The Melbourne Metro Rail Project

Feasibility Analysis & Performance Assessment

Integrated Design Infrastructure

CVEN90057

Presented by

Group TR2

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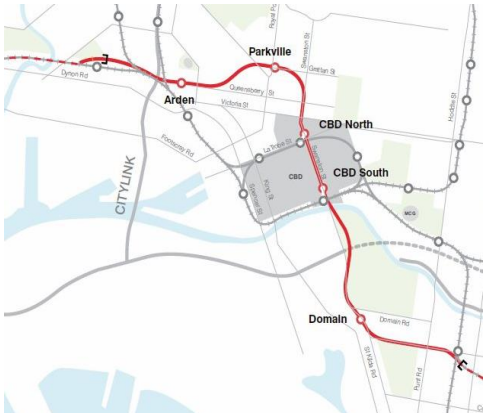
Executive summary

The MMRP proposes a cross-city underground train line, reminiscent of the Metro systems of London or Paris. The project would join the city's north-west corridor with its south east, and, in the most recent plans, consists of five stations: Arden, Parkville, CBD North, CBD South and Domain.



Path of proposed MMRP:
http://economicdevelopment .vic.gov.au/news -and-media-releases/work-begins-on-the-melbourne-metro-rail-project

In depth analysis of key literature surrounding the Melbourne Metro Rail Project (MMRP) and synthesis of this has allowed for the establishment of feasibility assessment framework to be developed in the following report.

The key issues identified led to the establishment five core categories of assessment; Economic, Environmental, Engineering, Social and Integration. Breaking these categories and establishing the significance of them to core stakeholder groups, as well as performing parried comparison techniques allows for the creation of a high fidelity assessment framework. From this, the current proposed station locations will be assessed, giving base line scores to which alternate proposals can be gauged.

Whilst all team members contributed to all aspects of the project, specific responsibilities are listed below.

Team Member	Major contributions to final report	
Megan Jennings	2.	Literature Review
	2.2.	Land Use
	2.3.	Transport infrastructure
	2.4.	Environmental Concerns
	3.2.5.	Transport Organisations
	4.1.5.	Integration
	4.2.	Relevant Key Issues
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1.1 The Melbourne Metro Rail Project

With Melbourne's population set to grow to almost 8 million by 2061 (Australian Bureau of Statistics, 2013). The Melbourne Metro Rail Project (MMRP) has been designed to ease pressure on heaving public transport infrastructure (PTI) and meet the growing demand on public transport (PT) caused by the predicted population, and following employment growth.

The following report provides an in depth analysis of the literature surrounding the MMRP as well as a broad range of effected stakeholders and their concerns. This analysis forms the basis of a feasibility analysis framework, to be used to assess and compare the MMRP's proposed station locations.

1.2 Report Objectives

The following report presents the process undertaken to establish a feasibility assessment matrix for the MMRP. This has been done by the following process:

1) Review of literature surrounding 'land use', 'transport infrastructure policy' and 'environmental concerns' in regards to the MMRP and the project areas (Section 2).
2) Establish extensive list of stakeholders affected by the MMRP and break down their individual 'needs', 'requirements' and 'wants' (Section 3).
3) Synthesise relevant and important stakeholder issues with findings from literature to establish a list of key project issues (Section 4).
4) Translate this list into measureable evaluation factors and performance metrics (Section 0).

By establishing this framework the suitability of station locations in question is assessed in Section 0.

1.3 Methodology

The steps taken to develop the final feasibility framework are as follows:

1) Perform literature review establishing key concerns and stakeholders regarding the MMRP in regards to; Land use, Transport Infrastructure and Environmental Considerations.
2) Establish a list of key stakeholders and develop a deep understanding of their needs, requirements and wants regarding the MMRP.
3) Using these outputs to establish a list of *key issues* and categorise them.
4) Prioritise these key issues, within their respective categories
5) Translate and develop key issues into a range of evaluation factors with associated measurement metrics.
6) Develop a universal scoring method for station location performance across all evaluation factors.

Finally Section 0 uses this assessment framework to undertake an evaluation of the MMRP's proposed station locations, forming a 'base case' score that can be used to gauge the performance of the current proposal against any future proposals. Furthermore, this assessment provides an example of how the feasibility is to be used, and the facets of the project it can assess in isolation.

2. Literature Review

Section 2 provides an analysis of literature surrounding the three key areas of concern in construction of infrastructure in regards to the MMRP.

2.1 Introduction

The diverse range of literature surrounding the Melbourne Metro Rail Project has been analysed from three varying perspectives; land use, transport infrastructure policy and environmental considerations. A multitude of major findings pertaining to many different stakeholders were identified, the most significant of which are summarised below. The most important documents found are those which originate from official bodies and project owners such as the Victorian Government, Public Transport Victoria (PTV) and to a lesser extent the City of Melbourne.

2.2 Land Use

The land usage along the MMRP corridor has been discussed widely in relation to the need for continued growth in Melbourne. Melbourne is set to grow to between 7.6 and 9.8 million people by 2061(ABS, 2013). The need for upgrading facilities in the areas close to the city has been discussed by many (Government, 2014; Melbourne, 2012a, 2012b, 2012c, 2015a), and is a part of the Metropolitan Planning Authority's vision for Melbourne's future (MPA, 2015). The growth of the '20 minute city' and extension of the central city to the north and west of the current CBD is something which the City of Melbourne sees as a way forward (Melbourne, 2012a).

The City of Melbourne has published several plans for its vision of future Melbourne (Melbourne, 2012a, 2012b, 2012c, 2015a). In these plans there is much mention of creating a city in which walking, cycling and public transport are key modes of transport, and where the safety of these active travellers in paramount. This idea of safe and lively streets for people, rather than cars is one which is benefitted by the introduction of the MMRP, and the further developments planned as part of this project, particularly around the proposed Arden and Parkville Stations (Melbourne, 2012a, 2012b). The Arden Macaulay Structure Plan (Melbourne, 2012a) proposes the largest change to land use in the MMRP corridor. The extreme underutilisation of the area, and its proximity to the central city make it a prime location for further development. The creation of 14,000 jobs, 4000 residents and the ability to cater for 12,000 students (Melbourne, 2012a) is vital when considering the challenges that a growing Melbourne faces. The City North Structure Plan (Melbourne, 2012b) focuses on the area surrounding the University of Melbourne and the Royal Melbourne Hospital, both of which would be serviced by the proposed Parkville station. The further development of what is seen as the education, research and health precinct of Melbourne is something which could cement Melbourne's position as one of the best cities in the world (Smethurst & Bennett, 2014).

The CBD of Melbourne is a thriving centre, with residents, workers and tourists all enjoying what the city has to offer (Melbourne, 2015b). The crowded tram routes along Swanston St and St Kilda Rd are consistently overcrowded, and there is a clear need for better access to transport (PTV, 2014). The area around the current Domain Interchange is a hub of activity, with commercial and residential towers in close proximity to the major tram stop. When the Shrine of Remembrance and surrounding gardens are taken into account, this destination is a no-brainer when it comes to upgrading the current public transport infrastructure (Melbourne, 2015c).

2.3 Transport Infrastructure

The need for more and better transport infrastructure has been recognised by at least the current and previous State Governments (DTPLI, 2014; Government, 2014). While

the previous government favoured the East West link as the major investment in our roads (Government, 2014), the current government is in favour of the MMRP (MP, 2015), so much so that the 2014 State Election was labelled as a 'referendum on the East West Link' (Tomazin & Lillebuen, 2014). The funding for the MMRP is another highly political matter, with the State planning on funding to come from three sources: State Government, Federal Government and private investors, although the Federal Government and private investors have not been forthcoming (Keen, 2013).

In 2012, PTV published a Network Development Plan (NDP) (PTV, 2012) which lists the proposed upgrades to the Melbourne Train Network and a timeline for these works, for the next 20 years and beyond. The NDP lists projects which are to be completed in stages with the MMRP occurring in Stage 2, and further projects such as a train line to Melbourne Airport are reliant upon the successful completion of the MMRP. The NDP does not mention where funding for these projects will originate, and there are many who oppose this order of projects due to the lack of funding, and the possibility that the MMRP will prevent other projects from being funded, as the City Loop project did when it was first introduced (Mees, 2008).

The City of Melbourne's Transport Strategy (Melbourne, 2012c) focusses on the need to improve the amenity for pedestrians, cyclists and public transport users throughout the city. The strategy confirms that the City of Melbourne is supportive of both an underground train line connecting the west and south-east of the city, and the improvement of services for pedestrians, cyclists and public transport users.

The "Eddington Report" (Eddington, 2008), commissioned in 2006 and published in 2008, outlines the challenges that Melbourne faces with regards to transport in the next 30 years. The report notes that due to the shift from a manufacturing to service-based economy, the majority of trips for employment will be to the central city, and also recognises that the most efficient way of moving a large number of people to the same place is by public transport. It is also noted that there is no need for a "roads vs rail" approach to transport infrastructure, and indeed that the most efficient transport policy would be to create these projects simultaneously, with both an underground train tunnel, and a cross-city road corridor, which could ease the burden on the Westgate Freeway. The report also specifies that these are only recommendations made for an east-west connection, and do not address issues surrounding other proposed projects, such as an Airport Link.

2.4 Environmental Concerns

The impact of the MMRP on biodiversity will mainly focus on the flora of the proposed corridor. Due to the proposed MMRP corridor running near both the Royal Botanic Gardens and the Queen Victoria Gardens (DTPLI, 2014), there is a need for the construction work to be completed in a way which will not negatively impact these areas. The other key issue regarding biodiversity is a positive one – the planting of more trees as part of the upgrade of the areas surrounding the stations, particularly around the Arden and Parkville stations (Melbourne, 2012a, 2012b).

The MMRP may also have an effect on the heritage sites of Melbourne. With the tunnel running along Swanston St and St Kilda Rd only set to be 10m deep (Lucas, 2015), there could be issues related to the sub-structure of buildings. Extensive geotechnical investigations are being undertaken to ensure there is no risk to any of these important structures. The Shrine of Remembrance is also very close to the proposed Domain Station, and as such there care will need to be taken when the construction is underway. The history of the city ensures that there will be many underground services, and care will also need to be taken not to interrupt the supply of these services (such as water, electricity, telecom, gas and sewerage systems). The

construction of the tunnel could be seen as a chance to upgrade some of these services, however there is not currently any detail surrounding this possibility.

The possible flooding of the MMRP is a considerable risk. The tunnel will travel underneath the Moonee Ponds Creek and the Yarra River (DTPLI, 2014), and will have underground stations close to these areas. The area where the proposed Arden Station will be situated in particular is prone to inundation when the Moonee Ponds Creek breaks its banks (Melbourne, 2012a). The groundwater situation will also be of importance when considering the construction methods for the MMRP. Already, one alignment has been rejected due to the presence of an underground river beneath Elizabeth St (Lucas, 2015).

The sustainability of the MMRP is of high concern to important stakeholders. Sustainability can be economic, environmental or social, and when all three are combined they form part of the assessment of the project. Economically and socially, Dr Paul Mees (2008) makes some important points from a perspective which opposes the project. It is important for these views to be considered when deciding whether to proceed with the project. Environmentally, there are many aspects which can be taken into account, both during the construction and usage phases of the MMRP. During construction there is the danger of excessive noise, dust and vibration causing problems for neighbours and the surrounding environment (EPA, 1996). However it is hoped that the project will reduce the number of cars on the road and therefore the greenhouse and other emissions which are inherent in the use of private vehicles for transportation (EPA, 2013). It must be noted that these positive effects are dependent upon the uptake of the new service provided. Therefore it is important for the MMRP owners to undertake further research and modelling in order to decide upon the best route alignment and station locations.

3. Stakeholder Analysis & Concern breakdown

Section 4 establishes a substantial list of stakeholders affected by the MMRP and breaks down their key concerns and general objectives.

3.1 Introduction

Based upon a thorough analysis and understanding of the literature, the stakeholders relevant to the MMRP are listed and individually analysed to determine their *needs*, *requirements* and *wants*. By separating the stakeholders and assessing them in this way, a base for defining the key issues and their importance is established. The information provided in 0, provides an in-depth analysis of a broad range of specific entities pertaining to key stakeholder groups.

3.2 Summaries

Section 0 provides summaries of the findings from analysis of each stakeholder group and shifts the focus of these objectives onto the MMRP. A detailed list of individual stakeholders and their objectives is presented in Appendices

Detailed Stakeholder List & Breakdown.

3.2.1 Governance

Government stakeholders involved in the project are broken down by level of governance – Federal, State and Local. As a result their needs, requirements and wants are of varying scope and specificity.

The federal objectives listed in table 4 are generally higher level and relate to the general themes of the project (i.e. land use, PT and environmental concerns), while the objectives of the state and local governments, in particular the City of Melbourne, are much more specific and provide clear direction for station the areas in question as well as general performance metrics for the MMRP.

At the federal levels, main objectives include:

- Enhanced integration of infrastructure strategy and operation
- Further cooperative investment between state government, federal government and the private sector
- Utilising sustainable PTI design to account for growing population and major cities

At lower levels of governance, objectives focused more directly on:

- Integrating PTI offerings
- Developing Arden Macaulay as a PT hub (AM Central)
- Joining NW and SE
- Increasing accessibility to the CBD

The objectives of more specific departments of the State Government are also broken down in table 4.

3.2.2 Business councils

The stakeholders listed in table 4 provide just a sample of the broad range of business councils and government advisors representing specific industries. Councils consist of an executive body and a membership base from which their objectives and values are drawn. These councils lobby the state and federal governments, seeking the best policy decisions for their members.

Council objectives are generally very specific to the group, however, there is generally a push for:

- Improved infrastructure at both the national (freight) and state level – remove capacity bottlenecks in infrastructure systems.
- Improved CBD accessibility for pedestrians and cyclists.
- Eased traffic congestion.
- Collaboration and cooperation between the private sector and the government.
- Nationally consistent regulation.

3.2.3 Utility companies

Electricity, gas, water and telecommunications companies are responsible for Melbourne's infrastructure and not only require their existing assets to remain undamaged, but are eager for opportunities to upgrade.

Damage during construction causing disruption to essential services could shut parts of the city down. It is therefore a necessity that the construction phase of the project cause as little disruption as possible.

3.2.4 Regulatory Authorities

Regulatory authorities oversee the implementation of, and successful cooperation with, regulations and policies for projects in Victoria. The regulatory authorities come from a wide range of specialist fields, and cover many different aspects of the planning and construction of any new infrastructure. The most influential authority is the Environmental Protection Authority (EPA) because of the major environmental

considerations of the project. The EPA calls for the regulation of the construction site and the surroundings of the project including:

- Waste management and disposal
- Pollution
- Hazards generated by the development of the project

The other authorities have similar responsibilities, however these are more specifically related to their respective fields of interest.

3.2.5 Transport Organisations

The stakeholders listed under the Transport Organisations include the owners and operators of Victoria's PT. These stakeholders have varying levels of involvement in the MMRP, during construction and operation. The most important of these stakeholders are:

- VicTrack, the government's rail agency who own all train and tram rails within Victoria
- Public Transport Victoria (PTV), who are responsible for the day to day operations of the Victorian PT network
- Metro Trains, who operate the metropolitan train system on behalf of PTV

These organizations require the project to be completed with high quality, to ensure ease of operation and maintenance. On the other hand, the other main concern of the transport organisations is the ability to deliver a service and remain profitable throughout the construction of the project. As such, it is important that closures and potential interruptions to current PTI be planned effectively or avoided.

3.2.6 Unions

Workers unions are responsible for protecting the rights of their members while undertaking tasks related to their work. Some of the considerations unions must account for are:

- Occupational Health and Safety of the workers
- Wellbeing
- Fair compensation for work done

In this project the unions considered are the Australian Council of Trade Unions (ACTU), Australian Rail, Tram & Bus unions, Electrical Trades and CFMEU. The work of the unions are similar, as most of them are affiliated with the ACTU, meaning there are similar policies and processes in place to look after the interests of their members.

3.2.7 Users

The users in this instance represent not only the everyday users of PT, but also the occasional user, tourists, pedestrians, motorists and cyclists – in short any commuters within the Melbourne transport network. The key issues of the users are as follows:

- Convenient access to transport
- Less congestion on PT and roads, particularly with a growing population
- A PT network which is reliable and efficient
- Minimal disruptions to any means of transport during construction of the project

The users are one stakeholder group which have possibly the least amount of power, but a potentially very high interest in the project. They need to be kept informed of any

plans which may affect them and in order for the project to be deemed successful, how this project will impact their lives for the better.

3.2.8 Emergency services

The emergency services considered include Fire, Police and Ambulance services. These services are provided for the safety and wellbeing of all citizens, and the construction phase cannot limit the ability of emergency services including ambulances to access in and around the city. This is especially important in the Parkville hospital precinct.

3.2.9 Hospital precinct

The hospital precinct includes The Royal Melbourne Hospital, The Victorian Comprehensive Cancer Centre, The Royal Women's Hospital, the Royal Children's hospital and surrounding health clinics and services. Fast and reliable public transport would be of great benefit to the hospitals and the precinct as a whole for patients and staff.

The construction phase of the project considering the current station location and route alignment would cause problems relating to the following issues:

- Accessibility problems
- Noise
- Dust
- Emergency vehicle access
- Safety of patients entering the area from construction activities including construction vehicle traffic

It is likely that temporary buildings would be constructed to overcome the above obstacles.

3.2.10 Businesses affected (Public properties)

Some of the businesses affected by the project include retail, entertainment, dining and nightlife found in places like Melbourne Central and Emporium and along Swanston Street and other areas along the alignment. The sports precinct around the MCG will also be affected by the project.

The station location and route alignment should enhance the city and its businesses and services. Indeed, it is in the interest of business and service providers that travel for PT users into and around the city is reliable and efficient.

Major issues include:

- Accessibility problems
- Noise
- Dust
- Obstruction of business to the public view.

It is also important to consider businesses where shop fronts and offices will not be affected, however the ability of the business to make money will be. This includes transport organisations such as Yarra Trams and Metro Trains, but also TransUrban, the owner of the CityLink and EastLink toll roads. This particular stakeholder might sustain damage to its assets (namely the CityLink bridges and tunnels around the proposed construction sites), but may also be affected by the potential change to user behavior (in the form of toll revenue).

4. Key Issues

Section 4 translates key stakeholder concerns into key issues for the entire MMRP. Key issues are also categorised and ranked in section 4.

4.1 Introduction

There are a multitude of key issues related to the MMRP that have been identified through the stakeholder analysis. These issues along with their relevance and importance to stakeholders are presented in table 1. A brief summary of Table 1 with key issues being grouped according to relevance is outlined below. The grouped key issues will be referred to as “Evaluation Factors” from this point onwards.

4.1.1 Economic

Delivering a high benefit to cost ratio, increased productivity to the Melbourne CBD and surrounding suburbs, delivering economic boost to businesses in the CBD, and minimising productivity losses in the CBD due to construction work.

4.1.2 Environmental

Fundamentally, one of the most important factors of the project is the reduction in greenhouse gas emissions, from reduced reliance on vehicles. Also important is the protection of, and the opportunity to improve, biodiversity along the project’s corridor.

4.1.3 Social

Improving access to services, employment and entertainment in Melbourne through less congested roads and a faster, more convenient and less crowded public transport network.

4.1.4 Engineering

Primarily the project must be delivered on time, to budget and to the required quality. The safety of the public and construction personnel must also be ensured. Reducing the impact of construction on the city function as a whole is a key issue during the construction phase.

4.1.5 Integration

The integration of the project, both as a whole, and as individual aspects, with its surrounds, be they natural or man-made. The project should not negatively impact any part of society in the long term.

4.2 Relevant Key Issues

This document provides an assessment of a proposed station location along a pre-determined route. Therefore, all of the key issues identified may not be relevant to performing the assessment. These issues are identified as “non-differentiators”. The key issues that affect station location are “differentiators” and have been transformed into criteria against which the proposal will be assessed.

Furthermore, differing key issues have varying significance to stakeholders. As such key issues have differing importance to the project based on the power of specific stakeholders. Table 1 below highlights this by presenting a weighted — by stakeholder power — significance score for each key issue to each stakeholder.

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Table 1- Key issues & Stakeholder significance

Categories	Stakeholder Groups		*Federal Government*	*State Government*	*Local Government*	*Business Councils*	*Utilities Companies*	*Regulatory Authorities*	*Transport Organisation*	*Unions*	*Users*	*Emergency Services*	*Hospital(s) Precinct*	*Effected Businesses*	
	Discussed in Section		***3.2.1***			***3.2.2***	***3.2.3***	***3.2.4***	***3.2.5***	***3.2.6***	***3.2.7***	***3.2.8***	***3.2.9***	***3.2.10***	**Percentage Score****
	Power Weighting*		0.114	0.182	0.091	0.068	0.068	0.103	0.114	0.073	0.063	0.038	0.03	0.056	
	Key Issue	**Differentiator**													
Economic	Increased access to employment in the station area	Yes	0.23	0.64	0.46	0.24	0.07	0.21	0.34	0.22	0.32	0.04	0.09	0.22	0.22
	Reduced home-work travel times	Yes	0.17	0.73	0.32	0.07	0.07	0.21	0.46	0.22	0.32	0.11	0.12	0.22	
	Increased productivity in the station area	Yes	0.23	0.64	0.38	0.24	0.20	0.10	0.11	0.15	0.13	0.04	0.03	0.28	
	Coordinated funding (Across Public and Private entities)	Yes	0.46	0.46	0.09	0.14	0.07	0.10	0.23	0.07	0.06	0.04	0.03	0.06	
	Highest cost-benefit ratio possible	Yes	0.57	0.91	0.18	0.07	0.07	0.10	0.46	0.07	0.06	0.04	0.03	0.06	
	Increase usage rates of PTI	Yes	0.34	0.91	0.36	0.07	0.20	0.21	0.57	0.15	0.06	0.11	0.09	0.17	
	Stimulus to economy (during construction)	Yes	0.57	0.91	0.36	0.27	0.20	0.21	0.11	0.07	0.06	0.04	0.03	0.22	
	Minimal disruption to all services during construction	Yes	0.11	0.64	0.46	0.17	0.34	0.21	0.57	0.07	0.32	0.15	0.15	0.28	
Environmental	Reduction In carbon emissions	Yes	0.34	0.55	0.27	0.14	0.07	0.36	0.34	0.15	0.06	0.04	0.09	0.11	0.18
	Groundwater contamination	Yes	0.11	0.36	0.36	0.07	0.20	0.41	0.11	0.26	0.06	0.11	0.06	0.11	
	Waste management (construction)	Yes	0.11	0.18	0.27	0.07	0.07	0.36	0.23	0.29	0.06	0.04	0.03	0.06	
	Effect on eco-systems along tunnel alignment (e.g. trees)	Yes	0.11	0.55	0.36	0.07	0.07	0.41	0.11	0.15	0.06	0.08	0.09	0.17	
	Protect the parks and biodiversity along the corridor	Yes	0.11	0.55	0.36	0.07	0.07	0.41	0.11	0.07	0.13	0.04	0.09	0.17	
	Tranquillity of parks	Yes	0.11	0.55	0.36	0.07	0.07	0.36	0.11	0.07	0.19	0.04	0.06	0.06	
	Immediate Air quality	Yes	0.23	0.55	0.36	0.07	0.07	0.31	0.23	0.15	0.25	0.04	0.12	0.11	
	Embodied energy usage of construction method	No	0.11	0.36	0.09	0.07	0.07	0.10	0.23	0.07	0.06	0.04	0.03	0.06	
	Townscape	Yes	0.11	0.55	0.46	0.07	0.07	0.10	0.23	0.07	0.25	0.04	0.03	0.22	
	Environmental focus of structural design	No	0.11	0.64	0.36	0.07	0.07	0.36	0.23	0.15	0.13	0.04	0.03	0.06	
Social	Reduced cars on the road -- less congestion	Yes	0.11	0.73	0.36	0.07	0.07	0.21	0.46	0.15	0.32	0.19	0.09	0.17	0.20
	Minimal disruptions to PTI	Yes	0.11	0.73	0.46	0.07	0.07	0.41	0.57	0.07	0.32	0.15	0.09	0.22	
	Minimal disruptions to roads and paths	Yes	0.11	0.64	0.36	0.07	0.07	0.21	0.34	0.07	0.32	0.19	0.15	0.22	
	Minimal disruption to Yarra river operations	Yes	0.11	0.46	0.36	0.17	0.07	0.10	0.23	0.07	0.19	0.11	0.03	0.06	
	Eliminate the risk of damage to the Heritage sites	Yes	0.11	0.73	0.36	0.17	0.07	0.46	0.11	0.07	0.13	0.04	0.03	0.06	
	Control noise pollution affecting residents and businesses in the surroundings of the construction site.	Yes	0.11	0.36	0.36	0.14	0.07	0.36	0.23	0.22	0.32	0.08	0.15	0.28	
	Reduce traffic congestion on arterial roads	No?	0.11	0.91	0.36	0.14	0.07	0.31	0.34	0.15	0.32	0.19	0.09	0.22	
	Urban renewal (Res. and Comm. in AM)	Yes	0.11	0.91	0.46	0.14	0.27	0.31	0.11	0.15	0.25	0.04	0.03	0.17	
	Disruption to events during construction	Yes	0.11	0.64	0.36	0.07	0.14	0.10	0.23	0.15	0.25	0.11	0.03	0.22	
	Establish Parkville as an internationally recognised Health precinct	Yes	0.29	0.73	0.32	0.14	0.14	0.10	0.11	0.07	0.13	0.04	0.15	0.06	

	Aesthetic of city during construction	Yes	0.23	0.73	0.46	0.14	0.07	0.10	0.11	0.07	0.19	0.04	0.03	0.17	
	Further improve Parkville's standing as an Education precinct	Yes	0.29	0.73	0.32	0.14	0.07	0.10	0.11	0.07	0.13	0.04	0.03	0.22	
	Increase Social Equity	No	0.34	0.73	0.36	0.14	0.07	0.31	0.11	0.07	0.25	0.08	0.09	0.06	
	Prioritise cyclists and pedestrians	Yes	0.17	0.73	0.46	0.07	0.07	0.31	0.23	0.07	0.25	0.11	0.06	0.06	
	Localise intensive activity to activity centres	Yes	0.11	0.36	0.36	0.07	0.14	0.10	0.23	0.07	0.25	0.08	0.03	0.17	
	Improve access to tourist attractions	Yes	0.23	0.91	0.32	0.14	0.20	0.10	0.34	0.07	0.25	0.04	0.03	0.17	
	Position Melbourne as a 'Global city'	No	0.34	0.91	0.36	0.20	0.14	0.10	0.23	0.07	0.19	0.04	0.03	0.22	
	Connecting people to parks	Yes	0.11	0.73	0.36	0.07	0.07	0.10	0.11	0.07	0.25	0.04	0.09	0.06	
	Better nightlife due to quick and easy public transport	Yes	0.11	0.46	0.36	0.14	0.14	0.10	0.23	0.07	0.32	0.04	0.15	0.28	
	Maintain service levels in line with growing pop.	No	0.46	0.91	0.46	0.20	0.27	0.41	0.46	0.07	0.32	0.04	0.09	0.17	
	Generate long-term pro-environmental behaviour change	No	0.34	0.82	0.36	0.20	0.07	0.41	0.34	0.07	0.13	0.04	0.03	0.06	
Engineering	Minimising disruptions for the public	Yes	0.23	0.73	0.46	0.20	0.34	0.41	0.46	0.07	0.32	0.19	0.12	0.28	
	Reduce risk of tunnel flooding	No	0.11	0.64	0.18	0.07	0.07	0.31	0.57	0.29	0.06	0.19	0.06	0.06	
	Geotechnical design and construction difficulties	Yes	0.11	0.55	0.18	0.07	0.14	0.31	0.23	0.15	0.06	0.04	0.03	0.06	
	Safety in Construction	No	0.11	0.91	0.27	0.20	0.07	0.52	0.23	0.37	0.06	0.15	0.09	0.06	
	Constructability	Yes	0.11	0.55	0.18	0.07	0.07	0.31	0.23	0.37	0.06	0.04	0.03	0.06	
	Construction logistics	Yes	0.11	0.55	0.18	0.07	0.07	0.31	0.11	0.37	0.06	0.11	0.03	0.06	0.19
	Planning	Yes	0.11	0.18	0.09	0.07	0.34	0.41	0.34	0.26	0.06	0.04	0.03	0.06	
	Damage to Third Party Property during construction	Yes	0.11	0.73	0.36	0.07	0.34	0.41	0.23	0.15	0.06	0.04	0.15	0.28	
	Cost	Yes	0.57	0.91	0.27	0.07	0.07	0.41	0.46	0.15	0.06	0.04	0.03	0.06	
	Minimising change orders and out of scope work	Yes	0.11	0.55	0.09	0.07	0.07	0.41	0.46	0.15	0.06	0.04	0.03	0.06	
	Environmental challenges in construction	Yes	0.11	0.55	0.27	0.07	0.07	0.41	0.23	0.22	0.06	0.04	0.03	0.06	
	Available skilled labour to build the design	Yes	0.11	0.18	0.09	0.07	0.07	0.31	0.23	0.37	0.06	0.04	0.03	0.06	
Integration	Allow for other projects	Yes	0.34	0.91	0.23	0.20	0.27	0.41	0.57	0.26	0.19	0.04	0.03	0.17	
	Integration with other train functions	Yes	0.23	0.91	0.23	0.14	0.07	0.41	0.57	0.26	0.32	0.11	0.09	0.17	
	Intermodal transport integration	Yes	0.23	0.91	0.46	0.07	0.07	0.41	0.57	0.22	0.32	0.11	0.09	0.17	
	User awareness of newer system/facilities	No	0.23	0.73	0.46	0.07	0.07	0.31	0.57	0.07	0.25	0.04	0.03	0.22	
	Establish Arden Central as PT hub/interchange for NW & Regional	Yes	0.11	0.91	0.36	0.14	0.07	0.10	0.57	0.07	0.32	0.04	0.03	0.17	
	Connecting NW to SE PTI	Yes	0.11	0.91	0.18	0.14	0.07	0.36	0.57	0.07	0.32	0.04	0.03	0.11	
	Reduce pressure on NS CBD tram routes	Yes	0.11	0.91	0.27	0.14	0.07	0.36	0.57	0.22	0.32	0.08	0.06	0.17	0.23
	Connect Southbank areas with River and the CBD	Yes	0.11	0.64	0.36	0.07	0.07	0.10	0.57	0.07	0.32	0.04	0.03	0.17	
	Connect the two 'halves' of Southbank	Yes	0.11	0.46	0.36	0.07	0.07	0.10	0.57	0.07	0.32	0.04	0.03	0.17	
	Enhance efficiency/usage of pre-existing infrastructure	Yes	0.34	0.91	0.46	0.20	0.27	0.41	0.57	0.15	0.19	0.04	0.03	0.06	
	Cycling integration	Yes	0.11	0.73	0.46	0.07	0.07	0.36	0.34	0.07	0.25	0.11	0.06	0.06	
	Emergency service access during construction	No	0.11	0.91	0.27	0.07	0.07	0.52	0.34	0.37	0.06	0.19	0.15	0.06	
	Develop and integrate roads	Yes	0.34	0.73	0.27	0.20	0.07	0.41	0.23	0.07	0.25	0.19	0.09	0.06	
	Establishment of the boundaries for land use	Yes	0.11	0.73	0.46	0.14	0.20	0.41	0.46	0.07	0.06	0.04	0.03	0.22	
Other* **	Usage	Yes	0.34	0.91	0.46	0.14	0.07	0.41	0.57	0.15	0.32	0.04	0.03	0.06	-

**** Power weighting:** This weight was calculated by mapping stakeholder power and converting it to a percentage score for each stakeholder.*

***** Percentage Score:** The aggregate score of significance for each key issue is averaged across each evaluation **category.** It is then transformed to relative percentage score for each evaluation category.*

****** 'Other' category:** Usage as a key issue was found to be an important factor in every category as it has a large effect on many different key issues.*

5. Assessment Criteria

Section 5 associates sections 4's key issues with objective quantitative and qualitative performance metrics that can be used to directly compare a proposal's station location options.

5.1 Introduction

The use of the 'paired comparison' technique, allows for the development of a hierarchy of key issues in each of the five evaluation categories. Taking this weighting forward into Section 6 provides a way to prioritise scoring within the category thereby improving the resolution of scoring. Furthermore, this weighting process allows for the elimination of identified differentiator key issues which are of little-to-no significance in the context of the MMRP.

5.2 Categorised Key Issues Weighting

Presented below is the weighted scores for the five core evaluation categories. These weightings were established using the paired comparison technique. The raw score calculation matrices can be found in appendix B.

Table 2 Categorised Key Issues Weighting

Designation	Economic key issue	Raw Score	Relative weighting
E-A	Increased access to employment in the station area	17	22.52
E-B	Reduced home-work travel times	12.5	16.56
E-C	Economic productivity increase in the station area	20	26.49
E-D	Coordinated funding	0	0.00
E-E	Highest cost-benefit ration possible	5.5	7.28
E-F	Increase usage rates of PTI	17	22.52
E-G	Stimulus to economy (during construction)	2.5	3.31
E-H	Minimal disruption to all services during construction	1	1.32
	Total	75.5	100
Designation	Social key issue	Raw Score	Weight
S-A	Reduced cars on the road -- less congestion	30.0	8.7
S-B	Minimal disruptions to PTI	13.0	3.8
S-C	Minimal disruptions to roads and paths	2.5	0.7
S-D	Minimal disruption to Yarra river operations	2.5	0.7
S-E	Eliminate the risk of damage to the Heritage sites	30.0	8.7
S-F	Control noise pollution affecting residents and businesses in the surroundings of the construction site.	15.0	4.4
S-G	Maintain service levels in line with growing population	30.0	8.7
S-H	Urban renewal (Res. and Comm. in AM)	16.0	4.7
S-I	Disruption to events during construction	2.5	0.7
S-J	Establish Parkville as an internationally recognised Health precinct	27.0	7.8
S-K	Aesthetic of city during construction	7.0	2.0
S-L	Further improve Parkville's standing as an Education precinct	30.0	8.7
S-M	Increase Social Equity	16.0	4.7
S-N	Prioritise cyclists and pedestrians	16.0	4.7
S-O	Localise intensive activity to activity centres	53.0	15.4

S-P	Improve access to tourist attractions	16.0	4.7
S-Q	Position Melbourne as a 'Global city'	2.5	0.7
S-R	Connecting people to parks	2.5	0.7
S-S	Better nightlife due to quick and easy public transport	2.5	0.7
S-T	Generate long-term pro-environmental behaviour change	30.0	8.7
	Total	344.0	100
Designation	Environmental key issue	Raw Score	Weight
ENV-A	Potential damage to surrounding eco-system health & biodiversity including parks	2.0	16.0
ENV-B	Opportunity to increase ecology & biodiversity	3.0	21.4
ENV-C	Groundwater contamination	5.0	35.7
ENV-D	Heritage	4.0	28.6
ENV-E	Embodied energy	0.0	0.0
	Total	14.0	100.0
Designation	Engineering key issue	Raw Score	Weight
ENG-A	Constructability	11.0	18.0
ENV-B	Available skilled labour to build the design	0.0	0.0
ENV-C	Minimising change orders and out of scope work	1.0	2.0
ENV-D	Minimising disruptions for the public	12.0	19.0
ENV-E	Geotechnical design and construction difficulties	4.0	6.0
ENV-F	Geotechnical design and construction difficulties	13.0	21.0
ENV-G	Construction accessibility	2.0	3.0
ENV-H	Environmental challenges in construction	4.0	6.5
ENV-I	Damage to private/public property due to construction & usage	4.0	6.5
ENV-J	Cost	11.0	18.0
	Total	62.0	100.0
Designation	Integration key issue	Raw Score	Weight
INT-A	Allow for other projects	14	16.18
INT-B	Integration with other train functions	14	16.18
INT-C	Intermodal transport integration	8	9.25
INT-D	Establish Arden Central as PT hub/interchange for NW & Regional	6	6.94
INT-E	Connecting NW to SE PTI	15	17.34
INT-F	Reduce pressure on NS CBD tram routes	11	12.72
INT-G	Connect Southbank areas with River and the CBD	0	0.00
INT-H	Connect the two 'halves' of Southbank	0	0.00
INT-I	Enhance efficiency/usage of pre-existing infrastructure	2	2.31
INT-J	Cycling integration	5	5.78
INT-K	Develop and integrate roads	7.5	8.67
INT-L	Establishment of the boundaries for land use	4	4.62
	Total	86.5	100.00

5.1.1 Economic Key Issue Weighting

- Increased access to the CBD, economic productivity and the usage rate of Melbourne's PTI proved to be the most important key issues through the paired comparison method.
- This is a result of the final use of the MMRP as a public good, which is for the benefit of the people and generations to come.
- One of the most important stakeholders – the government – stresses the importance of the MMRP working to the general benefit of all Victorians, as such the direct cost and transient negative effects of the project construction on the city are weighted much lower than options A, C and F.
- Finally, the internal preferences of the Government (D) are un-important to the success of the high profile project as they have no effect on the operation or location of the MMRP.

5.1.2 Social Key Issues Weighting

From a social perspective the major facts to keep in mind are control the road congestion supports to maintain the life quality levels looking after the expected density growth in the CBD and its surroundings. In addition, consider that the city is in a process of vertical growth, so major spots of attraction need to be considered in the alignment.
Furthermore, there are some requirements for the project as presented:

- Minimize issues to other transport services by coordinating activities
- Avoid generating discomfort to the resident and businesses
- Follow the urban renewal plans of the city and avoid generating a bad image of the city during construction.
- Facilitate the access to health centers to support the investment done lately and planned for next years.
- The city is recognized by its education activities, so it requires to offer better services to maintain that standard.
- Provide facilities to the people with less resources and access and support for the sustainable transportation means.
- Provide Tourists required access to the attractions, so the project should provide easier access

5.1.3 Environmental Key Issues Weighting

- Groundwater contamination is a key concern because it affects the other criteria. The opportunity to increase ecology and biodiversity takes into account town planning such as that occurring in Arden-Macaulay (City of Melbourne, 2012)

5.1.4 Engineering Key Issues Weighting

- Constructability, staying on schedule, geotechnical issues, and cost are the main engineering concerns in the project and are thus weighted accordingly
- Minimising disruptions for the public is a very important issue however in the context of station location assessment as compared to the other issues it is not as weighty.

5.1.5 Integration Key Issues Weighting

The The Integration Evaluation Factor is one which has been decided by this group to be highly influential on the overall success of the MMRP. The integration factor covers issues to do with

the Economic, Social, Engineering and Environmental factors, but goes beyond these, and combines them in a way which makes them more easily assessed, and looks at the overarching aims of the project in a more subjective manner, allowing for the preferences of the project owners to be viewed alongside that of other stakeholders, rather than separating them.
As can be seen, the most important criterion is allowing for other projects and integration with other PTI projects is the access for emergency services during construction. The reduced pressure on tram routes is seen as least important, and while this should be considered in the design of the project, it will not have an impact on the overall assessment.

5.2 Station Location Assessment Framework

Table 2 below presents the detailed scoring framework used to assess *each* station location incorporated in the overall design proposal for the MMRP. Within each category, key issues are translated into *evaluation criteria.* Which are then broken down into selection criteria which provide a micro-level project factor that is used to give the station location a score out of 5. A proposed metric for measuring the selection criteria is also presented. The selection criteria scores are then averaged across the relevant evaluation criteria. This average is weighted by the criteria's relevance to the overall category. Finally, the average weighted scores for each criteria are summed across the category and again weighted by the stakeholder significance scores established in table 1. This gives score for the station location's performance in each evaluation category. This can then be summed across the categories to give and overall score for station location. This is to be done for *all* proposed station locations.

Table 2 – Station Assessment Template

CATEGORY	Designation	Evaluation Criteria (Key Issue)	Significance weighting (%)	Selection Criteria	Proposed Measurement Method	Station Relevance*	Assessment**	Raw Score***	Category relevance score	Weighted Score****
ECONOMIC	E-A	Increased access to employment in the station area	22.5	PTI Capacity Boost	#patronage (Or %)					
	E-B	Reduced home-work travel times	16.6	Expected Travel Times	Distance & Employment density					
	E-C	Economic productivity increase in the station area	26.5	Business productivity growth	Qualitative					
				Productivity decrease during construction	Qualitative					
				Increased travel efficiency in employment areas	Times to get to work					
				Agglomeration Benefits	Qualitative					
					Evaluation Criteria Average					
	E-E	Highest cost-benefit ration possible	7.3	Revenue from usage	$ or %					
				Costs from damages (liability claims)	$ or %					
				Cost of disruptions during conc.	$ & Qualitative					
				Property Acquisition costs	$					
				Projected economic growth from investing in health	Quantitative/Monetary					
				Productivity due to better health outcomes	Quantitative/Monetary (back to work times)					
				Public health care costs reduced due to healthier citizens	Monetary					
				Attracting tourists to more attractions	Qualitative					
				Promoting nightlife	Quantitative/Monetary					
					Evaluation Criteria Average					
	E-F	Increase usage rates of PTI	22.5	Population/employment growth in station locations	Growth rates (%) or # Persons					
				increased ticket sales	$$					
					Evaluation Criteria Average					
	E-G	Stimulus to economy (during construction)	3.3	Jobs created during project delivery and flow on benefits	#Workers					
	E-H	Minimal disruption to all services during construction	1.3	Minimal disruption to PTI	Monetary, time, productivity					
				Minimal disruption to roads and paths	lost productivity, increased fuel costs					
				Minimal disruption to Yarra River operations	lost productivity, increased fuel costs					
				Disruption to rev generating public events	$$, qualitative					
					Evaluation Criteria Average					
		Total	100		Weighted category total multiplied by category significance				0.22	
SOCIAL	S-A	Reduced cars on the road -- less congestion	8.7	Increased capacity of rail and proximity to other transport options	Qualitative					
	S-B	Minimal disruptions to PTI	3.8	Disruption to PTI in the area	Qualitative					
	S-E	Eliminate the risk of damage to the Heritage sites	8.7	Qualitative assessment of risk	Qualitative					
	S-F		4.4	Truck congestion near the stations construction sites	Qualitative					

		Control noise pollution affecting residents and businesses in the surroundings of the construction site.		Proximity of construction site to businesses and residential structures	Qualitative
					Evaluation Criteria Average
	S-G	Maintain service levels in line with growing population	8.7	Proposed PTI growth rate Compared with car usage %	% Comparison
				Assess potential reductions	Qualitative
					Evaluation Criteria Average
	S-H	Urban renewal (Res. and Comm. in AM)	4.7	Re-zoning plans associated with station location	Qualitative
	S-J	Establish precinct as an internationally recognized Health precinct	7.8	Level of improved access to Hospitals and UoM	Distance from station location (m)
				Standard of healthcare	Qualitative
					Evaluation Criteria Average
	S-K	Aesthetic of city during construction	2.0		Qualitative
	S-L	Further improve the precinct's standing as an Education precinct	8.7	Potential increased access and funding to education in the area facilities	Qualitative
	S-M	Increase Social Equity	4.7	Potential increased access to the CBD and Employment to those who may not otherwise	Qualitative
	S-N	Prioritize cyclists and pedestrians	4.7	Assessment of Plans	Qualitative
	S-O	Localise intensive activity to activity centres	15.4	Assessment of Plans	Distance/Qualitative
	S-P	Improve access to tourist attractions	4.7	Assessment of Plans	Distance/Qualitative
	S-T	Generate long-term pro-environmental behaviour change	8.7		Qualitative
		Total	95.7		Weighted category total multiplied by category significance 0.20
ENVIRONMENTAL;	ENV-A	Potential damage to surrounding eco-system health & biodiversity including parks	14.3	Proximity to parks, flora and fauna for construction and usage phases	Quantitative (metres)
				Effect of foot traffic on surrounding plant and animal life. The resilience of the area to excessive pedestrian traffic	Quantitative (computer modelling)
				Effect of groundwater changes	Quantitative (computer modelling)
					Evaluation Criteria Average
	ENV-B	Opportunity to increase ecology & biodiversity	21.4	Biodiversity in surroundings; less and biodiversity will mean greater opportunity provided there is adequate space (e.g. area on footpath to plant trees), thus a higher score	Qualitative/Quantitative
	ENV-C	Groundwater contamination	35.7	Groundwater level at site location	Quantitative
				Proximity to flowing water sources & ability to contain possible contamination	Quantitative
					Evaluation Criteria Average
	ENV-D	Heritage	28.6	Proximity	Quantitative
	ENV-E	Embodied energy	0.0	The embodied energy for design and construction for the particular site location	Quantitative
		Total	100		Weighted category total multiplied by category significance 0.18
ENGINEERING	ENG-A	Constructability	18.0	Road access	Quantitative
				Surrounding heritage sites	Quantitative
				Surrounding infrastructure	Quantitative
				Surrounding buildings	Quantitative
				EPA regulations re: noise/vibration/dust/groundwater contamination/pollution during construction	Quantitative

					Evaluation Criteria Average	
	ENG-B	Available skilled labour to build the design	0.0	Background check of potential design/construct bidders history to build in site conditions specific to the region	Qualitative	
	ENG-C	Minimising change orders and out of scope work	2.0	Research similar projects to find past successes and failures to counter optimism bias and unrealistic time, cost, scope and quality assumptions	Qualitative	
	ENG-D	Staying on schedule	19.0	Constructability	Qualitative	
				Experience of design and construction companies	Quantitative	
				Adequate budget designated for planning	Quantitative	
					Evaluation Criteria Average	
	ENG-E	Minimising disruptions for the public	6.0	Disruptions to traffic	Quantitative	
				Disruptions to trunk services	Quantitative	
				Contingent options available for PT users and car routes that have been blocked	Qualitative assessment of plans	
					Evaluation Criteria Average	
	ENG-F	Geotechnical design and construction difficulties	21.0	Settlement along alignment	Qualitative assessment of plans	
				Station construction requirements	Qualitative assessment of plans	
				Importance of structures above alignment	Qualitative assessment of plans	
				Vertical configuration	Qualitative assessment of plans	
				Proximity to building foundations	Qualitative assessment of plans	
				Soil conditions	Qualitative assessment of plans(Distance)	
					Evaluation Criteria Average	
	ENG-G	Construction accessibility	3.0	Traffic in area	Qualitative assessment of plans	
				Feasibility of entry of large vehicles	Qualitative assessment of plans	
					Evaluation Criteria Average	
	ENG-H	Environmental challenges in construction	6.0	Proximity of landscape features such as trees, creeks and rivers, parks and heritage sites	Quantitative	
	ENG-I	Damage to private/public property due to construction & usage	6.0	Surrounding confinement above ground and below; buildings, foundations and trunk services	Qualitative assessment of plans	
	ENG -J	Cost	18.0	Constructability	Qualitative assessment of plans	
				Desired Quality of design	Qualitative assessment of plans	
				Area specific requirements of design of station due to geotechnical factors and integration of station with surroundings	Qualitative assessment of plans	
					Evaluation Criteria Average	
		Total	99.0		Weighted category total multiplied by category significance	0.19
INTEGRATION	INT-A	Allow for other projects	16.2	Assessment of wider PTI plans	Qualitative assessment of plans	
	INT-B	Integration with other train functions	16.2	Assessment of Plans in regards to other Metro rail	Qualitative assessment of plans	
				Easing crowding of other train lines	Qualitative assessment of plans	
				Assessment of Plans in regards to other Regional rail	Qualitative assessment of plans	
					Evaluation Criteria Average	
	INT-C	Intermodal transport and integration	9.25	Amount of other PT in area	Number	
				Distance to other PTI access	Distance	
				Number of proposed storage facilities for bikes, cars etc.	Qualitative assessment of plans	

					Evaluation Criteria Average	
	INT-D	Centralise PT operations in the immediate area	6.94	Proximity of proposed station to proposed city centres	Distance	
				Distance to other PTI access	Distance	
					Evaluation Criteria Average	
	INT-E	Connecting NW and SE PT corridors	17.3			
	INT-F	Reduce pressure on NS CBD tram routes	12.7	Assessment of Plans	Qualitative assessment of plans	
	INT-I	Enhance efficiency/usage of pre-existing infrastructure	2.3	Location in regards to other unutilised	Qualitative assessment of plans	
				Nature of infrastructure in close proximity (over/under utilised)	Qualitative assessment of plans	
					Evaluation Criteria Average	
	INT-J	Cycling and walkability integration	5.78	Connecting bike routes	Qualitative assessment of plans	
	INT-K	Develop and integrate roads	8.67	Assessment of Plans	Qualitative assessment of plans	
	INT-L	Establishment of the boundaries for land use	4.62	Assessment of Plans	Qualitative assessment of plans	
					Weighted category total multiplied by category significance	0.23
					Total Station score out of 5	

**** Station Relevance:*** *A score between 0 and 1 is given to weight selection criteria scores. This is dependent on the relevance of the selection criteria to the station in question*
***** Assessment:*** *This field is to provide the details of assessment for the selection criteria, data presented is likely to be of that suggested in the proposed measurement column.*
****** Raw Score:*** *Score from 1-5 gauging the performance of the station in the selection criteria*
******* Weighted Score:*** *Final score weighted by the evaluation criteria assessment and category significance score*
****** The key issues and importance to stakeholders for the environmental and engineering sections as presented in table XX (green & blue table) have been streamlined. Thus the key issues presented in table (green&blue) are presented slightly differently for clarity in comparing issues.*

6. Actual Assessment

Section 6 utilises the feasibility framework established in section 5 to perform a base line assessment of the currently proposed station locations across the five evaluation categories.

6.1 Introduction

The assessment of each individual station location has been performed, based upon the key issues, evaluation factors and assessment criteria discussed previously in this report. Whilst the scores presented appear nominal, they provide a base line score for the currently proposed station locations, which can be compared to alternative proposals when using this framework.

6.2 Station Location Assessment Summary

Table 3 below provides a summary of each stations performance in the five categories of assessment along with average scores (across all key issues in the category) out of five. The bottom row of the table gives the overall proposal weighted score in each category out of five. The far right column gives individual station location scores across all assessment categories out of five. Finally the bottom right cell gives the overall proposal's station location's score as a whole out of 25. The detailed scoring of stations by evaluation category, selection criteria and performance measurement is presented in appendix C.

Finally, the bottom rows of table 3 provide a sensitivity ranging of the projects performance in each evaluation category. The proposed ranges in each category are based on the accuracy of data used for raw assessment of each selection criteria. This allows for dynamic accuracy ranging of station location performance in each category, and provides a range for the final score of the project which will aid decision making when two proposals are assessed using this framework.

Table 3 Station Location Assessment Summary

CATEGORY	ECONOMIC	SOCIAL	ENVIRONMENTAL	ENGINEERING	INTEGRATION	TOTAL SCORE
STATION						Out of 5
ARDEN	The relatively remote proposed location for the AM station places the construction site in mainly industrial areas. This reduces the potential for damages to private property and public goods, furthermore it minimises potential disruptions to PTI and other events occurring in AM. As such, this station scores highly in related key issues.	Due to the industrial past of the area, the social aspects are divided into the urban renewal process and the industrial remaining. The precinct will be benefit widely because of the project, but as the zone is planned to become an extension of the CBD, the station will be used as a tool to attract people to the area instead of being a generator of improvement over a previously established base.	The proposed station location is very close to Moonee Ponds Creek (or Railway Canal) which is a potential issue during construction in terms of ground water contamination and inundation risks, other than that there are few parks, trees of significance or heritage sites in the vicinity making construction easier.	The lack of available data makes assessment of the station location at Arden impractical. The few proposed measurements that can be qualitatively assessed relate to the location of the site. It is an accessible area with less working constrictions as compared to sites in the city or at major intersections	Due in large part to the detail in the Arden Macaulay Structure Plan, the Integration evaluation has been scored quite highly. Connections to buses, as well as walking and cycling routes make the proposed integration of Arden Station with its surrounds quite promising.	
	0.7	0.6	0.6	0.75	0.5	3.15
PARKVILLE	Aligned with the push for health and education facilities and funding in the Parkville area, the PV station, located on the corner of Grattan and Royale Pde, has the potential to become a key piece of PTI in the area. It's location facilities access to health and education services, with both present in a 2 minute radius of the proposed station location. Furthermore, the station is located in an underserviced PTI area, wherein there is only 3 tram lines in close proximity	Parkville is a suburb that has become recognized by the educational and health facilities, and the station is mainly focused to improve the access to those establishments that enhance the worldwide reputation of the city. The benefits produced by the station will produce an improvement on several aspects as connectivity, nightlife increase, faster and easier accessibility to attraction spots and urban development. T	Lack of data: Partial Qualitative Assessment:: No parks adjacent although to the north there is princess park however it is a distance away. No heritage sites near. area is fairly densely populated by hospitals and medical centres thus little room to better ecology & biodiversity	Lack of data: Partial Qualitative Assessment: Difficult access due to busy arterial roads, difficult soil (Silurian mudstone), confined area and sensitive building surround (hospitals). Damage to trunk services must be avoided at all costs	As with the proposed Arden Station, there has been a lot of planning put into the integration of the Parkville Station with its surrounds. The City North Structure Plan outlines many of the issues of significance. The main reason for a lower score is the difficulty of access for emergency services during construction, particularly ambulance access to the Royal Melbourne Hospital.	
	1.1	0.9	0.55	0.5	1	4.05
CBD NORTH	The central location of the CBD North station, and it's close connection to a multitude of other PT services make it a prime location for generating more ticket sales and encouraging more public transport. However the potential for costly disruptions and damages to public and private infrastructure, particularly MC and Swanston st trams make the construction a logistical nightmare.	The location of the station is one of the most important spots on the city, so the construction will be required to take into consideration several aspects in order to minimize the affectation to the activities and population in the surroundings. The station will serve as a generator of urban development and will lead the vertical growth plans of the city by giving a possibility of increasing the trips widely..	Lack of data: Partial Qualitative Assessment:: few parks or heritage sites nearby	Lack of data: Partial Qualitative Assessment: Difficult access, difficult soil (Silurian mudstone), confined area and sensitive building surround (Melbourne central, existing rail tunnels). Damage to trunk services should be avoided. Outages must be planned if necessary	The integration of the CBD North Station with Melbourne Central Station and surrounding tram services score this station quite highly on the integration scale. The grid layout of the CBD allows emergency access via other avenues during construction.	
	0.8	0.7	0.6	0.3	1	3.4
CBD SOUTH	Similarly to CBD North, CBD South has even higher potential for disruptions to	The station will be located in probably the most important activity centre of the	Lack of data:	Lack of data:	The proximity of the CBD South Station to Flinders St Station and two major	

	public events and damages to public infrastructure (although slightly less as more access to FS from river and St Kilda rd). However there is potential relatively substantial agglomeration and intra-connectivity benefits which would increase economic productivity, and revenue raised from PTI usage to the CBD (Particularly for public events post construction).	city, rounded by Flinders station and the Fed Square, and close to Collins St, all of them major attraction points in the city with different purposes. The are is a strategically part for the development of the city, so the considerations during construction are required to be analysed deeply in order to avoid blocking these centres. The development of the station will produce several benefits for activities and connections within Melbourne.	Partial Qualitative Assessment:: The Yarra river, federation square and Flinders st station flank this site location making the area particularly sensitive to environmental concerns	Partial Qualitative Assessment: Difficult access, difficult soil (Silurian mudstone), confined area and sensitive building surround (Melbourne central, existing rail tunnels). Damage to trunk services should be avoided. Outages must be planned if necessary	tram stops, score this station quite highly. The location of the station in regards to the crossing of the Yarra River at Princes bridge means it scores slightly lower due to emergency vehicle access.	
	0.8	0.7	0.6	0.25	1	3.35
DOMAIN	The Domain Station improves PT flow along the St. Kilda Rd corridor by taking pressure off the current tram reliant system in the area. Furthermore, the businesses and hotels already on St Kilda road will receive agglomeration benefits, and ease the accessibility of tourists, diplomats and residents to the CBD. This station location losses marks for the high potential for damages and disruptions during disruptions. Furthermore, the location misses out on the opportunity to open up the back half of Southbank.	The station will be located in a zone where the activity is different to the other stations. The residential and office locations produce several trips that are spread along St Kilda road, and that makes this station a good possibility of producing a change of activities and generating major attraction points that will improve the urban characteristics of the area. Additionally, it will generate a link to the CBD by reducing travel times which will result in benefits for both locations.	Lack of data: Partial Qualitative Assessment:: The botanical gardens and the shrine of remembrance are nearby make the site sensitive.	Lack of data: Partial Qualitative Assessment: Decent access but obstruction to traffic during construction, Workable soil (sandy), Sensitive area due to botanical gardens and shrine of remembrance	Domain Station is proposed to be beneath the existing Domain tram interchange, making it highly integrated with existing infrastructure. The proposed station appears to connect well with its surrounds, including the Shrine of Remembrance.	
	0.6	0.8	0.65	0.55	0.7	3.3
PROPOSAL TOTAL SCORES (Out of 25)	4	3.7	3	2.35	4.2	17.25
CATEGORY	Given the huge lack of quantitative data regarding the economic factors impacting the validity of the MMRP, a relatively large Sensitivity range (+-25%) has been used to indicate accuracy boundaries of the economic score given	Due to the qualitative background of most of the factors considered on the evaluation of the social aspects, the result becomes sort of variable. Reason that supports the usage of a large range of sensitivity (+-30%) that indicates the relativity of the criteria used for the score.	Environmental assessment impacts are subjective and qualitative even if backed up by quantitative means, thus the higher sensitivity score	Technical engineering information and data can be fairly accurate thus the low sensitivity score	Considering that the majority of the integration factors require a qualitative and comparative analysis, there is quite a large sensitivity range of 0.5 applied. With more data, and a better comparison, this score could be decreased.	Range based on individual category ranges
SENSITIVITY	0.25	0.3	0.1	0.3	0.5	-
MIN	3	2.59	2.7	1.645	2.1	12.035
MAX	5	4.81	3.3	3.055	6.3	22.465

6.3 Limitations

The gaps in knowledge and areas of potential research are elicited in the literature review section and have been further developed whilst performing the station location assessment. There is a large body of research needing to be done in the economic, engineering, environmental, social and integration sections for the assessment to be performed accurately. The current assessments performed have been largely qualitative, with sensitivity analyses included, however with more data a better understanding of the strengths and weaknesses of the project, and lower sensitivity range can be gained. Some of the data which could be useful includes:

- Site characteristics and station designs
- Assessments of CO2 emissions from reduced congestion and car use
- Data such as the bids for the project or quantitative data to assess for instance the "Social" evaluation criteria such as a monetary figure tied to reduced crime in the CBD (possibly from reduced police resources used to curb late night violence etc..)

For our assessment method to be used accurately, a large amount of data and technical information is required. Lacking this information, the station location evaluation performed by our own team is qualitatively based and to be used as a reference only. The guidelines set out by Melbourne Water in their triple bottom line multi criteria assessment, (Figure 1)Figure 1 demonstrates the type of data required for a robust assessment.

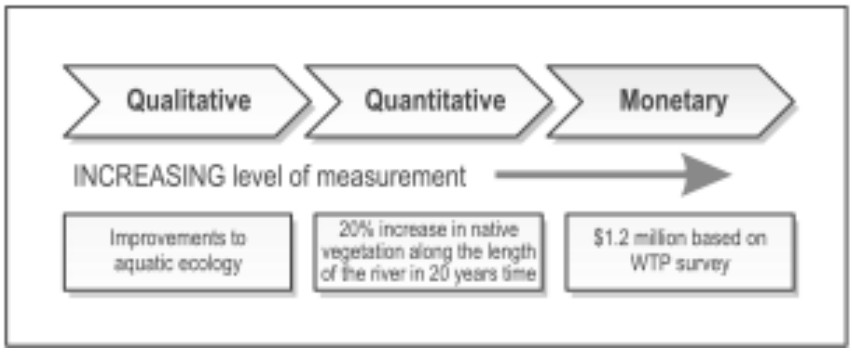

Figure 1 (Melbourne Water, 2007)

Conclusion

The synthesis of key literature and in-depth analysis of relevant stakeholders has allowed for the development of a high-fidelity feasibility framework outlining comparable scores for proposed station locations of the MMRP. The structure of the framework provides assessment of the proposal at several different levels, allowing for the comparison of station performance in specific evaluation categories or more generally. Such a robust framework, combined with high levels of detail will allow for effective comparison between differing proposals. Whilst the score provided in section 6 are mainly based on qualitative assessment, as detail surrounding the project are released to the public, the use of the proposed measurement metrics (table 2) will further improve the effectiveness of this framework.

It is clear from this analysis that there is no one correct answer for station location. Given the multi-faceted nature of stakeholders and their preferences, differing aspects of the project will always fall short of some expectations. However taking this into account allows for clear, detailed assessment of this, helping to guide the project owner in their final decisions.

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Appendices

Appendix A Detailed Stakeholder List & Breakdown

*'Power' weighting for each stakeholder group is calculated by averaging the power rank (1-5) of individual stakeholders in the group. This is then compared to other stakeholder groups and transformed to a relevant percentage. This ranking is used to weight the aggregate significance scores of differing key issues (table xx) across all stakeholder groups.

Table 4 Stakeholder Groups & Concerns

Stakeholder Groups & Concerns					
Stakeholder Group (Power ranking)*	**Stakeholder**	**Explanation**	**Needs**	**Requirements**	**Wants**
Governing Bodies (0.387)	***Federal Government***	Currently **Liberal**, headed by the Hon, Tony Abbot	• Accommodation of growing population • Accommodation of shift towards service based economy • Encourage state focus on PTI investment1 • More efficient use of PTI use in urban networks1 • Incentivise development of higher density residential and commercial areas1 • Shift the balance of investment from cars/roads to PTI1 • 30 Increase in rail capacity1	• Ensure the most cost efficient PTI projects are chosen and funded[1] • Identify $80 billion on infrastructure opportunities1 • Align supported projects with national strategic direction frameworks1 • Encourage transit orientated residential development1 • Consolidate local governments PTI management/development1 • User payment to help fund maintenance and further development1	• Establish strong partnership between federal, state and industry regarding infrastructure projects. • Co-ordination of bus, tram and train networks1 • Improved maintenance of PTI at the state level1 • Re-priorities investment funding1 • Attract private investors by generating revenue from transport infrastructure1
	Victorian Government	Currently **Labour**, headed by The Hon. Daniel Andrews	• The project must achieve value for money • Financially viable • 5 stations • Connect the North-West corridors with the South-East • Enable future projects on the rail network (e.g. rail link) • *Reduce Melbournian work travel times and distances.*	• Enhance the accessibility of the city from outer suburbs. • Account for the predicted doubled 'peak hour' usage of public transport • Improve access to jobs in the CBD • Proportionally reduce cars (proposed 18,000) on the road and associated emissions • Improve the integration of all PT integration	• Protection of biodiversity throughout growth corridors[2] • Efficient integration of trunk services into the tunnel construction and maintenance

[1] Australian Government (2013)
[2] DEPI (2015)

			• Private and Federal investment in the project • Increase usage rates of PTI • Reduce dwelling-work travel times • Reduce the reliance on roads and private vehicle usage	• Jobs creation (3,500) during the construction of the project). • No pollution of water ways and ground water during construction	
	City of Melbourne	Comprised of smaller local councils.	• Have no adverse effects on the geology of the city (No settlement) • No effect on foundations of current and heritage listed structures • Swanston St to become a PT hub7 • Reduce pressure on North-South CBD tram routes7 • Drastically increase the amount of individual train services during peak hour3	• Little to no disruption to Swanston and Elizabeth street usage7 during construction • Urban growth is performed within the city's ecological limits[3] • Reduce the effects of climate change and the 'urban heat island' effect3	• Little adverse effects on inter/intra CBD travel times during construction • No disruptions to public events during construction (e.g. Anzac day march)
	Arden-Macaulay	Currently mainly industrial area	• Accommodate growth in residential and commercial occupants5 • Grow a prosperous place and viable economy: • Ensure well connected to the city and central ENVirons5 • Develop 'Arden Central' as a major transport interchange5 • Ensure regional access and high exposure to the AM Central area • Develop with variety (mixed density, land use etc.)—Allowing district to act as a natural extension of the city.	• For Arden-Macaulay station to act as catalyst for commercial and residential development of re-zoned industrial areas.[4] • 14,000 new jobs in Arden-Macaulay[5] • 4000 New residents in Arden Macaulay5 • 12,000 Students5 • Regenerate the areas structural realm:5 • Create permeable street network that reflects historic subdivision patterns • Establish, safe, direct street network providing direct access to PT services. • Upgrade Moonee Pones creek corridor (better for pedestrians and cyclists)	• PTI in the area to accommodate the growth • Alleviate pressure placed on roads due to increased residents and vehicles.5 • Increase urban forestry (Tree numbers) by over 500 by 20145 • Create a connected and accessible place:5 • Establish integrated transport network (prioritises cyclists and pedestrians) • Safe and highly accessible PT services which is commensurate with projected growth. • Prioritise growth of sustainable Transport options. • Support jobs and population growth (PT frequency) • Locate intensified activity around existing activity centres • Move traffic and freight efficiently through and t the area.

[3] City of Melbourne (2012)
[4] City of Melbourne (2012)
[5] Arden-Macaulay Structural Plan (2014)

	Parkville	Education and health hub containing several hospitals and the UoM. The Melbourne Zoo is also accessible from Parkville	• Further integrate[6] and grow health and education services in the area[7] • Ensure proper maintenance of numerous heritage listed sites in the area[8]	• Accommodate increased usage of PIT and access to the area due to the new *Victorian Comprehensive Cancer Centre*[9] • Reduction in the use of cars to travel to the area, reducing parking space requirements4	• Establish Parkville as the health and educational capital of Melbourne with global reputation. • Increases university residency.
	Domain	Key infrastructure in the area includes the Domain tram interchange, Melbourne Grammar school and the Botanic Gardens.	• No damage to the shrine and surrounding area. • No disruption to the tranquillity of the botanic gardens7 • No adverse settlement of gardens • No pollution of soils under gardens	• Little to no disruption of St Kilda road tram routes during construction • Reduction in St Kilda road traffic congestion • Accommodate jobs growth in the area[10] • Easier and quicker access to hospitals for disabled persons.	• No reduction in the natural capital of the botanic gardens[11] • No reduction in the natural capital of the Queen Victoria Gardens[12]
	City North	This area, within the City of Melbourne, is centred around Melbourne Central shopping centre and rail station. The State library and numerous retail, residential and commercial developments are also present in the 'CBD North' area.	• Cultivate a vibrant and distinct precinct connected to the Central City • Create a liveable local neighbourhood • Strengthen the knowledge economies to cultivate prosperity and creativity[13] • Retain the intimate precinct layered with charm • Develop City North as a new vibrant precinct within an expanded Central City • Create three new local activity hubs • Increase the provision of affordable housing • Increase the provision of open space • Increase the provision of community infrastructure	• Sunlight to public places (i.e. parks gardens etc.)[14] • Discretionary uses in residential zone 1 to prevent encroachment of incompatible non-residential users • ENVironmentally sustainable office buildings, reduce energy use and emissions from the area	• Heritage of all listed sites • Minimise loss of the cities character through redevelopment (Outside the CBD zone) • Encourage innovative physical design within the CBD limits

[6] Department of Health (2005)
[7] City of Melbourne (2014)
[8] parkvilleassociation.org.au (2013)
[9] VCCC (2013)
10 City of Melbourne (2013a)
11 Tourism Victoria (2012)
12 Queen Victoria Gardens (2015)
13 City North Structural plan (2012)
14 City North Structural plan (2012)

	Southbank Structural Plan	Southbank is somewhat split into riverside businesses, restaurants and notably, Crown Casino and more suburban areas further south of the Yarra.	• Three new 'hearts' • Connect and integrate Southbank with the central city and the Yarra River	• A high quality, expanded public realm • A new streetscape vision • Sustainable buildings	• A connected and permeable neighbourhood • Connect halves • Sustainable infrastructure
	Infrastructure Australia[15]	Role is to plan and coordinate infrastructure projects nationally, particularly when works go across state borders. They are ideally objective players in regards to politics etc.	• Committed to the development of **world class** PTI. • Develop and integrate long-term strategies aimed at managing land use, density, population and urban congestion • Urban regeneration • Pushing direct government investment in PTI • High speed rail • Managed motorways • **Congestion pricing**	• Reduce national carbon emissions • Transit orientated development aimed at facilitating PT use • Propose PTI, walking, cycling etc. as **viable** substitutes to driving • More efficient use of the current road networks	• Create competitive markets • Consolidate national legislation • Better use of existing infrastructure • Low carbon economy
	Tourism Victoria[16]	Tourism Victoria is a State Government Authority focused on strengthening and building the tourism and travel industries.	• To market Victoria as a tourist destination • Increase number of visitors • Increase travellers' length of stay • Increase the use of Victorian tourist facilities • Increase intra-Victorian travel	• Develop old and new Victorian tourism facilities • Increase efficiency of utilisation of investment in the tourism industry	• **Priorities:** • Attract high yield international visitors • Increase the domestic tourism market • Attracting and leveraging events • Air services attraction • Investment attraction • Investing in our workforce
	Sustainability Victoria[17]	Sustainability Victoria is a State Government Statutory authority advocating for the implementation of sustainable processes in private and public practise on behalf of the State Government[18]	• Integrated waste management including collection and recycling • Promote and facilitate ENVironmental sustainability and use of resources	• State wide leadership of waste management[18] • State-wide engagement in regards to waste management[18] • Help Victorians use less materials and waste less energy[18]	• Increase funding and effort spent on the promotion of sustainable living and building.

15 Infrastructure Australia (2015)
16 Tourism Victoria (2014)
17 Sustainability Victoria Strategic Plan (2015)
18 Sustainability Victoria Annual Report (2014)

	Parks Victoria	A State Government Authority, Parks Victoria is committed to delivering works on the ground across Victoria's park network to protect and enhance park values.	• Albert Park Master Plan[19] • Conserve/protect natural and cultural values of the park • Improve access • Generate revenue • Sustainable use of natural resources • Put safety first[20]	• Connecting people to parks:[20] • Preserving Victoria's special places[20] • Provide benefits beyond parks boundaries[20] • Ensure healthy eco-systems in parks[20] • Play major role in making communities safer[20] • Make parks contribute to a productive, healthy prosperous Victorian agriculture industry	• Provide excellent customer service • Collaborate with other government and non-government bodies • Lead innovation in park management globally • Act with integrity[20] • Make parks contribute to a productive, healthy prosperous Victorian agriculture industry[20].
	Department of ENVironment and Primary Industries (DEPI)	The State Authority DEPI advocates for more efficient management of public and private land and water. Main focuses include; protecting the ENVironment and boosting the state's economic activity.	• Effective management of water resources to meet future urban, rural and ENVironmental needs[21] • Effective ENVironmental and adaptation policy, investment and regulation[21]	• The community benefits from effective management of Victoria's land assets[21]	• Create productive and competitive agricultural industry [21] • Sustainably manage fish, game and forest resources.[21] • Reduced impact of major bushfires and other extreme events on people, infrastructure and the ENVironment[21]
	Department of Treasury and Finance	The State Department of Treasury and Finance focus mainly on developing, implementing and managing the State budget. There primary concerns revolve around public and private economic productivity and stimulation	• Funding for health research facilities and universities[22] • Upgrades to the Western Women's and Children's Hospitals[22] • 5-6 Bill on level crossings[22] • 9-11 Bill ON MMRP[22] • 20 New E-Class trams, 21 Regional train carriages[22] • Upgrading signalling[22] • 42 Capacity increase on Cranbourne-Pakenham lines[22] • $15 mil on network integration[22]	• Delivery of new schools in Footscray, Richmond, Albert Park[22] • Purchase of land in growing suburbs for schools[22] • Upgrades to TAFE[22]	• money on having more public events in Vic – to attract tourism • Pushing 'creative capital' Sporting growth

19 Parks Victoria (2015
20 Parks Victoria (2014)
21 DEPI (2014)
22 Victorian Department of Treasury & Finance (2015)

	Victorian Employers chamber of Commerce & Industry (VECCI)	VECCI focuses mainly on the development of private business. Acting as the voice for small to medium businesses operating in Victoria.	• Assist the interests of the Victorian business community through representation and avocation of concerns directly to the state government[23] • Roads, rail network and ports must be at the top of the next state government's agenda[23] • Commence construction of MMRP[23]	• Identify state assets that can be sold, leased or privatised to fund new infrastructure.[23] • Improve timeliness and certainty in the planning process and reduce unnecessary costs and complexity for business. • Fast track regional rail links	• Stronger consensus between private and public decision makers when it comes to infrastructure projects. • Encourage further non-solicited renders/bids from private sector to enhance infrastructure project viability
	Australian Industry Group	The Australian Business Group independently advocate for building sustainable and globally competitive industries and the required supporting infrastructure. As such, AIG strongly reflect private business priorities.	• Lift infrastructure investment • Remove capacity bottlenecks and enhance investment efficiency and sustainability[24]	-	-
	Civil Contractors Federation	The CCF are a body of civil engineering contractors and provide assistance in contractor development and industry issues. They are mainly concerned with the amount of private and public contracts available in Australia.	-	-	• Internal improvements • Professional services advice for members • More jobs for members • More opportunities for members
	Australian Logistics Council	The ALC are mainly concerned with developing national frameworks and regulations for logistics processes aiming to increase	• Collaborate with private sector to harness greater investment in infrastructure • National consistency of safety regulations and supply chain management procedures[25]	• Work with industry to provide and develop state and national freight logistics plans	• Institute high achieving supply chains • Develop above through consultation with industry and government[25]

23 Victorian Employers chamber of Commerce & Industry (2014)

24 Australian Industry Group (2015)

25 Australian Logistics Council (2015)

		efficiency and opportunity in the sector.			
	Victorian Transport Association	Made up of groups and members (Including: Safety and Compliance Group, General Freight Committee, VTA Container Group, Transport Industry Safety Group (TISG), Technology Group	• Working collaboratively with governments and regulatory bodies to ensure member's concerns are met • Improve operating ENVironment of the transport industry • Alternative river crossing for road freight	• Completion of the M80 ring road[26] • Freight rail projects – Melbourne-Brisbane inland rail	-
	Australian Council of small business	The Australian Council of Small Business advocate and lobby on behalf of small business. Aiming mainly to improve small business influence over taxation, workplace regulations and competition law.	-	• Promote and support the development of small businesses in Australia; • Advocate to advance the interests of small business in Australia, including through policy change and regulatory reform; • Foster an increased awareness and understanding of the role of small business in Australia amongst public servants and elected government officials, larger businesses, the media and the general community.	• Provide support to small business owners who are in crisis or who are ready to grow. • Create a fairer market place for the owners of small business. • Have governments treat small business as individuals and not expect them to have the same skills, knowledge, resources and capacity of big business. • Decrease red tape and compliance costs on small business owners.
	Australian Hotels Association	The Australian Hotels Association lobbies on their members behalf to advocate best practises within hotel management. They are concerned with relevant government regulation and stimulatory actions for the tourism industry.27	• Ensure the significant economic and social contributions made by hotels are recognised by governments.[27] • Promote the continued development of the Australian hospitality and tourism sector.[27] • Promote and encourage new investment in the hotel industry.[27]	• Protect the interests of the hotel sector against harsh or excessive regulation.[27] • Pursue a fair and equitable workplace relations system.[27] • Gain greater access to overseas workers for hotels facing chronic labour shortages.[27]	• Work to ensure hotels are able to operate and compete on a level playing field, with fair access to the products and services required to meet customer demands.[27] • Mandatory Pre-Commitment for Electronic Gaming Machines.[27] • Pursue a fair and equitable workplace relations system.[27]
	Indigenous Business	The Indigenous Business Council of	• Fair work and policy regulation for indigenous persons	-	-

26 Victorian Transport Association (2014)
27 Australian Hotels Association (2015)

	Council of Australia	Australia acts as the voice of Indigenous business owners from all sections of the economy	• Fair opportunity for indigenous persons • Acknowledgement of indigenous land and contributions to projects.		
Regulatory Authorities	***EPA Victoria***	Protecting the Victorian ENVironment, headed by the Hon, EPA Chairman Cheryl Batagol - http://www.epa.vic.gov.au	• Ensure that the projects in the city stick to the pre-stablished ENVironmental parameters. • Address the biggest risks to the ENVironment and health[28]. • Ensure minimal disturbance from noise to the community, avoiding to affect their wellbeing[29]. • Control the waste management during construction of major projects including an assessment of the accomplishment of standards for disposal • Avoid any possible affectation to the Royal Botanic Gardens and the Queen Victoria Gardens • Ensure that planning urban development will follow the Victorian Government's Biodiversity Conservation Strategy to protect the biodiversity through growth corridors.[30] • Minimize or eliminate any possibilities of contaminate groundwater or disturb contaminated groundwater during the project construction.[31] • Ensure the usage of protective measures to control any possibility of flooding along the project.	• Use an engagement policy to have a standard form of promoting upholding and empowering the community, businesses and other organisations to generate long-term pro-ENVironmental behavior change.[32] • Regulate pollution produced during the project • Being an independent authority to make regulatory decisions based on the ENVironment Protection Act 1970[33]. • Ensure an ENVironmentally safe work on major projects requiring plans for implementation and monitor of regulations • Look for an effective design of the project to be capable of mitigate the climate change and the urban heat island effect.[34]	• Work with the community, businesses and other organizations to protect the ENVironment. [35] • Foster the population to become ENVironmental citizens, engaging Victorians to protect the ENVironment. [36] • Generate a healthy ENVironment that impulses a liveable and successful Victoria[37]. • Collaborate with the constructors and contractors to ensure the best practices to protect the ENVironment. • Maintain and protect the biodiversity in the parks along the project.

28 Who we are (2014)
29 Who we are (2014)
30 DEPI. (2015)
31 Department of Transport, Planning and Local Infrastructure. (2015)
32 EPA Victoria(2014)
33 Who we are (2014)
34 City of Melbourne (2012)
35 EPA Victoria(2014)
36 EPA Victoria(2014)
37 Who we are (2014)

	Department of ENVironment, land, water and planning Victoria	Regulating policies and regulations in Victoria, headed by The Honorable Lisa Neville MP, Minister for ENVironment, Climate Change and Water The Honorable Richard Wynne MP, Minister for Planning The Honorable Natalie Hutchins MP, Minister for Local Government - delwp.vic.gov.au	• Control of building policy and legislation in Victoria[38.] Determine and analyze if the project is accomplishing the requirements of the city • Managing and monitoring the regulatory framework for the project. • Work together with EPA to supervise the project planning, construction and operation including the ENVironmental requirements. • Supervise the geological testing and considerations for the design due to mistakes may cause delays or potential hazard during the construction. [39]	• Work collaboratively with local government and other stakeholders to lead state and metropolitan development, strategic and statutory planning, development regulation, and ENVironmental assessment. [40] • Working together with industry and stakeholders to develop better building outcomes. [41] • Prepare guidelines to assist the responsible for designing and planning the urban ENVironment. [42] • Control the accomplishment of the guidelines during the design of the project.	• Creating liveable, inclusive and sustainable communities[43.] • Provide safer urban ENVironments for Victorian communities. [44] • Offering guidance for planning on projects that will shape Victoria´s ENVironment. [45]

38 Department of Environment, land, water and planning (2015)
39 Jha, A. K. (2015)
40 Department of Environment, land, water and planning (2015)
41 Department of Environment, land, water and planning (2015)
42 Department of Environment, land, water and planning (2015)
43 Department of Environment, land, water and planning (2015)
44 Department of Environment, land, water and planning (2015)
45 Department of Environment, land, water and planning (2015)

	Heritage Council of Victoria	Protect heritage in Victoria. Ten members are appointed by the Governor-in-Council on the recommendation of the Minister for Planning. - http://heritagecouncil.vic.gov.au/about-heritage-council	• Provide high level of legal protection for cultural heritage places in Victoria.[46] • Avoid any effect on foundations of current heritage listed structures • Eliminate any possible issues and risks that affect the heritage places near the project	• Operate in accordance with the Victorian Heritage Act to protect the heritage places that might be affected.[47] • Protect the surroundings of the places that might be affected by the project as the Shrine of Remembrance. • Protect the heritage sites near the project from the possible damages due to the increase of pedestrian traffic.	• Generate awareness about the protection of heritage places to the community and planners. • Work together with the designers and constructors to protect heritage places.
	OH&S-Worksafe Victoria	Ensure good conditions for the workers in Victoria. John Walter is interim chair since March 2015 - http://www.worksafe.vic.gov.au	• Ensure that the usage of High-risk equipment in the project site will follow the *Equipment (Public Safety) Act 1994*.'[48] • Ensure the accomplishment of the Section 28 of the OHS Act 2004 which aim is to make sure that the design of the project does not pose risks to people when using the workplace for a purpose for which it was intended. [49]	• Apply Victoria's work-related health and safety laws and regulations • Provide and promote a reasonably priced work grievance insurance to employers • Promote and provide health, safety and wellbeing in the workplace for employees based on the *Occupational Health & Safety Act 2004* [50] • Ensure that the Worksafe team improves workplace safety by implementing the organisation's compliance strategy focusing on information and education, incentives, enforcement, investigations, prosecutions and penalties. [51]	• Help the companies involved to avoid workplace injuries occurring. • Collaborate with the community to provide workplace safety.
	Victoria Building Authority	Ensure the accomplishment of building regulations. The Board consists of Chief Commissioner William (Bill) Kusznirczuk, Deputy Chief Commissioner, and (Dr) Damien Cremean. - http://www.vba.vic.gov.au/	• Undertaking examinations, investigations and audits to implement agreement with concerning legislation • Ensure the accomplishment for the project of the *Building Act 1993* which governs building activity in Victoria including the legislative	• Regulating for providing a good quality built ENVironment for the project. • Guard the safety and health of habitants who will be users of the project facilities • Prevent the changes that will occur on land use after the project development and generate policies to manage the changes.	• Facilitate the development of ENVironmentally and energy efficient constructions.

46 About the Heritage Council of Victoria (2015)
47 Heritage Council of Victoria (2015
48 Work safety Victoria(2015)
49 Work safety Victoria(2015)
50 Work safety Victoria(2015)
51 Work safety Victoria(2015)

			framework for the regulation of building construction.[52]		
	Transport Safety Victoria	Protect the transportation system in Victoria. It is headed by the Transport Safety Director, http://www.transportsafety.vic.gov.au/	• Ensure the delivery of a safe transportation system that will follow the regulations of the state.	• Managing bus and rail safety regulations and legislation looking for encouraging transport safety outcomes in the train network and affected trams and buses • Provide information for the developers and users of the system to improve their knowledge about safety.	• Look to obtaining the highest transport safety standards which are reasonably practicable for the project • Analyse the issues for transport safety presented during the project in order to create a base for upcoming projects • Reduce error and improve safety by understanding of human capabilities and limitations, and interactions with other people, the equipment they operate, and their living and work ENVironment[53]
	Surveyors Registration Board of Victoria	Determine land boundaries. Mr. John E. Tulloch Chairperson, Surveyor-General of Victoria http://www.surveyorsboard.vic.gov.au/	• Provide a reliable determination and establishment of the boundaries of the land used for the project and the private owners in the surroundings.	• Ensure the usage of appropriate technology and techniques for the cadastral surveying related to the project	• Look after the integrity of the system of land boundaries in the surroundings of the project.[54]
Unions	***Aus. council of Trade unions***	Protect workers. Gerardine Kearney is ACTU President http://www.actu.org.au/	• Provide health and safety ENVironments on the workplace for the workers that will be involved in the project development. •	• Provide better wages and good conditions on the workplace • Provide support and information for the smaller unions that are affiliated to improve the working well being of its members	• Improve the living standards and job quality of the workers in the project • Implement the concept of an inclusive workplace that provides equal opportunities for all the workers in the project [55]
	Aus. Rail/Tram & Bus unions	Protect workers The union is governed by different divisions - http://www.rtbuvic.com.au/	• Establish a fair working timetable for the workers in the network and the Melbourne Metro Rail • Ensure the safety and wellbeing of the rail, tram and bus system during labor hours.	• Look after the members´ work conditions and fair wages in the network • Negotiate the correct number of workers to be add in the network to provide the metro service	• Provide a good quality and enjoyable working ENVironment for the rail, tram and bus system workers in the project • Generate a community ENVironment between all the rail, tram and bus industry workers
	Electrical Trades	Protect workers. Troy Gray is the State	• Ensure the safety and wellbeing of the electrical, communications and	• Look after the members´ work conditions and fair wages in the electrical,	• Provide a good quality and enjoyable working ENVironment for

52 Victorian Building Authority (2014)
53 Transport Safety Victoria, 2015
54 Surveyors Registration Board of Victoria, 2015
55 Aus. council of Trade unions, 2015

		Secretary of the ETU Victoria Branch - https://www.etuvic.com.au/	electronic industry workers involved in the project • Ensure safety measures for procedures followed for the workers involved in high risk electrical, communications and electronic industry work	communications and electronic industry workers involved in the project •	the electrical, communications and electronic industry workers involved in the project
	CFMEU	Protect workers. Ralph Edwards is the president of the union in Victoria - http://www.cfmeuvic.com.au/	• Ensure the safety and wellbeing of the construction workers involved in the project • Ensure safety measures for procedures followed for the workers involved in high risk construction work	• Look after the members´ work conditions and fair wages for the construction workers involved in the project •	• Provide a good quality and enjoyable working ENVironment for the construction workers involved in the project
Utility retailors – pipelines, sewage, electricity, telecommunications	***Citipower (Electricity Distributor)***	Citipower are the provider of electricity in Melbourne's CBD and inner city suburbs. Electrical wiring runs overhead and underground through the corridor of the proposed MMRP alignment.	•Opportunity to expand network with growing demand due to city agglomeration of services and population •**Construction:** •No disruption to the company's ability to provide service to customers. This includes being able to run and maintain their services •No damage to property, capital and company's ability to provide service and generate revenue	•To meet minimum requirements as enforced by the Australian Energy Regulator •Access to property and capital for normal business flow and maintenance works •No damage to property and capital •Safety of staff not reduced from works	• Extended outages (20 hours or longer) must be planned[56] • No more than 10 interruptions in a calendar year[57]
	Australian Gas Networks	Australian Gas Network (formerly ENVestra) provides gas for suburbs in the corridor alignment north of the CBD; Carlton, Parkville and North Melbourne.[58]			• That there be few disruptions to service if any at all. Disruptions should be planned and brief during off-peak usage times
	Multinet	Multinet is a gas company that provides service in the corridor alignment through the CBD and south thereof; Melbourne CBD, Southbank and South Yarra [59]http://www.energyandresources.vic.gov.au/en			

56 CitiPower, 2014
57 CitiPower, 2014
58 Victorian State Government, 2015
59 Victorian State Government, 2015

		ergy/gas/gas-distributors			
	Telstra	Telstra owns the existing copper network where NBN is yet to be rolled out	•Telstra does not have "wants" for the MMRP	• Access to property and capital for normal business flow and maintenance works • No damage to property and capital • Safety of staff not reduced from works	• That there be few disruptions to service if any at all. Disruptions should be planned and brief during off-peak usage times
	NBN corporation	New network of fibre optic cables will be owned and operated by the NBN co. Wholly owned by the Government[60]	• That the MMRP does not hinder installation progress of the NBN61	• Access to property and capital for normal business flow and maintenance works • No damage to property and capital • Safety of staff not reduced from works	• Ability to continue roll-outs as planned62
	Melbourne Water *Corporation*	The Melbourne Water Corporation referred to as Melbourne Water is the water authority in Melbourne. They approve planning, construction and maintenance of new development.	• Construction is in line (where applicable) with Melbourne Water's vision and goals.	• Melbourne water must approve the project's various stages for it to commence. Their needs be that the project follows practise and guidelines in regards to Melbourne Water's jurisdiction.[63]http://www.melbournewater.com.au/Planning-and-building/land-development-process/Pages/The-land-development-process.aspx	• Meet ENVironmental legislative requirements; abide by ISO14001[64] • Protect natural assets[65] • No pollution of drinking water
Tunnels	***Trans-urban (citylink)***	Trans-Urban is a top 20 company on the ASX and owns and operates Citylink – a toll road crossing the proposed corridor of the MMRP.	• Greater traffic flow and thus profits due to decreased congestion in city-link • A more desirable traffic route due to quicker travel times because of reduced congestion	• No damage to integrity of capital and company's ability to provide service and generate revenue. This includes factors such as settlement which could cause foundation issues	• Minimal disruptions to tunnel operation during construction phase. If required, the disruptions should be at low usage periods and last a short duration.
Businesses along corridor	***Tertiary Education Centre: University of Melbourne, RMIT***	Both Universities are situated adjacent to MMRP corridor/station location. Dual importance of 1. Providing education to	• Greater power to attract students both nationally and internationally due to increased desirability of city from the MMRP	• Access to and from university during construction for students and staff • No damage to property	• Noise being kept to reasonable standards • Reasonable access to property • PT access during construction to be functional as to facilitate student

60 NBN Co., 2015
61 Australian Federal Government, 2015
62 Australian Federal Government, 2015
63 Melbourne Water, 2015
64 Melbourne Water, 2015
65 Melbourne Water, 2015

		citizens and 2. The big market of international students [66]			travel to and from university in reasonable times • Dust control for a clean air
	Hospital Precinct: Cancer Centre, Royal Melbourne, Women's and Children's hospital,	The MMRP would better link Victorians to the hospital precinct resulting in better health outcomes. The construction stage of development must provide adequate access for patients and emergency vehicles.	• Better access for patients, staff and medical practitioners • Reduced pressure on parking • Having the trip to the hospital a less frustrating experience due to ease of access and the avoidance of road congestion and parking issues. • Increased safety for transit to and from hospital due to reduced traffic[67] •	• Unrestricted, unfettered access at all times to emergency departments • Power, water and gas services to be completely reliable during construction	• Noise being kept to reasonable standards • Reasonable access for patients, staff, medical practitioners and supplies • Infrastructure for people with disabilities and the elderly such that they can make use of the MMRP. An example could be station entry's and exits being clearly visible and lift access to the subway for those less mobile.
	Retail: Melbourne Central, Emporium, QV	Numerous retail outlets line the project corridor which will benefit from the project although the construction phase may cause issues	• More visitors and greater profits • Planning phase: Increased visibility, accessibility and interconnectivity to other services • Construction phase: Minimal impact on profits during construction phase	• Access during construction • Ability to generate revenue	• Planning: • Construction: ▪ Reasonable Access ▪ Minimal impact on profits ▪ Reasonable noise levels
	Hospitality/Entertainment Industry	Frequent, fast public transport will allow people to enjoy the city's offering of restaurants, bars, nightclubs and entertainment venues while feeling safe and not having to rely on driving (congestion, parking, alcohol)			
	Queen Victoria Market	The City of Melbourne (council) is providing massive upgrades to QVM[68]http://www.melbourne.vic.gov.au/AboutCouncil/MediaReleases/Pages/QueENVictoriaMarketattheheartofDraft2015-16Budget.aspx. The		• Due to the QVM's location, it is not thought that construction would cause any dire needs of the QVM.	• Sufficient access for customers from the east of the MMRP alignment during construction stage

66 RMIT, 2010
67 Australian Federal Government, 2013
68 City of Melbourne, 2015

		MMRP will help to provide business to the area (along with the AMURP). The corridor does not go through the QVM however			
	Sports: AFL (MCG, Docklands), Melbourne Sports and Aquarium	Sport plays a large part in Melbourne's culture and improving transport during these periods of heavy strain on the public transport system could result in greater attendees and more money being spent in the city on food, drink and entertainment	• Faster, easier access for fans • Larger attendance figures and popularity of sports	• Settlement: Geotechnical and ground water level issues to be considered in design as the tunnel is close to both the docklands area and the MCG sports precinct and the Yarra river introduces the issue of high GWL	• Safe and reliable services during peak periods
	Public: Federation Square, State Library, National Gallery	Public spaces: Liveability of Melbourne, Arts, connectedness, vibrancy, fresh air, noise reduction,	• Faster, easier access for the public • More visitors • Reduced congestion • Better walk-ability • Reduced noise from traffic • Increased vibrancy of the city	• Access to property and capital for normal business flow and maintenance works • No damage to property and capital • Safety of staff not reduced from works	• Planning: • Construction: ▪ Reasonable public access ▪ Reasonable noise levels
Emergency Services	***Fire Brigade, SES, PSO's***	These Emergency services need to have quick and reliable contingency routes during the construction phase to protect public safety and property	• Faster emergency access from reduced congestion due to the MMRP	• Construction ▪ Reliable and fast access for vehicles and personnel Planning ▪ Access to stations	
	Police stations	The St. Kilda road, Melbourne East and Melbourne North police stations are situated on the MMRP corridor/stations. High levels of access during construction is needed to maintain public security.	• Faster emergency access from reduced congestion due to the MMRP • Reduced traffic incidents • Safer means of late night transport and a safer city		
Project Runners	***PTV***	"Statutory Authority that manages Victoria's train tram and bus services" (http://ptv.vic.gov.au/about-ptv/). Invite companies to tender for day to day	PT to operate to all areas of Melbourne, and regional centres. • http://ptv.vic.gov.au/about-ptv/ptv-data-and-reports/network-development-plan-metropolitan-rail/	• Needs to meet delivery and punctuality performance monitoring standards (http://ptv.vic.gov.au/about-ptv/victoria-s-pt-network/performance-monitoring/).	Smooth operations, minimal delays, minimal crowding. • Close to 100 delivery and punctuality, with no overcrowded transport. (For all transport methods, but specifically for trains).

		operations and maintenance of PT (http://ptv.vic.gov.au/about-ptv/victoria-s-pt-network/public-transport-partnership-agreements/).	• Needs for the majority of works to be planned and remain on schedule, to limit disruptions.		
	Metro Rail	Runs the day to day operations of the metropolitan train service (http://www.metrotrains.com.au/who-we-are/).	Tracks to operate Services on. • Needs to meet PTV's performance standards, otherwise tender will be in jeopardy. • Needs for the majority of works to be planned and remain on schedule, to limit disruptions.	• More trains if going to operate more services on a metro style system.	• Less congestion to meet performance standards
	Yarra Trams	Runs the day to day operations of metropolitan tram service. Operated by Keolis Downer (http://www.yarratrams.com.au/about-us/who-we-are/).	• Needs operations to run throughout the project. • Needs for the majority of works to be planned and remain on schedule, to limit disruptions.	• Operations to be regular and on time.	• Operation to run along all routes, particularly Swanston st/st Kilda rd., with no disruptions.
	Buses	32 privately owned bus companies in Melbourne(http://en.wikipedia.org/wiki/Buses_in_Melbourne), will use transdev as an example	• Services to operate through the course of the project • Needs for the majority of works to be planned and remain on schedule, to limit disruptions.	• Minimal delays to the services during the construction of the project.	• Operations to run along all services with no disruptions.
	VLine	Operates regional train and coach services on behalf of PTV. http://www.vline.com.au/about/ourcompany/Intro.html	• Services to operate through the course of the project	• Minimal delays to the services during the construction of the project.	• Operations to run along all services with no disruptions.
	VicTrack	Government Rail agency, "number one priority is working with Public Transport Victoria (PTV) to help meet Victoria's transport challenges" https://www.victrack.com.au/en/we-are-victrack	• Rail to be operational. As with PTV and metro rail, mostly concerned with rail services operating.	Minimal track closures. • High quality track laid, that will need minimal maintenance.	• Most efficient track layout.
	Vicroads	"VicRoads plans, develops and manages the arterial road network and delivers	• No major shutdowns of freeways etc.	• No major delays to freeways	• No minor delays, shutdowns of VicRoads operated roads.

		road safety initiatives and customer focused registration and licensing service" https://www.vicroads.vic.gov.au/about-vicroads in charge of arterial roads in Victoria.			
	City Link	Owned and managed by transurban. A similar outcome desired as that by VicRoads. https://www.citylink.com.au/whatiscitylink.asp#jumpToVisitorsMap http://www.transurban.com/cityLink.htm	• As above + commercial interests.	• As above + commercial interests.	• As above + commercial interests.
	Victorian Taxi Association	Website down	• Need to be able to run the business.	• Need to be able to operate in the CBD.	• Would like access to Swanston st
	Melbourne Airport	Tullamarine. Owned and operated by Australia Pacific airports corporation limited.	• Need to be able to fly in and out of Melbourne.	• Needs project to have the option for a rail connection to the airport.	• Should not impact on anyone getting to or from the airport.
	Southern Cross Station	Operates regional and metro trains, regional coaches and airport shuttles. http://www.southerncrosstation.net.au/index.php	• Need to be able to operate trains, buses and coaches at the station.		
Users	***PT Users***	Represented by PTUA http://www.ptua.org.au/. The everyday users of public Transport.	• Need public transport to operate.	• Require a regular and timely service	• Want a comfortable trip
	Tourists	Don't really have much impact as a stakeholder. Wants, needs and requirements align with that of users.			
	Drivers	As with VicRoads.	• Need to be able to use major roads.		
	Cyclists	Bicycle network Victoria.	• Need to have access to major roads and bike paths	• Require easy access to these paths.	

Appendix B Key Issues Raw Score Matrices

Scoring Scale

- Very much better +4
- Much better +3
- Moderately better +2
- Little better +1
- No change (same as base case) 0

Table 4 Key issues score Matrices

Economic Key Issues Raw Scores

A	B	C	D	E	F	G	H
A	1.5A	2C	6A	1.5A	1.5F	2A	6A
	B	2C	3B	1.5B	1.5F	1.5B	5B
		C	7C	3C	0F	4C	3C
			D	3E	4F	1G	1H
				E	2F	1E	1.5E
					F	4F	4F
						G	1.5G
							H

Social Key Issues Raw Scores

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
A	2A	3A	3A	A/E	1A	A/G	1A	3A	1A	2A	A/L	1A	1A	2O	1A	3A	3A	3A	A/T
	B	2B	2B	2E	1F	2G	1H	2B	2J	1B	2L	1M	1N	3O	1P	2B	2B	2B	2T
		C	C/D	3E	2F	3G	2H	C/I	3J	1K	3L	2M	2N	4O	2P	C/Q	C/R	C/R	3T
			D	3E	2F	3G	2H	D/I	3J	1K	3L	2M	2N	4O	2P	D/Q	D/R	D/R	3T
				E	1E	E/G	1E	3E	1E	2E	E/L	1E	1E	2O	1E	3E	3E	3E	D/T
					F	1G	F/H	2F	1J	1K	1L	F/M	F/N	2O	F/P	2F	2F	2F	1T
						G	1G	3G	1G	2G	G/L	1G	1G	2O	1G	3G	3G	3G	G/T
							H	2H	1J	1H	1L	H/M	H/N	2O	H/P	2H	2H	2H	1T
								I	3J	1K	3L	2M	2N	4O	2P	I/Q	I/R	I/R	3T
									J	2J	1L	1J	1J	2O	1J	3J	3J	3J	1T
										K	2L	1M	1N	3O	1P	1K	1K	1K	2T
											L	1L	1L	2O	1L	3L	3L	3L	L/T
												M	M/N	2O	M/P	2M	2M	2M	1T
													N	2O	N/P	2N	2N	2N	1T
														O	3O	4O	4O	4O	2O
															P	2P	2P	2P	1T
																Q	Q/R	Q/S	3T
																	R	R/S	3T
																		S	3T

					T

ENVironmental Key Issues Raw Scores

A	B	C	D	E
A	A/B	1C	1D	2A
	B	2C	1D	3B
		C	1D	2C
			D	2D
				E

Engineering Key Issues Raw Scores

A	B	C	D	E	F	G	H	I	J
A	2A	2A	A/D	1A	A/F	2A	2A	1A	1A
	B	1C	3D	1E	3F	1G	1H	1I	1J
		C	2D	C/E	3F	1G	1H	1I	2J
			D	1D	D/F	2D	1D	3D	D/J
				E	2F	2E	1H	1E	1J
					F	3F	2F	I/G	1J
						G	1H	1I	3J
							H	1I	1J
								I	1J
									J

Integration Key Issues Raw Scores

A	B	C	D	E	F	G	H	I	J	K	L
A	1B	A/C	2A	A/E	2A	3A	3A	2A	2A	A/K	A/L
	B	B/C	1B	1B	1B	3B	3B	1B	2B	B/K	1B
		C	1C	1E	1C	2C	2C	1C	1C	C/K	C/L
			D	2E	1F	1.5D	1.5D	1D	2D	D/K	1L
				E	1E	3E	3E	1E	2E	1E	1E
					F	3F	3F	1F	1F	1F	1F
						G	G/H	1I	1J	1.5K	1L
							H	1I	2J	2K	1L
								I	1J	1K	1L
									J	K/J	1J
										K	2K
											L

Appendix C Station Assessment Tables

Table 5 Station Assessment Tables

CATEGORY	Evaluation Criteria	Significance weighting (%)	Selection Criteria	Station Relevance	Assessment	Raw Score	Category relevance score	Weighted Score
ECONOMIC	E-A	22.5	PTI Capacity Boost	1	Capacity boost of overall line (Non-diff). Proposed 14,000 jobs to be generated. Area surrounding Proposed station is industrial and is capable of housing employee growth. Therefore distance is very close.	4		0.9
	E-B	16.6	Expected Travel Times	1	The station guides the growth of the entire area. With aligned job and residential numbers targets (22,500 & 20,050 respectively), the home-work travel times in the area can be expected to be small. However, as the MMRP increases flow to the city, it will not ease employment access from outer Melbourne	3		0.5
	E-C	26.5	Business productivity growth	1	Given the mutual growth in business and residential, the potential from agglomeration benefits is high in the area.	3.5		
			Productivity decrease during construction	1	Whilst methods of construction of the station may have varying effects on local businesses in the area (although this is not such an issue in AM which is mainly industrial at this stage.) the location of the station (in currently industrial areas) has low proximity to other PTI, therefore the AM station scores high in this category	5		
			Increased travel efficiency in employment areas	1	This is already covered above	4		
			Agglomeration Benefits	1	The MMRP AM station provides quick access to the CBD. However the zoned business areas relative to the metro station are 10-15 minutes walks away. This limits the ability of the station to connect the two business areas. However business connectivity within the area has potential to be high	2		
					AVERAGE	3.6		1.0
	E-E	7.3	Revenue from usage	1	Low initially, however will grow as station is closest to proposed Arden central	3		
			Costs from damages (liability claims)	1	The proposed station location in AM is located in purely industrial zones, as such the risk to damage of property is low, and any associated cost would also be low.	4		
			Cost of disruptions during conc.	1	Located in highly industrial zone, with little residential or key structures around it. However the only major access road is Macaulay road, there is potential for congestion here.	3		
			Property Acquisition costs	1	Low, as major structures at station location are industrial complex (therefore performance in this category is high	4		
			Projected economic growth from investing in health	0	N/A			
			Productivity due to better health outcomes	0	N/A			
			Public health care costs reduced due to healthier citizens	0	N/A			
			Attracting tourists to more attractions	0.2	The station provides no access to heritage or tourist attractions on the AM area.	0.2		

			Promoting nightlife	0.5	The station is located at least a 10-15 minute walk to the three proposed central activity areas, therefore limiting the potential for patrons to the station to access the potential nightlife in these three areas.	0.75		
					AVERAGE	2.5		0.2
	E-F	22.5	Population/employment growth in station locations	1	COVERED IN ROW 2	4		
			increased ticket sales	1	As access to the station from residential and business areas is not as direct as say a CBD station, the level of ticket sales is expected to be lower than it could be if more central to proposed more populated zoned areas	2		
					AVERAGE	3		0.7
	E-G	3.3	Jobs created during project delivery and flow on benefits	1	More workers expected in the area, however in Arden, the areas where workers may travel to are far from the construction site, limiting any boost to the local economy	2		0.1
	E-H	1.3	Minimal disruption to PTI	1	PTI will be re-directed to the area and connected after construction takes place, therefore there will be little disruptions to current PTI due to constructions.	4		
			Minimal disruption to roads and paths	1	The only road that may suffer (Depending on tunnel construction technique) is Macaulay road, as it will provide access to the station construction site. There are no paths in the station construction site area.	4		
			Minimal disruption to Yarra River operations	0	N/A	0		
			Disruption to rev generating public events	1	Not many public events held in Arden Macaulay, and the ones that are normally held in the northern section of the area (So no disruptions and scores highly in the area)	4		
					AVERAGE	3		0.04
		100					0.22	0.7
SOCIAL	S-A	8.7	Increased capacity of rail and proximity to other transport options	1	Important vehicular and freight trips are delivered through and within Arden-Macaulay area. Promoting a change in transport usage on the network is expected to produce a long term shift from private cars. The station will encourage the shift of transport usage supporting the requirements of the structure plan.	5		0.4
	S-B	3.8	Disruption to PTI in the area	1	Arden-Macaulay counts with four railway stations including access to three lines, two tram routes and five bus routes. The area is served by existing public transport service, but with an issue of long waiting times that creates agglomeration. It is important to avoid disruptions to the service by the work produced in the station providing measures to limit disruption times especially during rush hours.	3		0.1
	S-E	8.7	Qualitative assessment of risk	0	N/A	0		0
	S-F	4.4	Truck congestion near the stations construction sites	1	Macaulay road is very close to this site, this is a main road and congestion may occur during construction. However this is not near shops or residential areas	3		
			Proximity of construction site to businesses and residential structures	1	Currently industrial area surrounding construction site	3		
					AVERAGE	3		0.1
	S-G	8.7	Proposed PTI growth rate Compared with car usage %	1	Residential and employment is set to grow in the area. With a metro station in close proximity to the area, there will be less reliance on cars	4		
			Assess potential reductions	1	Several main roads and a freeway in the area. This gives potential for large transfer of patrons from car to PTI in the area.	4		
					AVERAGE	4		0.3
	S-H	4.7	Re-zoning plans associated with station location	1	Re-zoning plans associated to the area are required to be considered and evaluated to locate the station and the entry and exit points. The projected community and business development is an important consideration for the project.	5		0.2
	S-J	7.8	Level of improved access to Hospitals and UoM	0	N/A	0		
			Standard of healthcare	0	N/A	0		
					AVERAGE	0		0
	S-K	2.0		1	Due to the urban renewal taking place in the area, the construction of the station and the project in general is required to provide the facilities to avoid generating spaces that will affect to the aesthetic of the precinct.	5		0.1

	S-L	8.7	Potential increased access and funding to education in the area facilities	0	N/A	0		0
	S-M	4.7	Potential increased access to the CBD and Employment to those who may not otherwise	1	The social equity is expected to be upgraded due to the location of the station which will serve to new neighbourhoods and the workers for the industrial business improving their lifestyle.	4		0.2
	S-N	4.7	Assessment of Plans	1	Arden-Macaulay counts with a poor walking and cycling network because the paths does not seem safe or attractive for users. Some issues include unpleasant environments, poor visibility, lack of shade and vegetation and poor connectivity. On the other hand, the proximity to the CBD presents a great possibility for cycling to become a primary transport mean. It is expected that the urban renewal approach and the benefits presented by the metro connectivity will improve the usage of these means.	5		0.2
	S-O	15.4	Assessment of Plans	1	The activity is expected to be increased in the precinct specially because it is expected to become an extension of the CBD, so the project and the station of Arden Macaulay is going to produce and increase of attraction points in this centre.	5		0.8
	S-P	4.7	Assessment of Plans	1	The tourist attractions on the area are limited and are mainly about green areas or old industry spots. The station will generate a new attraction point that will give the opportunity for creating new attraction places. Additionally, it will give the possibility of providing tourists a easy mean of transportation to the CBD and important tourism attractions.	2		0.1
	S-T	8.7		1	Arden-Macaulay counts with four railway stations including access to three lines, two tram routes and five bus routes. The area is served by existing public transport service, but with an issue of long waiting times that creates agglomeration. It is important to avoid disruptions to the service by the work produced in the station providing measures to limit disruption times especially during rush hours.	3		
		95.7					0.20	0.6
ENVIRONMENTAL	ENV-A	14.3	Proximity to parks, flora and fauna for construction and usage phases	1	Not close to parks however there is a creek adjacent	3		
			Effect of foot traffic on surrounding plant and animal life. The resilience of the area to excessive pedestrian traffic	1	There are no particularly sensitive areas nearby	5		
			Effect of groundwater changes	1	There is a creek nearby, groundwater change from construction and usage phases could be detrimental	1		
					AVERAGE	3		0.4
	ENV-B	21.4	Biodiversity in surroundings; less and biodiversity will mean greater opportunity provided there is adequate space (e.g. area on footpath to plant trees), thus a higher score	1	Underutilised area to be revamped by the Arden Macaulay Urban Renewal Project (City of Melbourne, 2012)	4		0.9
	ENV-C	35.7	Groundwater level at site location	1	Information not available	-		
			Proximity to flowing water sources & ability to contain possible contamination	1	Close proximity to creek	2		
					AVERAGE	2		0.4
	ENV-D	28.6	Proximity	1	Few heritage sites nearby	5		1.4
	ENV-E	0.0	The embodied energy for design and construction for the particular site location					0
		100					0.18	0.6
ENGINEERING	ENG-A	18.0	Road access	1	Good road access	5		
			Surrounding heritage sites	1	Few heritage sites nearby	4		
			Surrounding infrastructure	1	Not a densely populated area	4		
			Surrounding buildings	1	Not a densely populated area	4		

			EPA regulations re: noise/vibration/dust/groundwater contamination/pollution during construction	1	Not a densely populated area	4		
					AVERAGE	4.2		0.8
	ENG-B	0.0	Background check of potential design/construct bidders history to build in site conditions specific to the region					0
	ENG-C	2.0	Research similar projects to find past successes and failures to counter optimism bias and unrealistic time, cost, scope and quality assumptions	1	Constructability	4.2		
			Planning and design phases adequately funded with sufficient time	1	Information not available	-		
					AVERAGE	4.2		0.08
	ENG-D	19.0	Constructability	1	As derived from criteria A	4.2		
			Experience of design and construction companies	1	Information not available	-		
			Adequate budget designated for planning	1	Information not available	-		
					AVERAGE	4.2		0.8
	ENG-E	6.0	Disruptions to traffic	1	Traffic flows are relatively lower	4		
			Disruptions to trunk services	1	not a densely populated area	5		
			Contingent options available for PT users and car routes that have been blocked	1	not a densely populated area	4		
					AVERAGE	4.33		0.3
	ENG-F	21.0	Settlement along alignment	1	Citylink nearby, possible settlement problems if not carefully managed and designed for. However there are no other significant buildings nearby as compared to other potential sites in the CBD	3		
			Station construction requirements	1	Information not available	-		
			Importance of structures above alignment	1	Information not available	-		
			Vertical configuration	1	Information not available	-		
			Proximity to building foundations	1	Mainly industrial, no deep foundations in the area	3		
			Soil conditions	1	Sandy-clay	3		
					AVERAGE	3		0.6
	ENG-G	3.0	Traffic in area	1	Some traffic during peak times but relatively minor in comparison to other potential sites	3.5		
			Feasibility of entry of large vehicles	1	Good access	4		
					AVERAGE	3.75		0.1
	ENG-H	6.0	Proximity of landscape features such as trees, creeks and rivers, parks and heritage sites	1	Nearby creek	2		

	ENG-I	6.0	Surrounding confinement above ground and below; buildings, foundations and trunk services	1	not a densely populated area	5		
	ENG -J	18.0	Constructability	1	Refer to criteria A	4.2		
			Desired Quality of design	1	Information not available	-		
			Area specific requirements of design of station due to geotechnical factors and integration of station with surroundings	1	Information not available	-		
					AVERAGE	4.2		0.8
		99.0					0.19	0.75
	INT-A	16.2	Assessment of wider PTI Plans	1	Current discussion regarding newer projects hinge on the Arden station, suggesting the station will enable a wide range of newer projects	4		0.65
INTEGRATION	INT-B	16.2	Assessment of Plans in regards to other Metro rail	1	Due to the separation of train lines, Arden will not become a transport hub for the north-west	1		
			Easing crowding of other train lines	1	Poor given the distance to other train line stations. And singular connection to wider Melbourne train line.	2		
			Assessment of Plans in regards to other Regional rail	1	Plans to run regional rail tunnels suggest the designs for the Arden station will incorporate regional access and associated facilities well	1		
					Average	1.33		0.3
	INT-C	13.9	Amount of other PT in area	1	AM is to be shaped around the station, as such other PTI will be adjusted to integrate effectively with the Arden station	4		
			Distance to other PTI access	1	AM is to be shaped around the station, as such other PTI will be adjusted to integrate effectively with the Arden station	4		
			Number of proposed storage facilities for bikes, cars etc.	1	This is dependent on final implementation, however the objectives of AM suggest a strong focus on promoting this in AM.	4		
					Average	4		0.4
	INT-D	10.4	Proximity of proposed station to proposed city centres	1	Closest centre is 5-10 minute walk, however the other proposed central areas are further away. Furthermore, the distance from the proposed Arden station to other train lines is far.	1		0
			Distance to other PTI access	1	AM is to be shaped around the station, as such other PTI will be adjusted to integrate effectively with the Arden station	4		0
					Average	2.5		0.2
	INT-F	19.1	Assessment of Plans	0	N/A	0		0
	INT-I	3.5	Location in regards to other unutilised	1	Close, and more will be built, allowing for integration with the tunnel.	4		
			Nature of infrastructure in close proximity (over/under utilised)	1	High score due to usage of pre-existing trunks services, warehouse conversion from low use to high use, easing congestion in area	4		
					Average	4		0.1
	INT-J	8.7	Connecting bike routes	1	AM is to be shaped around the station, as such other cycling tracks will be adjusted to integrate effectively with the Arden station	4		0.2
	INT-K	13.0	Assessment of Plans	1	Good access: no obstruction to roads, away from hospital precinct	4		0.3
	INT-L	7.0	Assessment of Plans	1	Extension of boundary road, Improve access and amenities for pedestrians; walkability. Station location is carefully integrated in the AMURP	4		0.2
							0.23	0.5
						Total Station Score		3.15

Appendix D Location of heritage sites

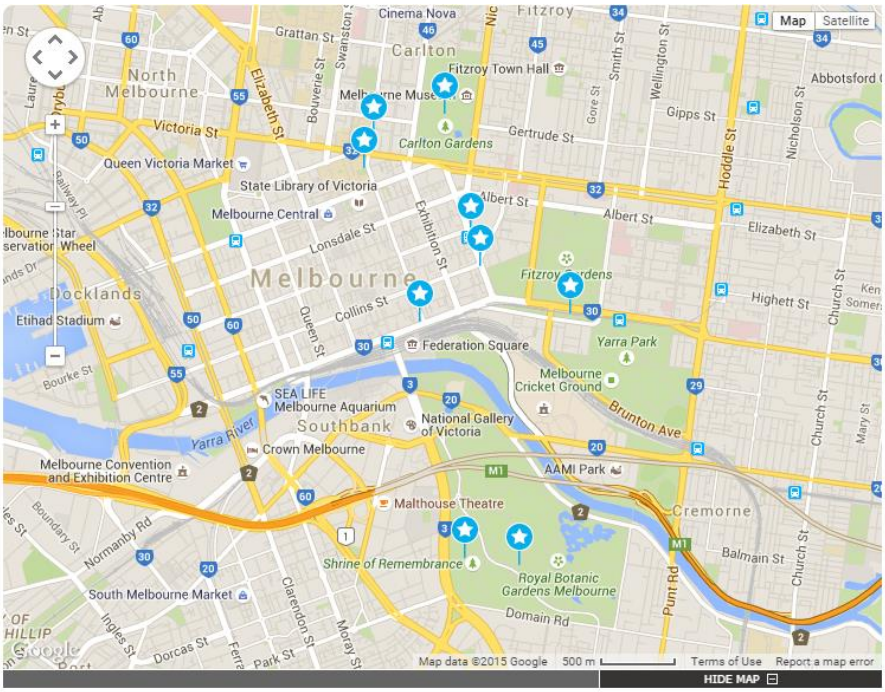

Figure 2 Heritage listed sites (Victorian State Government, 2015)