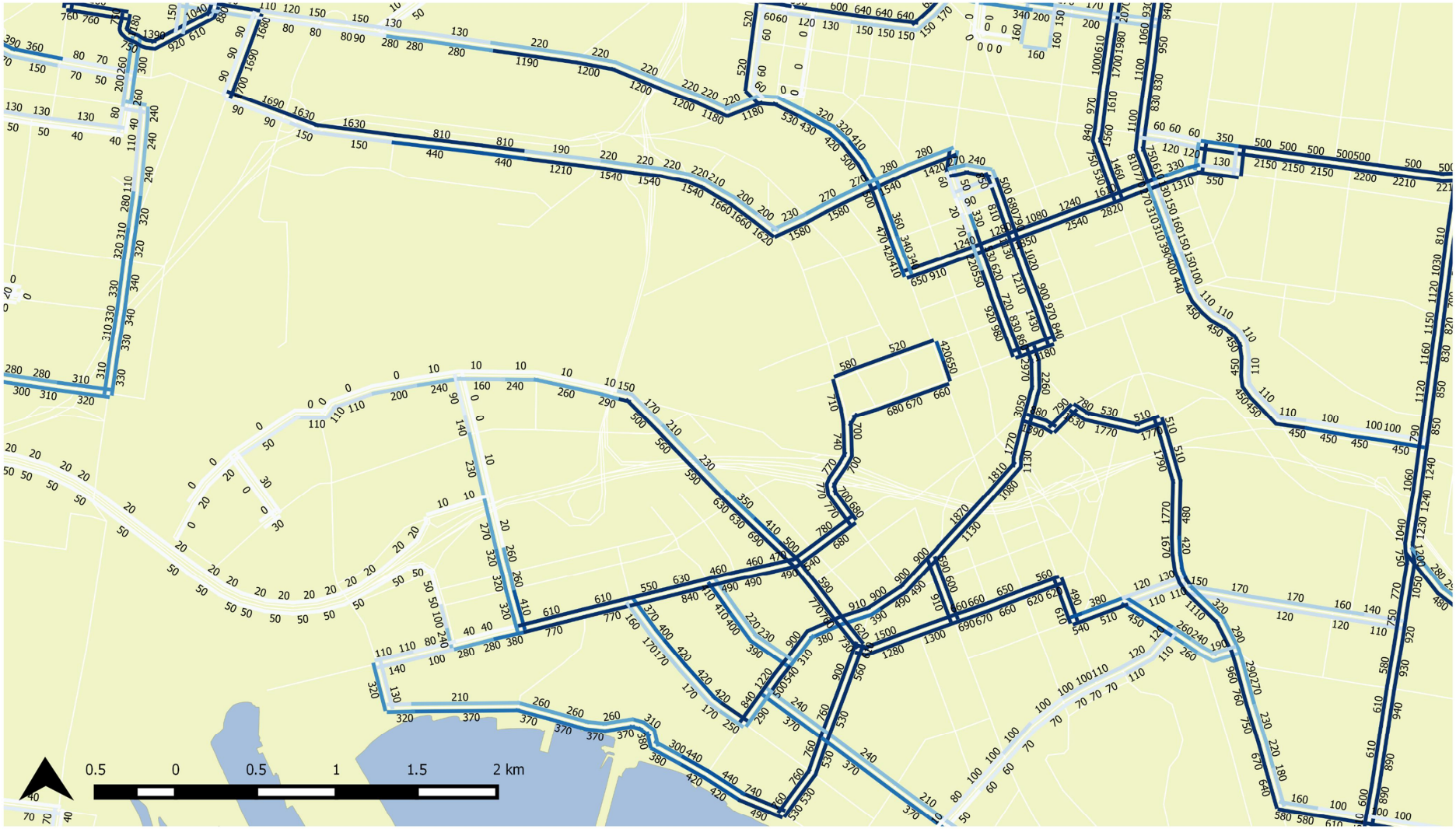
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



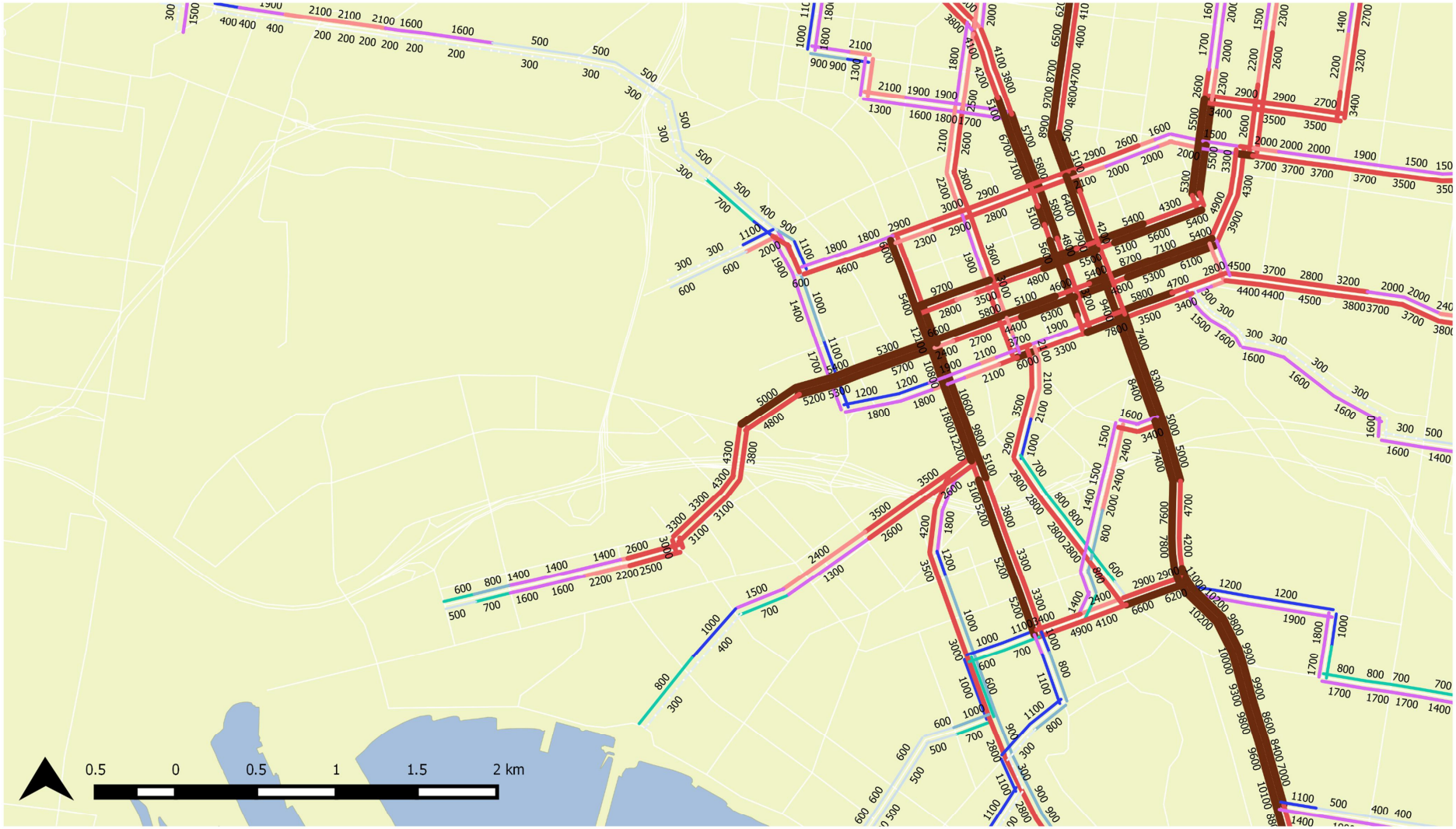
Project Case 1 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



Project Case 1 - AM peak bus volume

SOURCE: Victorian Integrated Transport Model (VITM)

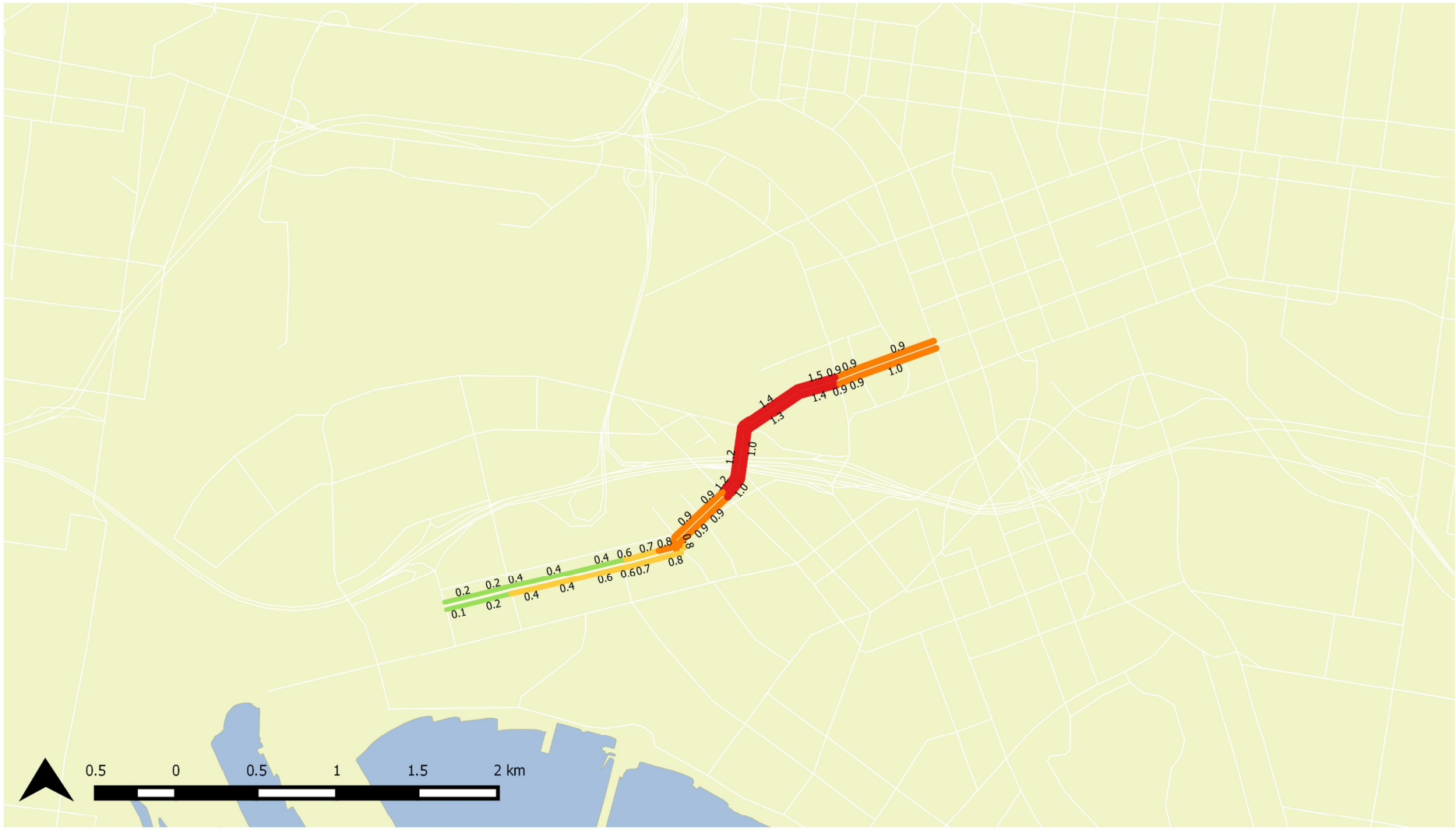


Project Case 2 - AM peak tram load

- 0 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- 1000 - 1200
- 1200 - 2000
- 2000 - 2500
- 2500 - 5000
- >5000
- Coastal Boundary
- Proposed road network
- Land

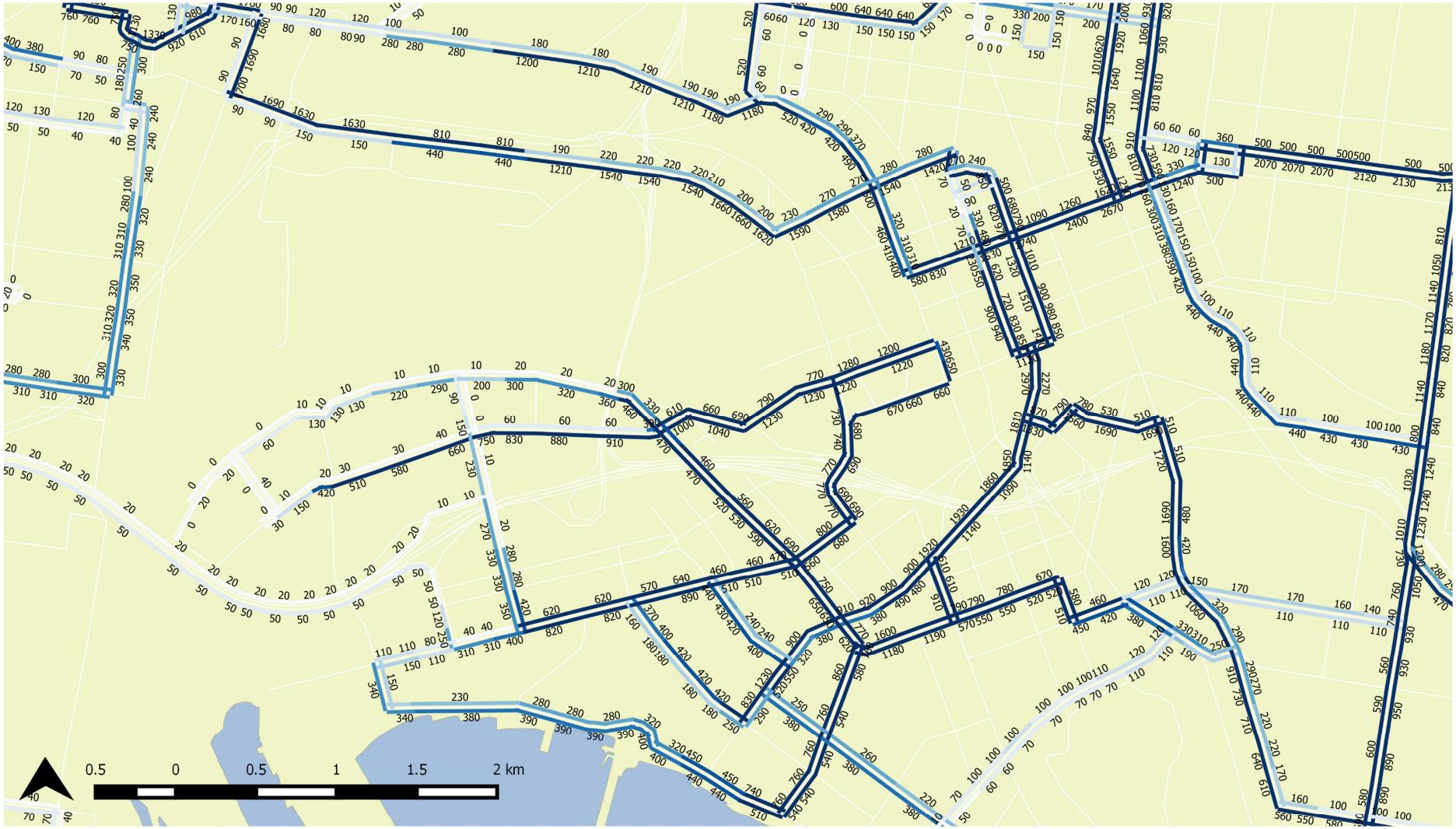
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



Project Case 2 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



Project Case 2 - AM peak bus load

- 0-50
- 50-100
- 100-150
- 150-200
- 200-250
- 250-300
- 300-350
- 350-400
- 400-450
- >450
- Coastal Boundary
- Proposed road network
- Land

Project Case 2 - AM peak bus volume

SOURCE: Victorian Integrated Transport Model (VITM)

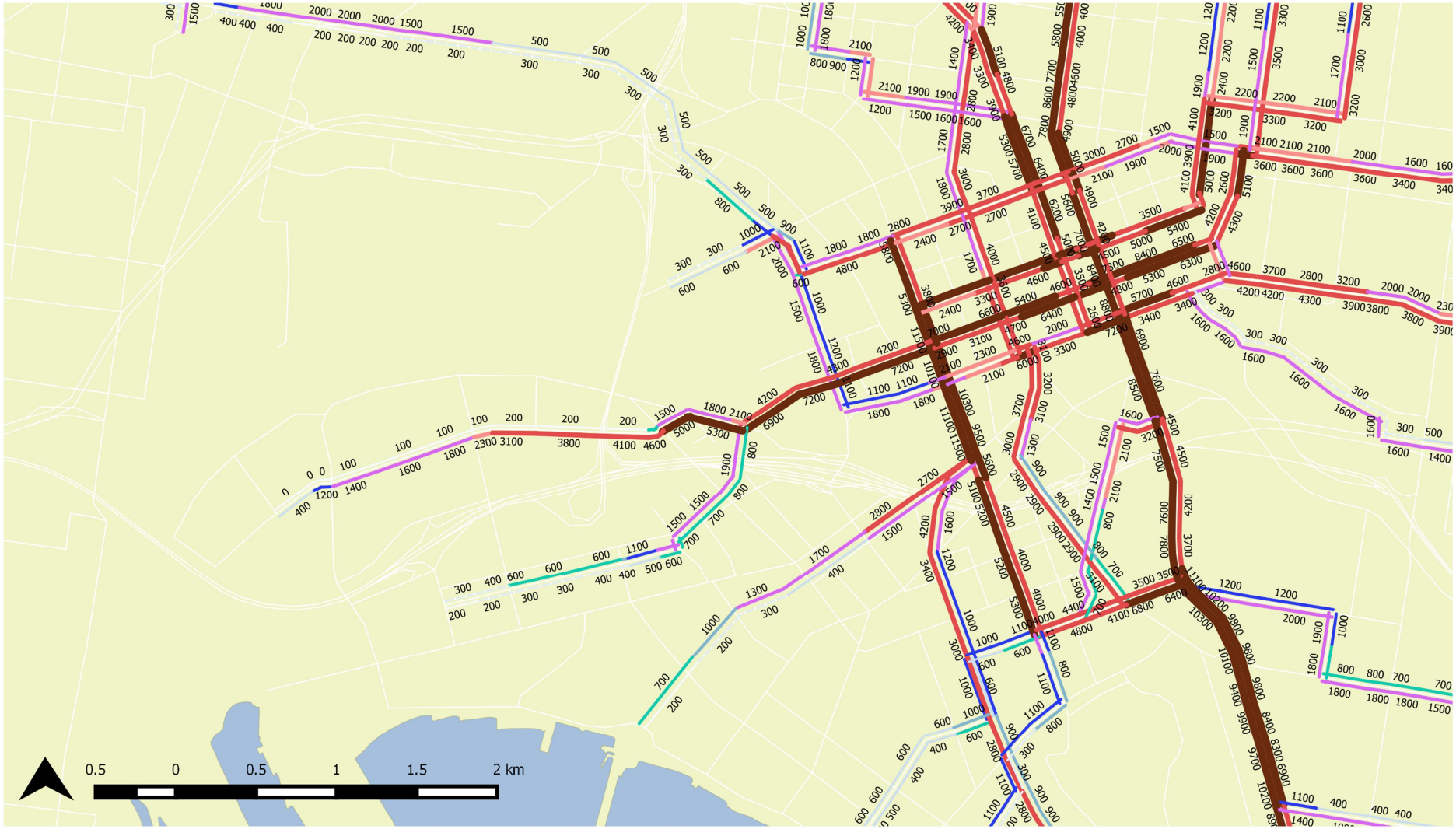
Project Case 2 - AM peak Smartbus V/C

- <0.4
- 0.4-0.8
- 0.8-1.0
- >1.0

Coastal Boundary
Proposed road network
Land

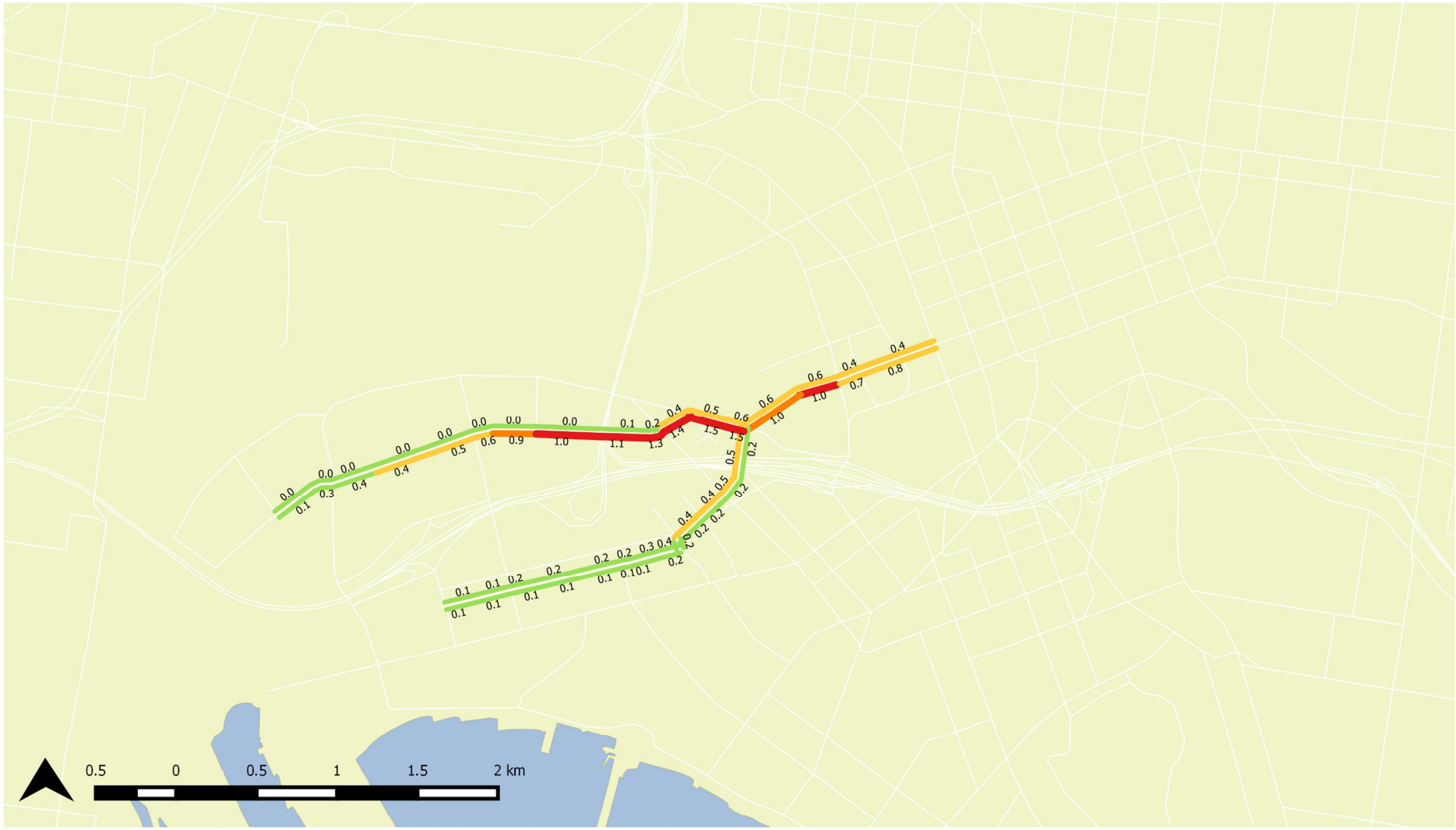
AM peak bus V/C

SOURCE: Victorian Integrated Transport Model (VITM)



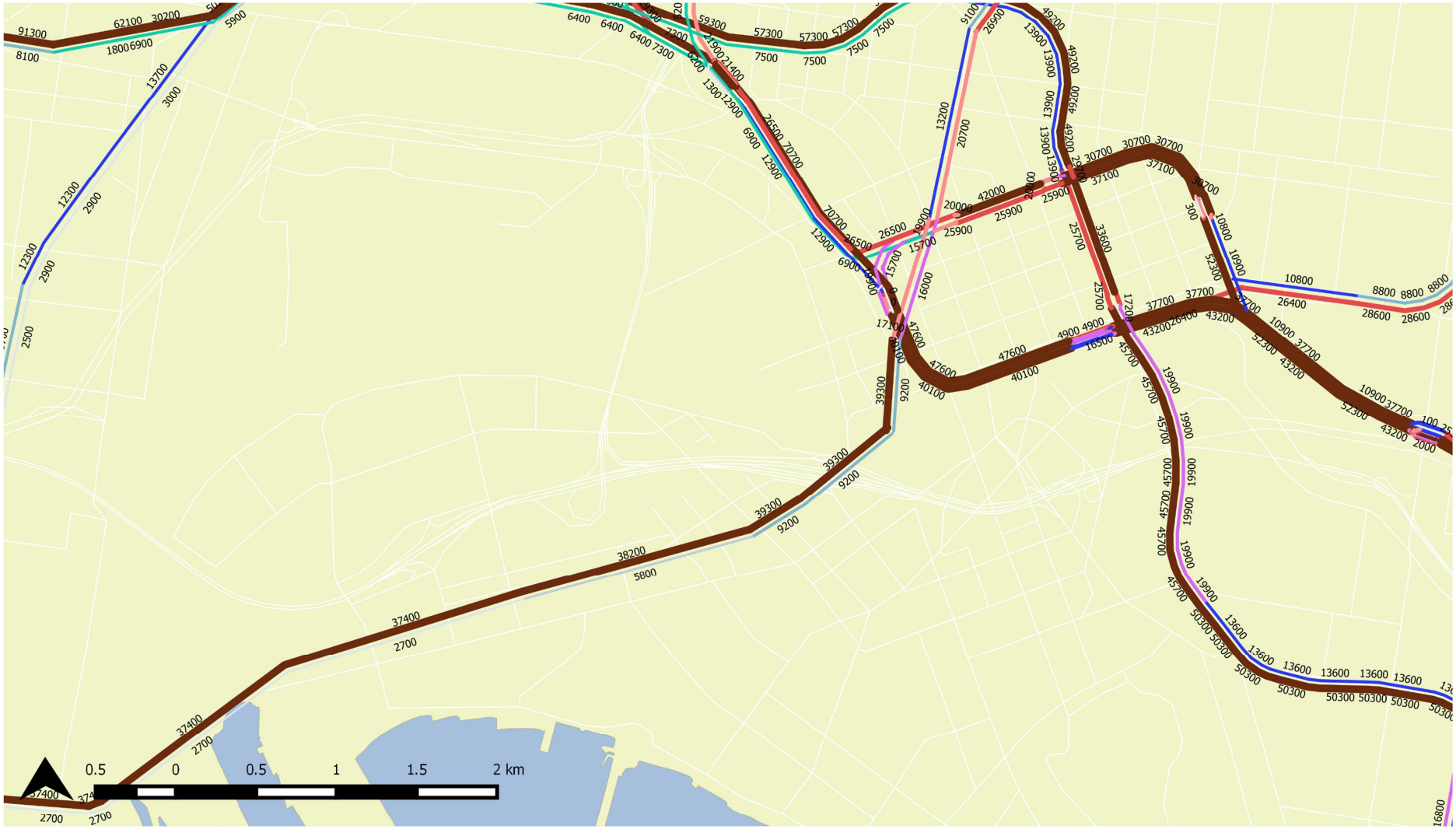
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



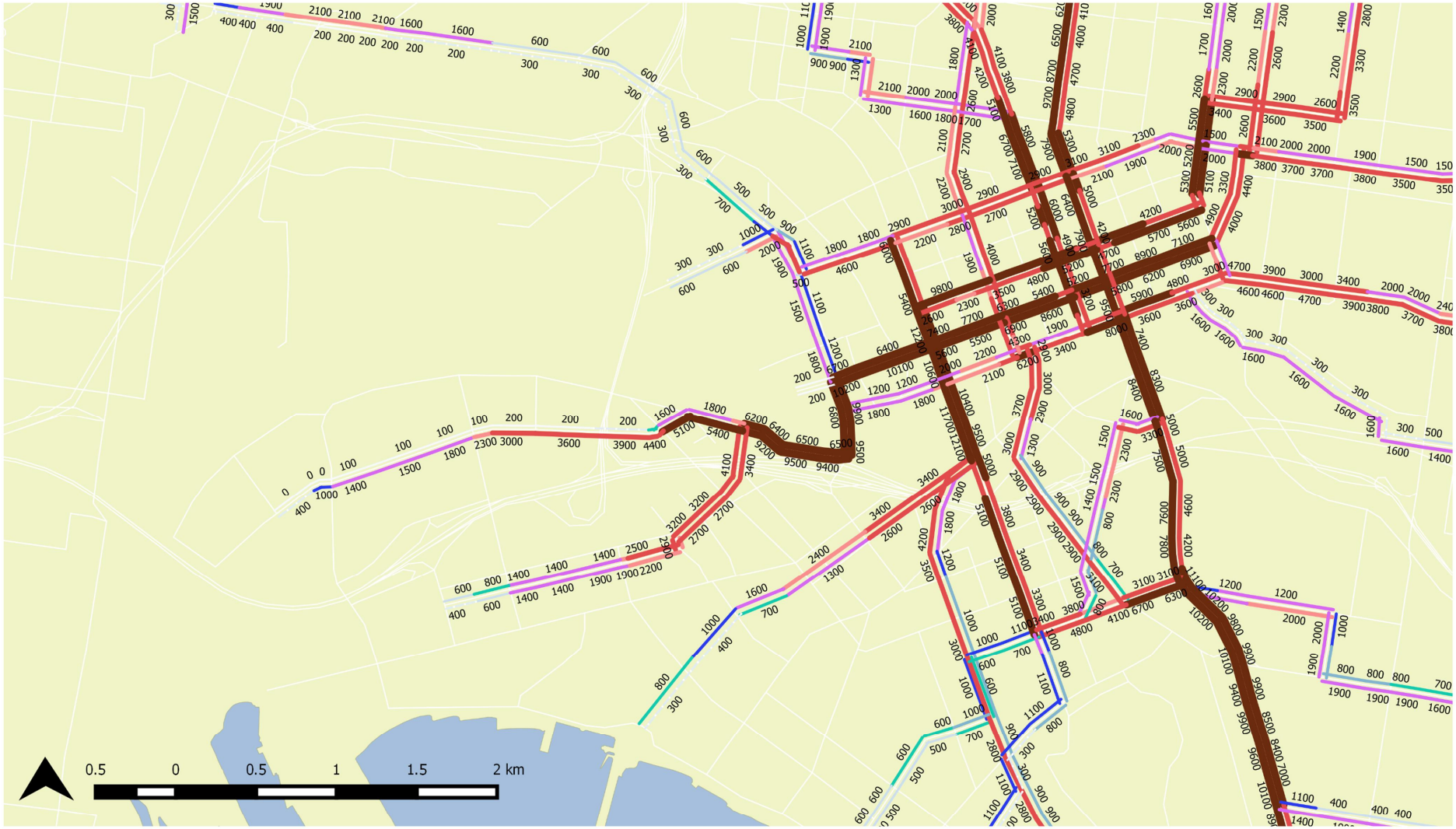
Project Case 3 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



AM peak train volume

SOURCE: Victorian Integrated Transport Model (VITM)

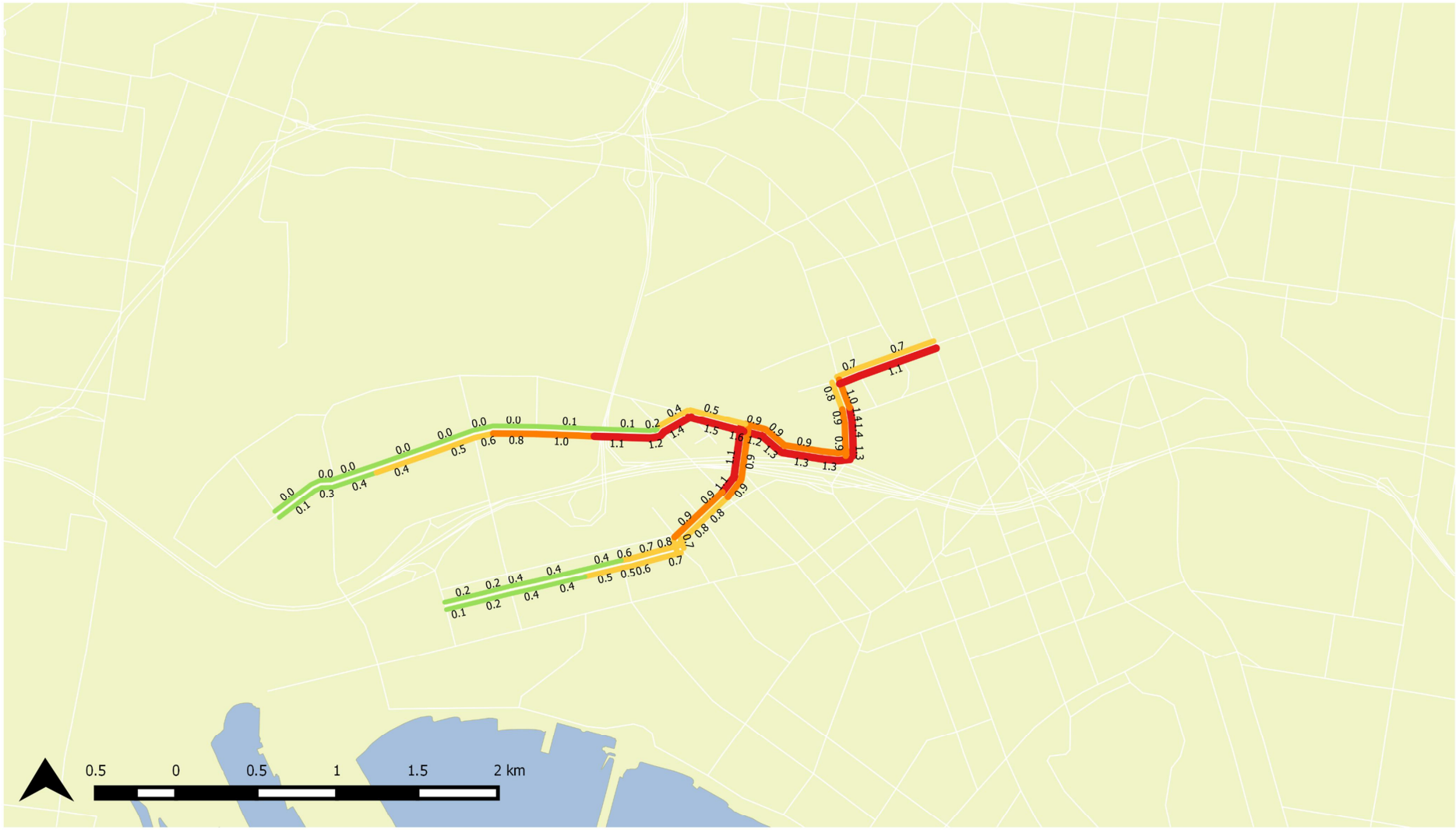


Project Case 4 - AM peak tram load

- 0 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- 1000 - 1200
- 1200 - 2000
- 2000 - 2500
- 2500 - 5000
- >5000
- Coastal Boundary
- Proposed road network
- Land

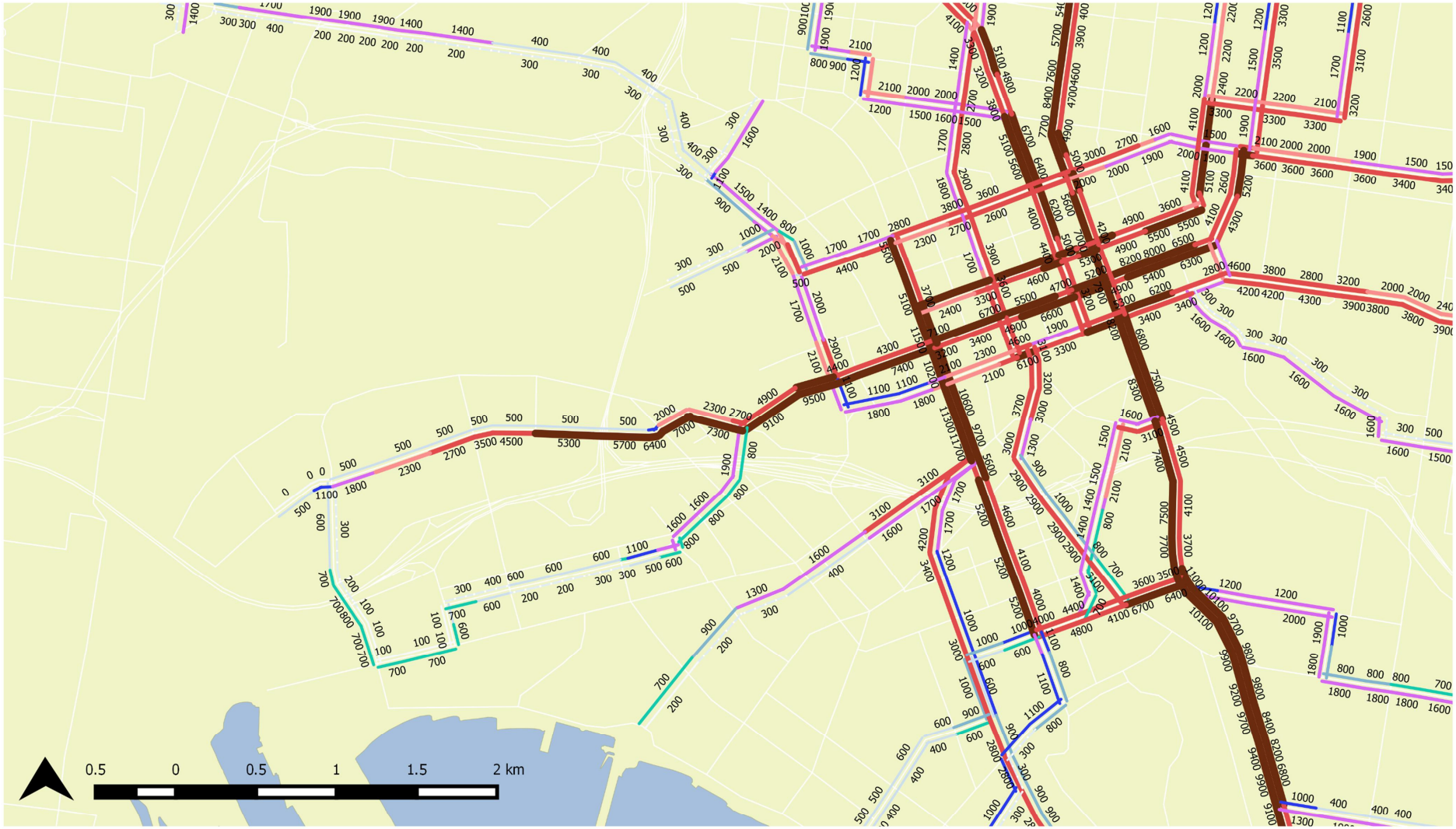
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



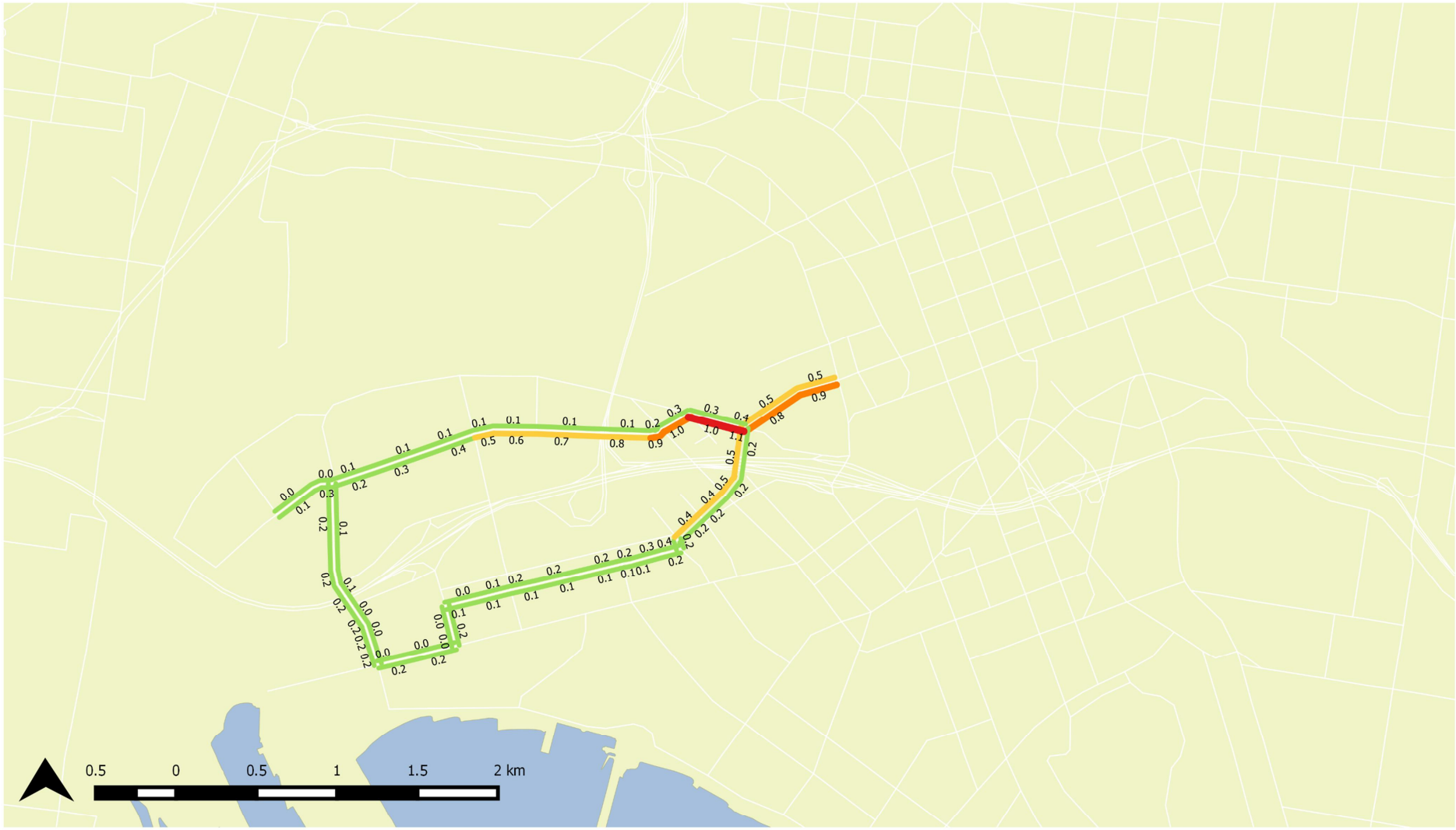
Project Case 4 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



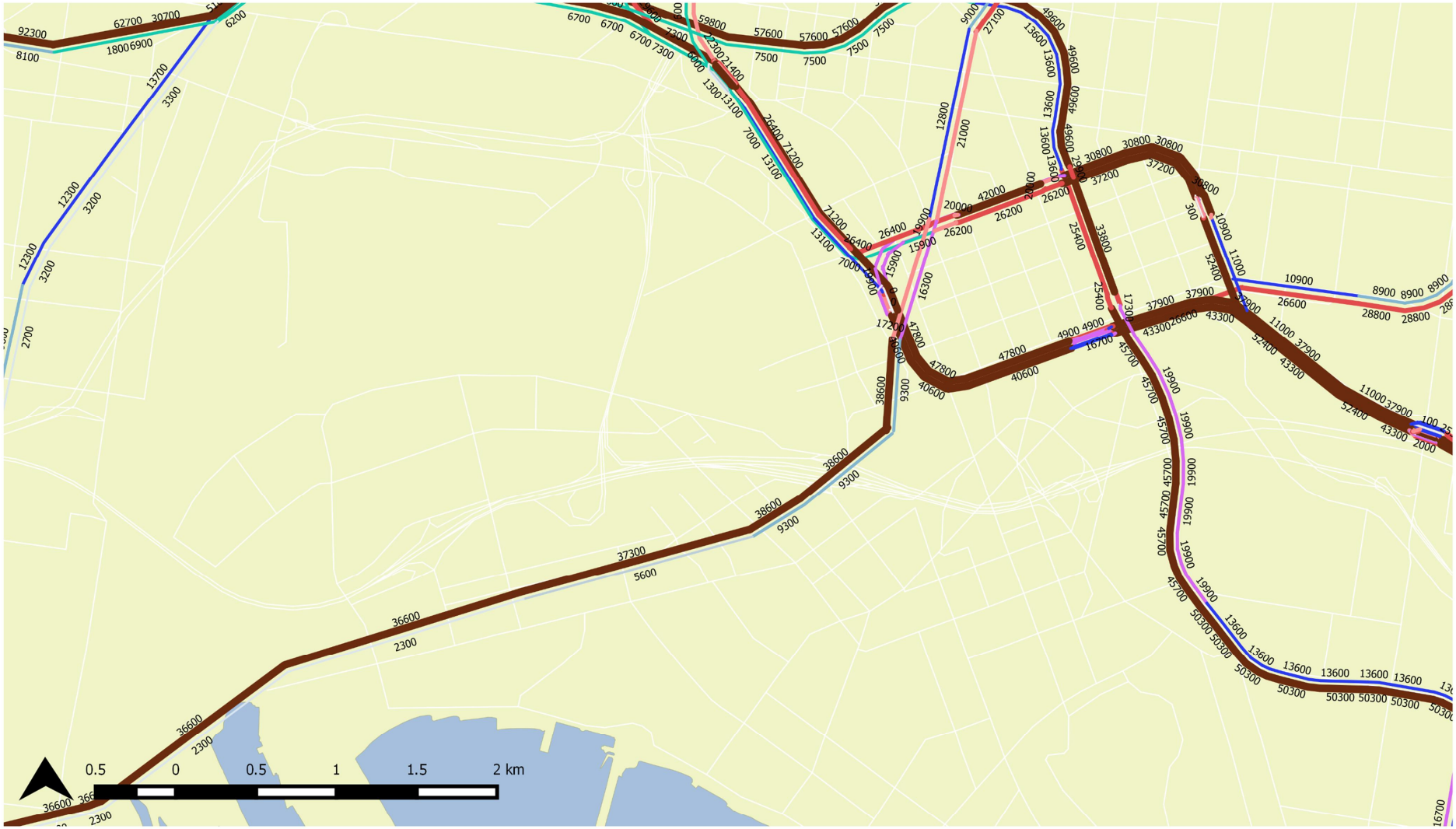
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



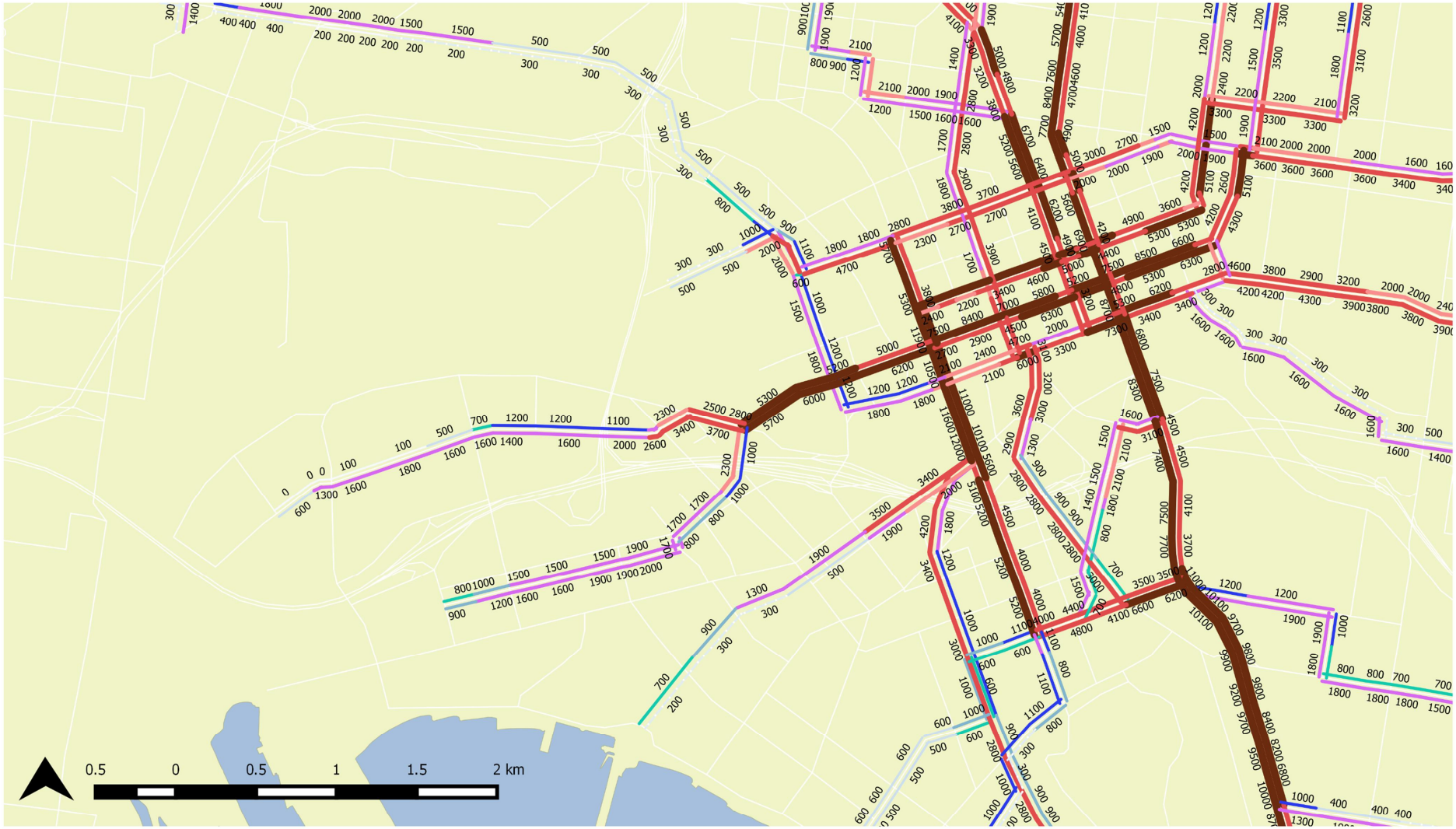
Project Case 6 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



AM peak train volume

SOURCE: Victorian Integrated Transport Model (VITM)

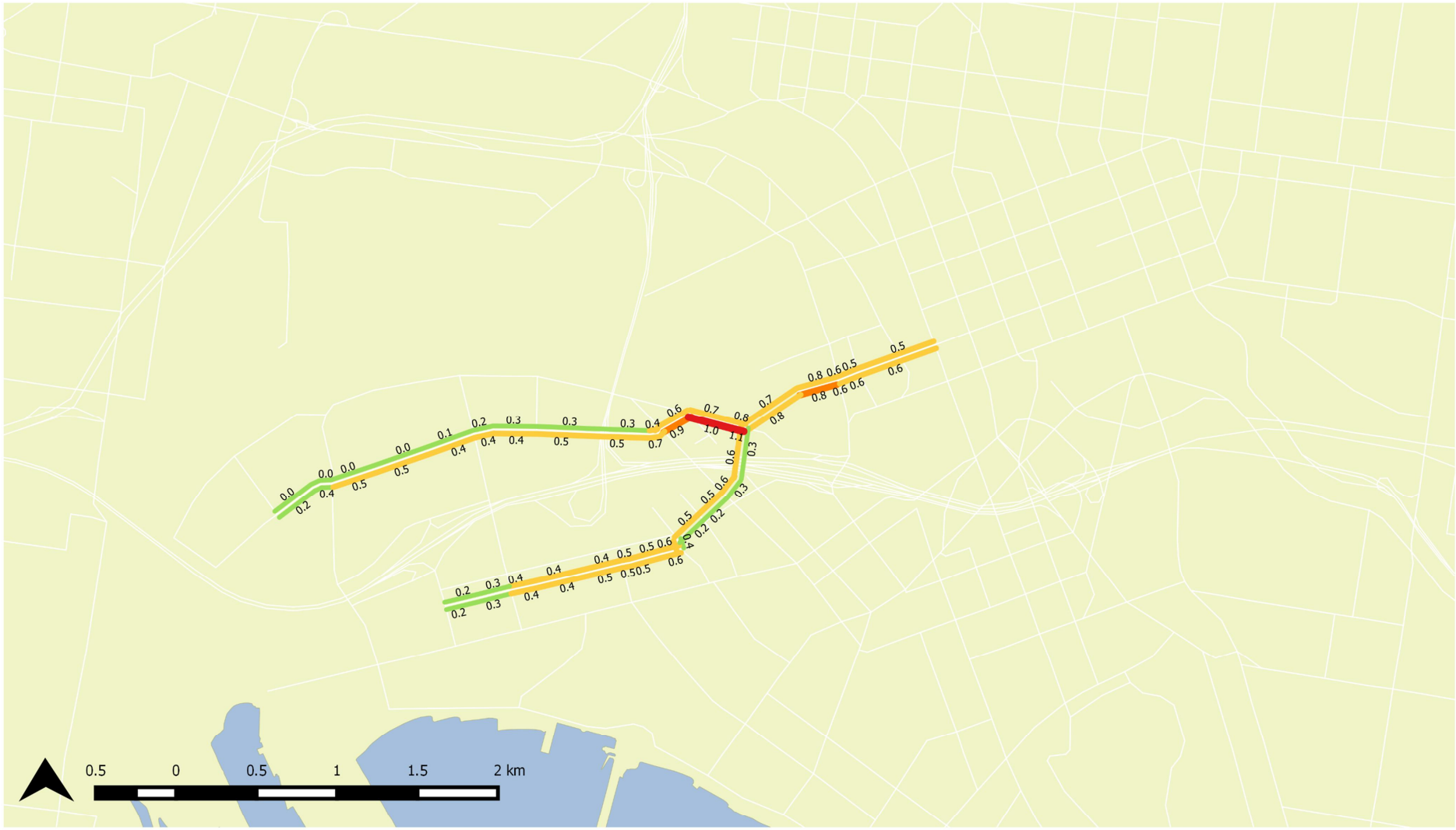


Project Case 7 - AM peak tram load

- 0 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- 1000 - 1200
- 1200 - 2000
- 2000 - 2500
- 2500 - 5000
- >5000
- Coastal Boundary
- Proposed road network
- Land

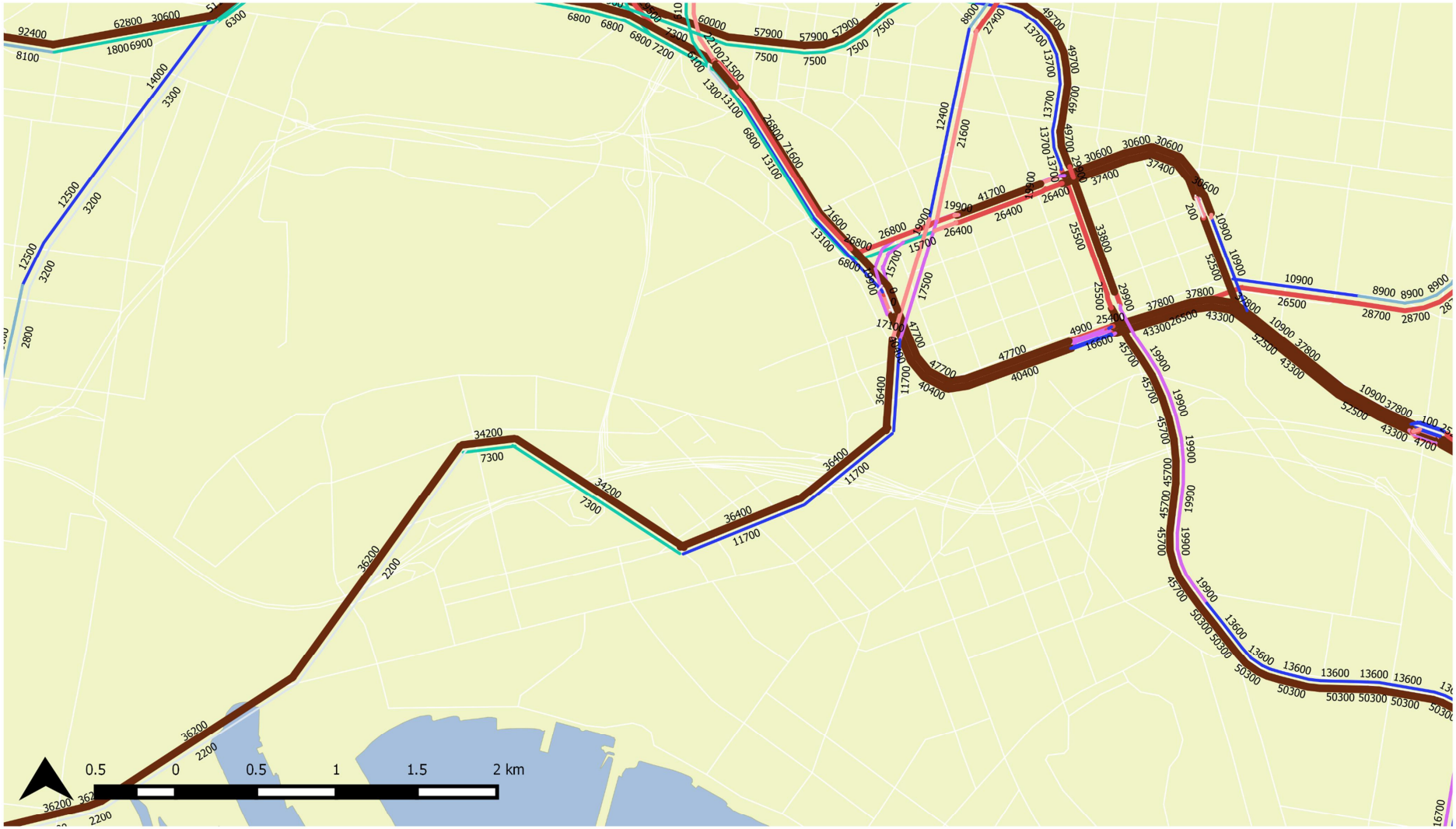
AM peak tram volume

SOURCE: Victorian Integrated Transport Model (VITM)



Project Case 7 - AM peak tram V/C

SOURCE: Victorian Integrated Transport Model (VITM)



AM peak train volume

SOURCE: Victorian Integrated Transport Model (VITM)