Shepparton Passenger Rail Improvements Economic Impact Study

Prepared for Greater Shepparton City Council

Final Report – April 2017

Independent insight.

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Executive Summary

SGS was commissioned by the Greater Shepparton City Council to provide a cost benefit analysis of improved passenger rail services to between Melbourne and Shepparton.

Base Case and Project Case

Since January 2017 Shepparton has been served by four return rail services to Melbourne on weekdays and two on weekends with an average journey times of at least two and a half hours. The continuation of this service was the Base Case for this cost benefit analysis.

The Project Case is based on Scenario 2A as described in the *Shepparton Passenger Service Project* report prepared by GHD (dated March 2017). Under this scenario Shepparton would be served by eight return rail services to Melbourne on weekdays and seven on weekends, with journey times of 2 hours and 20 minutes in peak periods and 2 hours and 10 minutes off-peak. These improvements will also result in significantly higher levels of service to the Shepparton, Mooroopna, Murchison East and Nagambie stations.

The following assumptions have informed the modelling of the costs and benefits associated with the improved service:

- Design and construction commences in the 2018 financial year (17/18) and takes four years;
- Improved services commence operation in the 2022 financial year (21/22);
- Increased patronage progressively ramps up between 2022 and 2025;
- Patronage settles at a new 'equilibrium' from year 2025 onwards;
- 50% of new rail passengers area result of mode shift from car travel (1.5 persons per vehicle);
- 50% of new rail passengers are induced travel (they would not travel in the Base Case).

Costs

To allow a more frequent and faster rail service additional rolling stock and rail infrastructure upgrades will be required. Rolling stock upgrades will be to the VLocity type with a requirement for 4 x 3-car sets. The rail corridor between Seymour and Shepparton will need to be upgraded to meet operating and safety requirements of the new rolling stock. The total cost of additional rolling stock and other upgrade works has been estimated to be $186 million (GHD, 2017).

Benefits

The potential benefits of improved passenger rail for Shepparton are:

- User benefits (travel time savings; reduced travel costs and productivity benefits)
- Reduced externalities from vehicle usage
- Health benefits derived from increased physical activity;
- Enhanced business productivity
- Human capital improvements
- Improved housing choice (i.e. a greater share of infill vs greenfield development)
- Reduce infrastructure costs (as a result of an increase in the share of infill development)
- More balanced spatial development of Victoria; and
- Option and non-use value.

Patronage assumptions

Improvements in the frequency, speed and reliability of rail services to Shepparton will result in higher patronage. A key question for estimating the benefits of the improved service is the size of this patronage increase.

The current service provides capacity for approximately 550,000 trips per annum. The estimated total number of passengers boarding and alighting at Shepparton, Mooroopna, Murchison East and Nagambie stations was 155,000 per annum in 2016 (based on data from November and assuming this is a typical patronage month). This equates to an *average* occupancy between Seymour and Shepparton of 28% of the available capacity, although occupancy of individual services varies significantly from as low as 5% and up to 60%.

Under the Base Case capacity will increase to 1.7 million trips per annum. A doubling of patronage would utilise, on average, 18% of the Project Case capacity; a 2.5 times increase in patronage would utilise 23% of the total capacity; and a tripling of patronage would utilise 27% of total capacity, almost matching the current average occupancy.

To put these figures in context, the introduction of the Regional Fast Rail (RFR) service to Bendigo coincided with significant increases in patronage. Passenger numbers more than doubled in four years, increasing from 1.5 million passengers in 2005/6 to over three million in 2009/10. Passenger numbers for the Traralgon service increased by a similar magnitude. All services that benefited from the RFR service improvements saw increases in passenger numbers of at least one million passengers over the same four year period.

CBA results

The table below present the findings of the CBA based on the three different patronage scenarios:

- A doubling of passenger numbers relative to the Base Case;
- A 2.5 times increase in passenger numbers relative to the Base Case; and
- A tripling of passenger numbers relative to the Base Case.

The first set of results in the table is the base CBA results. The second set includes option and non-use value benefits.

Under the mid-patronage scenario the net present value is a loss of $31 million dollars and the cost benefit ratio 0.85. The high-patronage scenario returns a positive NPV of $24 million and a BCR of 1.12.

When the option and non-use value benefits are included the NPVs and BCRs improve significantly with the mid-patronage scenario returning an NPV of $12 million and a BCR 1.06.

CBA RESULTS ($ MILLIONS)

Patronage scenario relative to Base Case	Results excluding non-use and option value		Results with non-use and option value		Annual passengers by year 8*
	NPV	BCR	NPV	BCR	
2x patronage	$(85)	0.58	$(56)	0.73	300,000
2.5 patronage	$(31)	0.85	$12	1.06	400,000
3x patronage	$24	1.12	$81	1.40	500,000

* Four years after the introduction of the improved passenger rail service.

Additional benefits not included in this CBA

It is likely that improvements to the Shepparton passenger rail service will result in additional direct rail services to Seymour. The benefits to Seymour users were not addressed in this CBA however they are likely to be significant. Service improvements could also have a catalytic effect on the renewal of the Shepparton station precinct. These additional benefits and should be considered in future work assessing the merits of the proposed passenger rail service improvements.

1. Introduction

This chapter provides the context for the study and gives a general overview of cost benefit analysis.

1.1 Context

The current rail service between Melbourne and Shepparton has traditionally been treated as a long-haul service providing journey times of between two hours and 30 minutes and two hours and 50 minutes. Enhancing this service to reduce the travel time to Melbourne and provide more frequent services will benefit Shepparton and its surrounding communities. These benefits would be both financial (e.g. cost savings due to reduce private vehicle usage) and non-financial (e.g. travel time savings and reduced pollution).

When assessing the merits of infrastructure investments, governments are obliged to consider the full range of economic, social, and environmental costs and benefits. This is typically done via cost benefit analysis (CBA).

CBA calculates the net costs and net benefits against a 'do nothing' or Base Case situation in this case maintaining the current rail service as is. The Project Case assumed the introduction of additional rail services between Shepparton and Southern Cross. Replacement of rolling stock and upgrades to the rail line, and works at level crossings will also be required.

This study has been informed by a parallel commission undertaken by GHD to estimate the costs of the rolling stock, infrastructure upgrades and additional operating costs. This CBA was guided by the Department of Treasury and Finance's guidelines for assessing infrastructure investments within the state of Victoria. This type of analysis requires that both financial and non-financial costs and benefits to be monetised and discounted to the present day to establish the expected net community benefit over the life of the investment.

1.2 Purpose of this report

This report presents the results from the CBA and financial analysis. The chapters following this introductory chapter provide:

- Key background data including population, employment and patronage data;
- A description of the Base Case (business as usual) and Project Case (improved passenger rail);
- A description of the anticipated costs and benefits; and
- The findings of the CBA and financial analysis.

1.3 What is cost-benefit analysis?

Cost benefit analysis (CBA) in government policy development

Cost benefit analysis is an approach routinely used to evaluate the merits of a projects and/or to distinguish between a series of project options. As specified in State Government guidelines, CBA must address the full spectrum of environmental, social, and business impacts of the proposal at hand. Positive and negative effects are quantified and monetised (expressed in dollar terms) as far as possible and then compared to arrive at a conclusion as to whether the proposal is likely to make the community better off, or worse off, in net terms compared with persevering with business as usual conditions.

The principal steps in the generic cost benefit analysis method (see Figure 1) include:

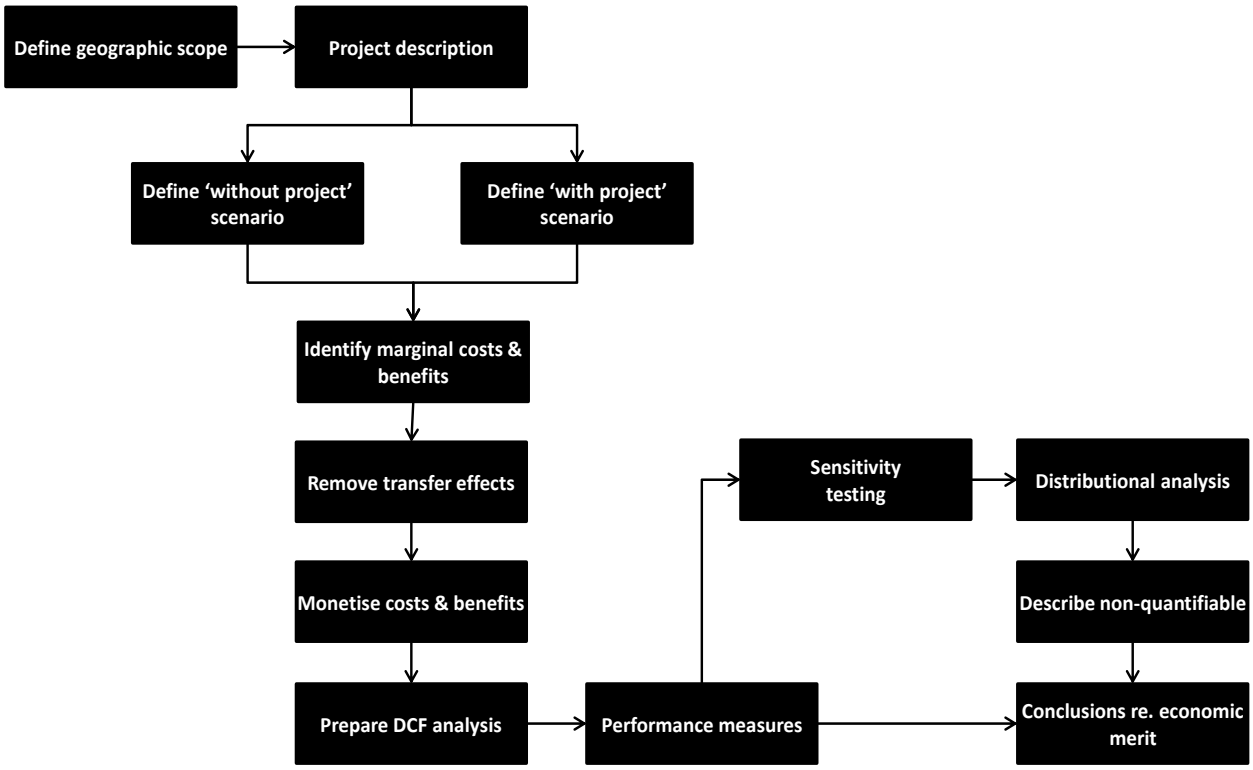
- Differentiating between the outcomes under a 'business as usual' or 'Base Case' scenario (maintain current rail services and timetable), and the Project Case (extension of a number of rail services to Shepparton);
- Identifying the economic, social, and environmental costs and benefits that might arise in moving from the Base Case to the Project Cases;
- Quantifying and monetising these costs and benefits, where possible, over a suitable project evaluation period (in this case 30 years) and with due acknowledgment of on-going benefits and costs;
- Generating measures of net community impact using discounted cash flow techniques over the 30 years in question; this requires expression of future costs and benefits in present value terms using a discount rate that is reflective of the opportunity costs of resources diverted to the implementation of the Project Cases;
- Testing the sensitivity of these measures to changes in the underlying assumptions utilised; and
- Supplementing this quantitative analysis with a description of costs and benefits that cannot be readily quantified and monetised.

It is important to note that all impacts of the proposed project versus the Base Case must be taken into account, whether or not they are 'traded' effects or 'externalities'. Traded costs and benefits are those which have a financial value in the market. Externalities on the other hand are unpriced costs and benefits sustained by third parties in any market transaction. The cost benefit analysis must account for these impacts even though they are not directly mediated (bought and sold) in the market. The monetised value of these external effects needs to be imputed using a variety of techniques as advised by DTF in its Cost Benefit Analysis Tool Kit.

Another vital characteristic of cost benefit analysis is that the community benefit delivered by this regulatory initiative is judged by reference to the 'Kaldor-Hicks' rule. This states that the initiative in question is worth undertaking if the gain in welfare by the beneficiaries is greater than the loss in welfare for those adversely affected. In other words, a particular Project Case would be warranted if the beneficiaries could, if required, compensate those adversely affected and still be better off. This is where the term 'net' community benefit comes from. Whether such compensation is actually paid is not material.

The 'Kaldor Hicks' rule differs from the 'Pareto' test which is sometimes invoked in town planning practice. The Pareto test is that an initiative is only warranted if there are no losers in the process. The Pareto test is not sanctioned in regulatory impact assessment because it places an unworkable onus of proof on the economic merits of a project.

FIGURE 1. COST BENEFIT ANALYSIS METHOD



1.4 Limitations and common problems

There are some common pitfalls in assessment of net community benefit. One is to confuse 'economic impact' with 'economic benefit'. The former deals with the commercial flow on effects of an initiative or program (sales made, people employed, suppliers contracted etc.), while the latter relates to an improvement in community welfare.

By way of illustration, a $10 million construction contract to dig a long trench then fill it up again would generate the same economic *impact* (i.e. multiplier) as a $10 million contract using the same equipment and workers to undertake earthworks for the improvement of a parkland. The economic *benefit* from the latter is clearly superior to the former.

Another pitfall is to construe construction and operational jobs as a 'benefit' of a proposal whereas they are typically factored into cost benefit analyses as a cost. This is because the labour in question has an opportunity cost – it could be deployed elsewhere to produce benefits for the community were it not for the project at hand. Employment is usually only counted as a benefit when the project creates jobs for people who would otherwise be permanently unemployed or underemployed.

For these reasons, amongst others, the DTF advises that the use of economic multipliers should generally be avoided in economic (CBA) evaluations.

A third common misapplication of economic thinking to the net community benefit test is to implicitly or explicitly confine the analysis to the local district or host region of the development in question. Again, in line with usual advice offered by jurisdictional Treasuries, the frame for assessing net community benefit should be set at the State jurisdiction level. To do otherwise runs the risk of patently illogical findings; that is, a net community benefit may be found for the local area, but this might be more than offset by transfers or external costs for neighbouring communities or the host metropolitan area or state.

The upshot, in the case of increased rail services to Shepparton, is that a given Project Case must be demonstrated to generate a net community benefit at the level of the State and not necessarily at the local or district levels.

1.5 Financial analysis

The financial analysis is essentially a subset of the cost-benefit analysis. It takes into account the *financial* costs and benefits relevant to the project, and seeks to determine if the best option, as shown by the CBA, is feasible from the perspective of those who bear the financial impacts.

While the purpose of the CBA is to show which option is best from a whole community perspective, the purpose of the financial assessment is to allow relevant parties to make a decision on whether or not this option is realistic from a financial perspective.

In this particular case, where State Government funding is required, the financial assessment considers the financial investment the Victorian Government will need to make to improved passenger rail services between Southern Cross and Shepparton.

TABLE 1. FINANCIAL ANALYSIS

Item	Notional timing	Data source	Type
Infrastructure/build costs	Years 1 to 3	GHD	Capital
Rolling stock	Year 4	GHD	Capital
Additional operating costs	Year 4 onwards	GHD	Operating

Source: GHD, 2017.

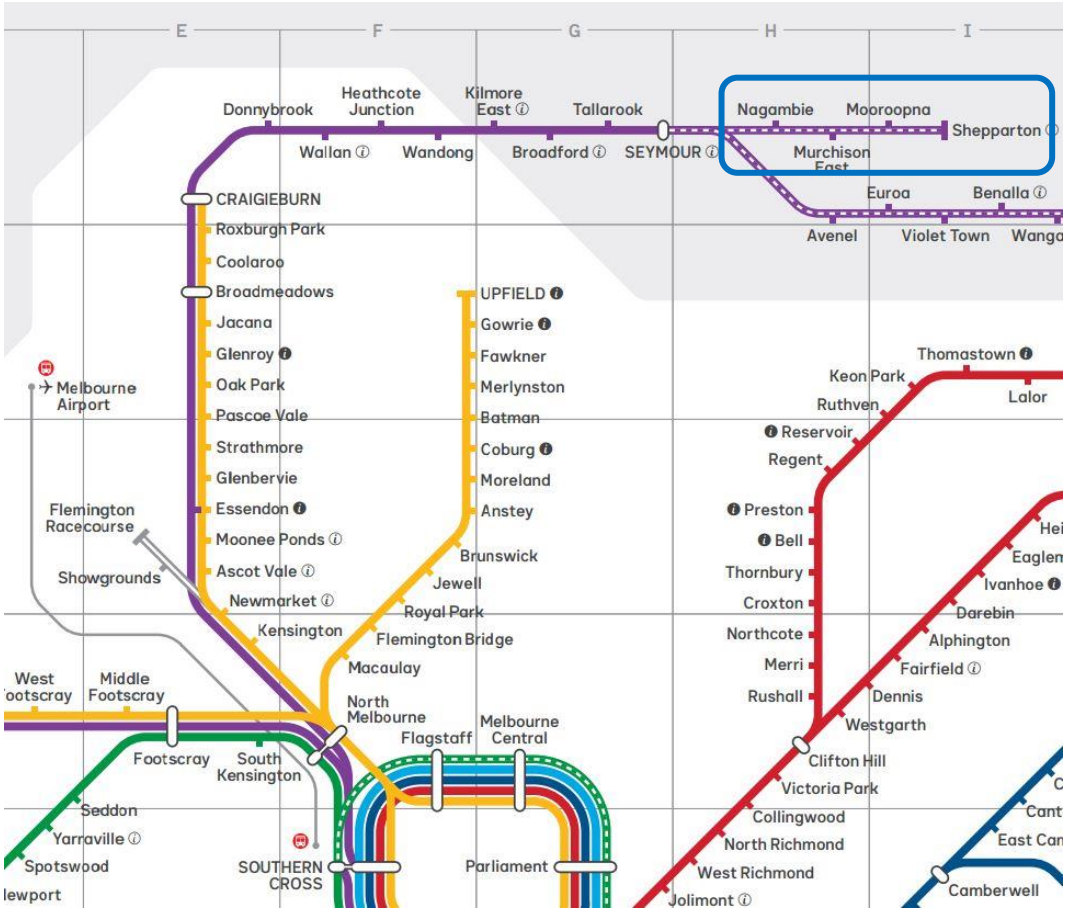
2. Background

This chapter provides background data relevant to the cost benefit analysis.

2.1 Context

Improvements to Shepparton's passenger rail service would require upgrades to the section of the Shepparton line between Seymour and Shepparton that is approximately 85 kilometres in length and includes the stations of Nagambie, Murchison East, Mooroopna and Shepparton (see Figure 2).

FIGURE 2. NORTHERN VICTORIA'S RAIL NETWORK



Source: PTV Train Network Map 2017 (https://static.ptv.vic.gov.au/Maps/1482457134/PTV_Train-Network-Map_2017.pdf)

2.2 Population and employment projections

Catchment

For the purpose of this CBA an indicative catchment for rail passengers served by the Shepparton rail service via stations at Nagambie, Murchison East, Mooroopna and Shepparton was developed.

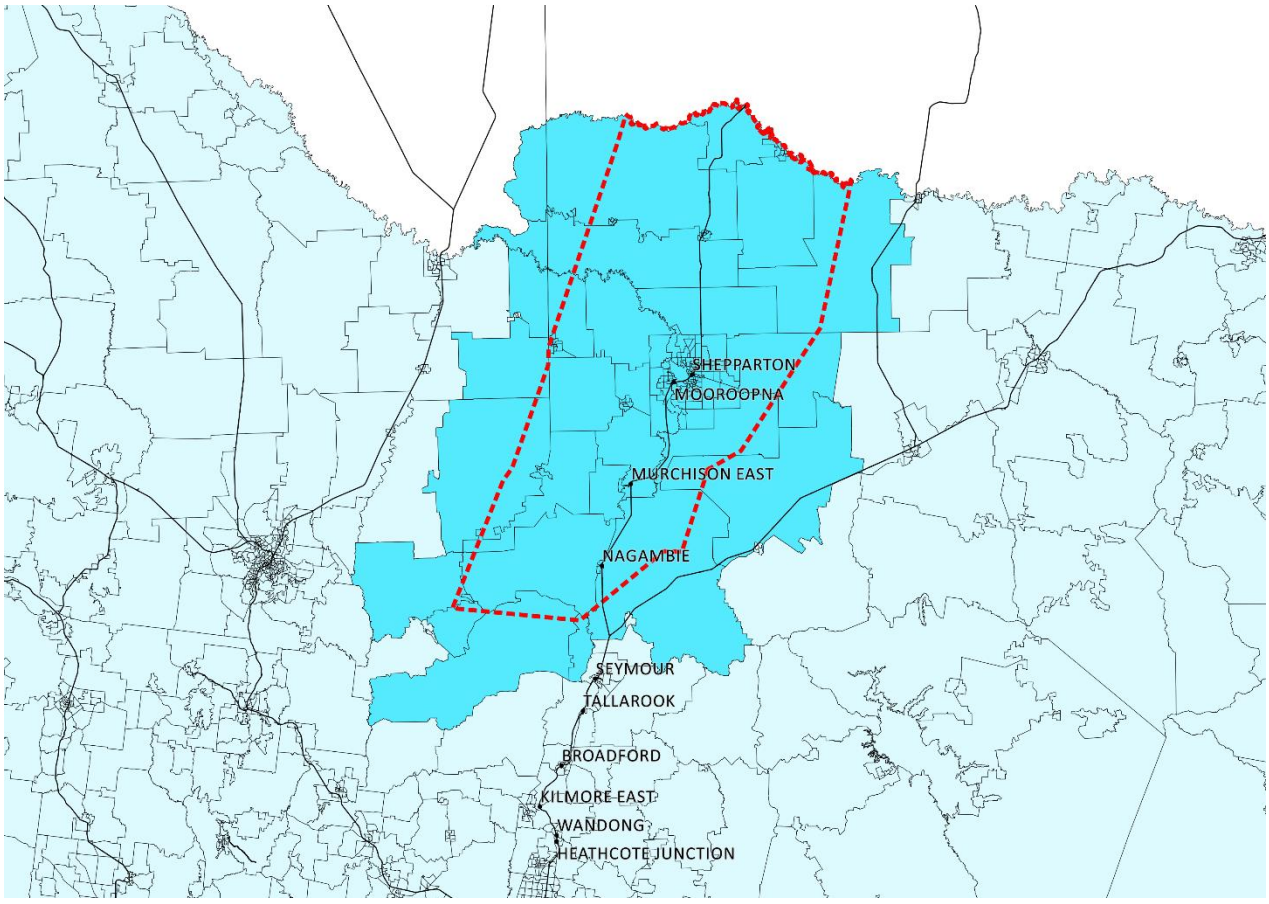
This was done by determining the areas for which these stations were the closest option (by a 'crow flies' measure) compared to alternative stations on alternative rail lines. The boundary of this area is shown as the dashed red line in Figure 3 below.

Population and employment projections for this catchment were estimated using an area-overlap procedure. This allocates a proportion of the total Travel Zone (TZ) population forecast or employment forecast, based on the area proportion of the TZ within the red boundary shown. For TZs entirely within the catchment, 100% of the population or employment was considered within the catchment. For a TZ where 10% of the area is within the red boundary, 10% of the population or employment was considered as falling within the catchment.

This catchment serves as an estimate only. There may be passengers from outside this area that use the Shepparton rail service (such as the Yarrawonga and Echuca area) as well as passengers within the area that use alternative services. Factors such as driving distance and times will affect whether passengers use the Shepparton line or an alternative rail services.

Regardless of these nuances the approach employed provides, in aggregate, a reasonable indication of the size of the population that might access the Shepparton service now and in the future.

FIGURE 3. TRAVEL ZONES IN THE SHEPPARTON RAIL CATCHMENT



Source: SGSEP Pty Ltd.

Population and employment forecasts to 2051

The population forecasts used in the CBA are based on Victoria in the Future data from 2016 (Table 2). The employment forecasts used are based on modelling prepared by SGS (Table 3). These forecasts are used for both the Base Case and Project Case.[1]

TABLE 2. POPULATION FORECASTS

	2016	2021	2026	2031	2036	2041	2046	2051
Nagambie	5,300	5,300	5,400	5,800	6,000	6,100	6,200	6,300
Murchison	3,100	3,200	3,200	3,300	3,400	3,500	3,600	3,700
Mooroopna	7,700	6,700	5,800	5,200	4,800	4,500	4,300	4,200
Shepparton	59,100	61,700	64,600	68,100	72,100	76,500	81,100	85,700
Total	75,200	76,900	79,000	82,400	86,300	90,600	95,200	99,900

Source: SGS analysis of VIF, 2015.

TABLE 3. EMPLOYMENT FORECASTS

	2016	2021	2026	2031	2036	2041	2046	2051
Nagambie	2,400	2,600	2,700	2,700	2,800	3,000	2,600	2,700
Murchison	1,300	1,300	1,400	1,400	1,500	1,600	1,800	1,800
Mooroopna	4,100	4,400	4,600	4,900	5,200	5,700	6,000	6,400
Shepparton	30,500	32,900	34,500	37,000	39,200	42,400	45,300	47,700
Total	38,300	41,200	43,200	46,000	48,700	52,700	55,700	58,600

Source: SGS Economics and Planning Pty Ltd

2.3 Current and projected rail patronage

Current patronage

In 2016 Shepparton was served by three northbound and four southbound services on weekdays and two services in each direction on Saturday and Sunday. Patronage data for 2016 suggests that, on average, around 200 passengers boarded and alighted from the Shepparton rail services between the Shepparton and Nagambie stations per day in 2016 (see Table 4 and Table 5). The data also suggests average daily boardings were slightly higher than the average daily alights (224 vs 200).

If November was a typical number, the total implied annual passengers numbers are 73,100 alights and 81,800 boardings. 78% of boardings and alights are at Shepparton Station, 7% at Mooroopna, 12% at Murchison East and 3% at Nagambie.

The total number of trips in both directions, 155,000, is roughly double the population within the catchment identified above (75,100). Based on this metric, the number of passengers using the service is approximate double the population in the catchment.

TABLE 4. AVERAGE DAILY ALIGHTS NOVEMBER 2016 (NORTHBOUND)

	Nagambie	Murchison East	Mooroopna	Shepparton	Total
Weekday	7	24	14	157	202
Saturday	5	28	13	148	195
Sunday	5	22	19	152	197
Weighted average	6	24	14	155	200
Implied passengers per annum					73,100

Source: PTV, 2017.

[1] If service improvements were to attract additional growth above the base projections, this would most likely be the diversion of growth from other locations within Victoria, rather than a net increase for the state as a whole. Additional growth beyond current projections for Shepparton could be the result of diversion of households from Bendigo or greenfield areas on Melbourne's urban fringe. Such shifts in the patterns of growth within the state may not constitute a net benefit (or cost), if the resulting travel behaviours, productivity and human capital outcomes of the diverted households was unaffected by their change in location.

TABLE 5. AVERAGE DAILY BOARDINGS NOVEMBER 2016 (SOUTHBOUND)

	Shepparton	Mooroopna	Murchison East	Nagambie	Total
Weekday	182	13	30	6	232
Saturday	157	18	28	4	207
Sunday	169	13	18	4	204
Weighted average	176	14	28	6	224
Implied passengers per annum					81,800

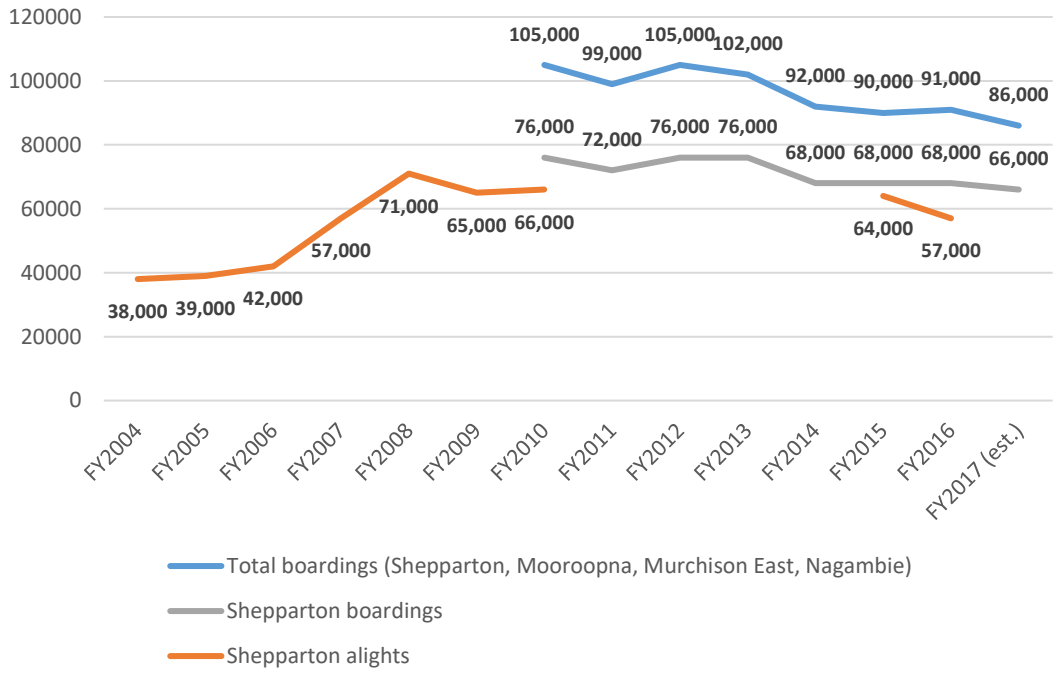
Source: PTV, 2017.

Longer term passengers trends

Total patronage for the four station north of Seymour has been progressively declining since 2010. This data could be interpreted as indicating that demand for passenger rail, based on the current level of services, has peaked. Despite population growth, the number of passengers using the service has apparently decrease. Passenger boarding at Shepparton Station have declined by 10,000 since 2010.

The number of passengers alighting at Shepparton increased between 2004 and 2016 from fewer than 40,000 passengers per annum to around 57,000 in 2016. Passengers alighting at Shepparton peaked at in 2008 at 71,000 passengers per annum.

FIGURE 4. BOARDINGS (ALL STATIONS AND SHEPPARTON) AND ALIGHTS (SHEPPARTON ONLY)

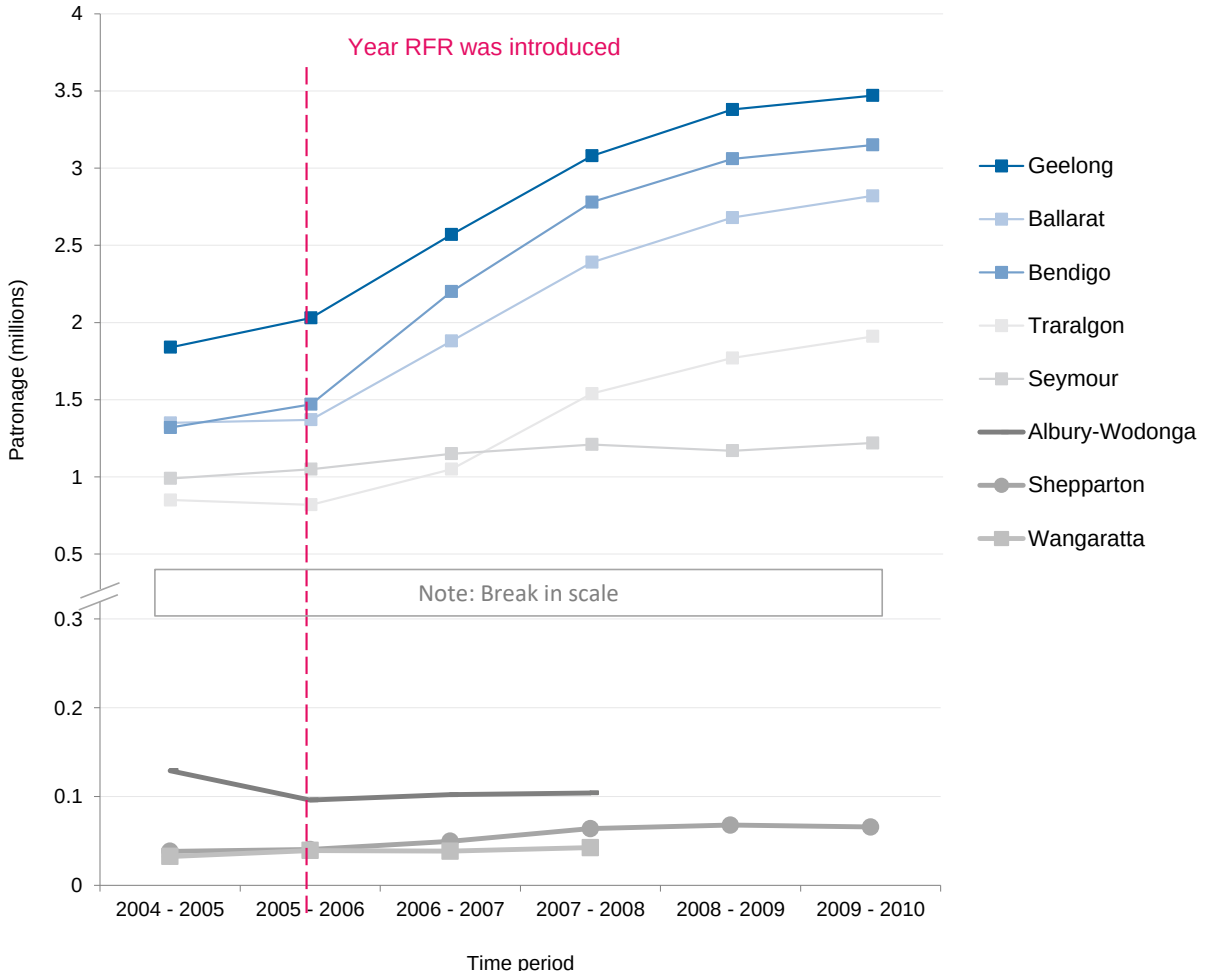


Source: V/Line (Total boardings series 2010 to 2017); PTV (Shepparton data, 2015 and 2016); GHD (Shepparton data, 2004 to 2010).

Patronage and Regional Fast Rail

The introduction of the Regional Fast Rail (RFR) services to other regional centres coincided with significant increases in passenger numbers (see Figure 5). In the case of the Bendigo service, passenger numbers more than doubled over a four year period, with around 1.5 million passengers using the services in 2005/6 increasing to over three million by 2009/10. Passenger numbers on the Traralgon service also doubled over a four year period. All services that benefited from RFR service improvements experienced increases in passenger numbers of at least 1 million passenger in the period shown.

FIGURE 5. REGIONAL FAST RAIL IMPACTS ON PATRONAGE ACROSS VICTORIA



Source: GHD, 2017.

Patronage of an improved rail service for Shepparton

It is assumed that improvements in the frequency, speed and reliability of rail services to Shepparton will also result in higher patronage. The CBA assumes that the proposed rail improvements (the Project Case) will provide eight services a day on weekdays and seven services a day on weekends. Travel times will be reduced by 10 to 20 minutes and the quality of the rolling stock will be improved with newer VLocity trains replacing the older locomotive-hauled trains.

A key question for estimating the benefits of the improved passenger rail service is estimating the magnitude of the likely patronage increase.

The current service provides capacity for approximately 550,000 trips. The estimated number of passengers boarding and alighting at Shepparton, Mooroopna, Murchison East and Nagambiee stations of 155,000 per annum equates to an *average* occupancy of 28%. Occupancy of individual services between Shepparton and Nagambie varies significantly; from as low as 5% for the early morning weekday service to Melbourne, and up to 60% for the Sunday evening service from Melbourne.

Under the Project Case capacity will increase to around 1.7 million trips per annum (870,000 trips in either direction); approximately 3 times the capacity of the current service.

A doubling of patronage (300,000 passenger per annum) would utilise, on average, 18% of the capacity on offer; a 150% increase in patronage (390,000 passengers per annum) would utilise 23% of the capacity; and a 200% increase in patronage (465,000 passengers per annum) would utilise an average of 27% of the available capacity – which would almost match the current occupancy rate.

2.4 Evidence of latent demand for passenger rail services

Previous reports and consultation associated with this project had suggested significant potential latent demand for passenger rail service between Shepparton to Melbourne. Key findings include:

- Council employees make an estimate 500 trips per annum to Melbourne via car for meetings and professional development. A larger proportion of these trips could be made using the rail service in more frequent and reliable.
- Goulburn Valley Health employees also make a significant number of trips to Melbourne for training and professional development. Most trips are made by car due to limited frequency of the existing passenger rail service.
- Both staff and students from the two Universities (La Trobe and University of Melbourne) and the GOTAFE would be potential users of improved passenger rail services.
- A survey conducted by Council in 2014 (sample size: 2,127) found that respondents would use passenger rail services more often if the services were more frequent (1,763 responses), faster (1,385 responses) and more direct services to and from Melbourne (1,179 responses) (Greater Shepparton City Council, 2014).
- Significant numbers of rail passengers from Shepparton and surrounds currently drive to Seymour in order to accesses the more frequent services that depart that station.
- With the ageing of the population the proportion of older residents in and around Shepparton is increasing. These residents are more likely to choose rail as an alternative to driving to avoid long drives, driving at night, or driving in heavy traffic.

3. Base Case and Project Case

This chapter describes the Base Case and Base Case to be tested in the cost-benefit analysis.

3.1 Base Case

As of January 2017 Shepparton has been served by four return rail services to Melbourne on weekdays and two on weekends with an average journey time of 2½ hours (Table 6).

TABLE 6. BASE CASE SHEPPARTON TO MELBOURNE RAIL TIMETABLE

To Melbourne		From Melbourne	
Shepparton Dep.	Melbourne Arr.	Melbourne Dep.	Shepparton Arr.
Weekdays			
5.15 am	7.59 am	9.32 am	12.07 pm
6.31 am	9.10 am	12.52 pm	3.23 pm
12.50 pm	3.15 pm	4.31 pm	7.21 pm
4.06 pm	6.35 pm	7.08 pm	9.45 pm
Saturdays			
7.04 am	9.28 am	9.12 am	11.41 am
4.05 pm	6.29pm	6.32 pm	9.05 pm
Sundays			
7.15 am	9.39 am	9.30 am	12.06 pm
5.05 pm	7.2 9pm	6.32 pm	9.05 pm

Source: GHD, 2017.

Passenger numbers

Under the Base Case it is assumed that the 2016 levels of patronage, as a proportion of total population, and the implied mode split of rail vs non-rail travel, will continue into the future. Data from PTV suggest that, on average, 200 passengers board and alight the Shepparton rail services between Shepparton and Nagambie per day on both weekdays and weekends.

The total number of trips in both directions is 155,000. This is roughly double the population within the catchment of 75,100. The Base Case assumes the relationship between rail patronage and the catchment population will remain constant and patronage will therefore increase each year at the same rate as population growth.

3.2 Project Case

The Project Case is based on Scenario 2A as described by GHD in their report *Shepparton Passenger Services Project, Shepparton Passenger Improvements* (2017). Under this scenario Shepparton will be served by eight return rail services to Melbourne on weekdays and seven on weekends as shown in the table below, with a journey times of between 2 hours and 10 minutes and 2 hours and 20 minutes.

To allow a more frequent and faster rail service, additional rolling stock and other upgrades will be required[2]. Rolling stock upgrades will be to the VLocity type, with a requirements for 4 x 3-car sets. The costs of the addition rolling stock has been estimated at $85,000,000 (GHD, 2017).

[2] Requirements taken from GHD (2016) Service Plans report (draft)

The rail corridor between Seymour and Shepparton will need to be upgraded to meet operating and safety requirements of the new rolling stock. The total costs of these upgrade, include a 30% contingency has been estimated at $101,000,000 (GHD, 2017).

TABLE 7. BASE CASE SHEPPARTON TO MELBOURNE RAIL TIMETABLE

To Melbourne		From Melbourne	
Shepparton Dep.	Melbourne Arr.	Melbourne Dep.	Shepparton Arr.
Weekdays			
5.20 am	7.55 am	6.10 am	8.35 am
6.40 am	9.10 am	8.20 am	10.40 am
8.50 am	11.10 am	10.30 am	12.50pm
10.55 am	1.15 pm	12.40 pm	3.00 pm
1.05 pm	3.25 pm	2.50 pm	5.10 pm
3.15 pm	5.35 pm	4.40 pm	7.10 pm
5.25 pm	7.50 pm	6.55 pm	9.15 pm
7.25 pm	9.45 pm	10.00 pm	12.20 am
Weekends			
6.20 am	8.40am	7.15 am	9.35 am
7.45 am	10.05 am	9.20 am	11.40 am
9.50 am	12.10 am	11.25 am	1455 pm
11.55 am	2.15 pm	1.30 pm	3.50 pm
2.00 pm	4.20 pm	5.30 pm	7.45 pm
4.05 pm	6.25 pm	7.30 pm	9.50 pm
8.00 pm	10.20 pm	11.00 pm	1.20 am

Source: GHD, 2017. (Will need are non-secure version of the GHD report to copy and paste the revised timetable data.)

Passenger numbers

The Project Case assumes an increase in rail patronage as a result of both a shift in mode split towards rail and induced travel. Three patronage scenarios were tested: a doubling of passengers; a 2.5 times increase; and a tripping in passenger numbers, relative to the Base Case.

The current service provides capacity for approximately 550,000 trips (both directions). The current estimated annual passenger number of 155,000 equates to an average occupancy of 28%. Under the Base Case capacity will increase to 1.7 million trips per annum (both directions)

A 100% increase in patronage – 300,000 passenger per annum – would utilise, on average, 18% of the capacity on offer. A 150% increase in patronage – 390,000 passengers per annum – would utilise 23% of the total capacity. While a 200% increase in patronage – 465,000 passengers per annum – would utilise 27% of total capacity, matching the current average occupancy rate.

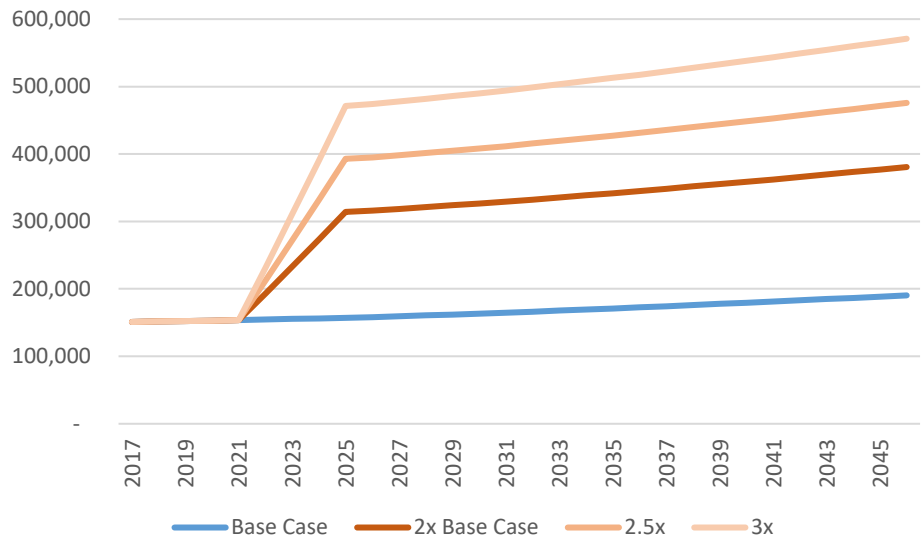
New passengers would be of two types: those that are already travelling by car in the Base Case and shift modes to the rail service; and those that were not travelling in the Base Case, but are induced to use the service in the Project Case because of the improvements to the timetable, service reliability and quality of the rolling stock. The 'mode shifting' passengers were assumed to be split between business and leisure trips on an equal basis. The induced passengers were all assumed be undertaking trips for leisure purposes.

Other key assumptions

The followings assumptions were also used in all Project Case scenarios:

- Design and construction commences in the 2018 financial year (17/18) and takes three years;
- Improved services commence operation in 2022 financial year (21/22);
- Increased patronage progressively ramps up between 2022 and 2025;
- Patronage settles at a new 'equilibrium' from year 2025 onwards (see Figure 6); and
- The split of new passengers between mode shift and induced travel types is 50:50, that is 50% of new rail passengers mode shift from car travel (assuming an average of 1.5 persons per vehicle) and 50% of new rail passengers are the result of induced travel (they would not have travelled, via any mode, in the Base Case).

FIGURE 6. BASE CASE AND PROJECT CASE PATRONAGE SCENARIOS (TOTAL PASSENGERS PER ANNUM)



Source: SGSEP Pty Ltd, 2017.

4. Costs and benefits

This chapter outlines the anticipated costs and benefits of improving passenger rail between Shepparton and Melbourne and the methods used to quantify and monetise them.

4.1 Overview

The proposed service improvements will reduce travel times between Shepparton and Melbourne and the intermediate stations and increase the number of rail services from four to eight on weekdays and two to seven on weekends. The CBA assumes that as a result of these improvements there will be an increase in the proportion of the population located along the corridor using the rail service.

4.2 Costs

The costs of the Project Case relative to the Base Case are:

- The procurement of additional rolling stock
- Upgrades to rail infrastructure to accommodate higher operating speeds and to provide storage of the additional rolling stock.
- Additional operating costs: vehicle operations and maintenance, track maintenance, customer service, security and so on.

A range of measurement strategies, principles, and assumptions were applied to quantify and monetise the impacts of the Project Case against the Base Case. The methods and data sources used to quantifying and valuing the costs are summarised in the table below.

TABLE 8. METHOD AND DATA SOURCES – COSTS

Cost item	Description/rationale	Method	Data source/s
Rolling stock	Procurement of rolling stock	Cost spread over two years	GHD, 2017.
Construction costs	Construction costs for upgrades (track improvements, level crossing improvements, stabling, contingencies)	Total cost spread over required construction period	GHD, 2017.
Additional operating costs	Additional costs for vehicle operations and maintenance, track maintenance, customer service, security.	Net additional operating costs	GHD, 2017.

Source: SGS Economics & Planning

4.3 Benefits

The benefits of the Project Case relative to the Base Case are:

- Travel time savings for existing users – current users of the rail service will benefit from travel time savings in the order of 15 minutes on average for the full journey between Shepparton and Southern Cross Station;
- User benefits for new users – which includes reduce vehicle operating costs and, in the case business trips, higher productivity during the duration of the journey;
- Increase business agglomeration – better linkages to other businesses in Victoria, particularly in Melbourne will enhance business productivity;
- Human capital improvements – households in Shepparton and nearby areas are expected to have better access to jobs and education, particularly in Melbourne, improving their skills and know how;
- Reduced VKT externalities – the reduction in VKT will generate savings in greenhouse gas emissions, other unwanted emissions, crashes and other externalities;
- Improved housing choice – the shift in pattern of development will increase housing choice for households in Shepparton and other communities on the rail corridor.
- Saved infrastructure costs (housing) – improved rail services might be expected to shift the balance of infill versus greenfield development in Shepparton and other communities on the rail corridor. Any savings in infrastructure costs between infill and greenfield development constitute a net benefit;
- Health benefits – higher PT mode share will likely result in increased physical activity via walking or cycling to and from stations, improving health outcomes.;
- Balanced spatial development of Victoria – it is anticipated that there will be a significant community willingness to pay to 'spread' development opportunities into regional Victoria through improved service provision in non-metro areas (even if this just 'holds the line' in terms of drift to the city); and
- Option and non-use value – the value of the service to non-users that existing regardless of the fact that they themselves do not receive direct user benefits.

The methods and data sources for quantifying and valuing the benefits are summarised in the table below.

Benefits not included

Not all of the identified benefits could be quantified reliably enough for inclusion in the CBA. Benefits associated with 'Balanced spatial development of Victoria' and 'Improved housing choice' have not been included in this assessment.

TABLE 9. METHOD AND DATA SOURCES – BENEFITS

Benefit item	Description/Rationale	Method	Data source/s
Travel time savings	Shortened travel and waiting time	Number of passengers x time saving x $14.99	BITRE parameter for value of time/patronage to be provided
User benefits (mode shift – business trips)	Travelling via rail as opposed to driving will generate costs savings and allow increased productivity of workers (active as opposed to passive work time)	Average Vehicle operating costs; margin increase in the value of active vs passive work time	BITRE parameters and SGS modelling
User benefits (mode shift – leisure trips)	Travelling via rail as opposed to driving will generate costs savings	Average Vehicle operating costs	BITRE parameters and SGS modelling
User benefits (induced travel)	Some users that would not have otherwise travelled will be induced to use the service as a result of the higher frequency and improved rolling stock.	Value of these trips proxied by the average value of leisure time and fares paid	BITRE parameters and SGS modelling
Business agglomeration	Better linkages to other businesses in Victoria, particularly in Melbourne.	EJD improvement	SGS modelling
Human capital improvements	Better access to jobs and social opportunities as a result of better connectivity	EJD improvement	SGS modelling
Reduced VKT externalities	Reduced externalities due to mode shift	Reduction in car km travelled	BITRE parameters
Saved infrastructure costs	Improved rail might shift the balance of infill versus greenfield development resulting in infrastructure cost savings.	Difference in infill vs greenfield infrastructure costs per dwelling x additional infill dwellings	Infraplan, 2013.
Health benefits	Increased physical activity via walking or cycling to and from stations will improve health outcomes.	Saved health care costs as a result of increased physical activity.	ATAP guidelines for valuing active transport.

Source: SGS Economics & Planning

4.4 Other assumptions

Time frame

A 30 year time frame was used. Whilst such infrastructure investments tend to have a longer life span than this, 30 years is a reasonable timeframe within which to predict likely costs and benefits.

Discount rate

In guidance provided by the Department of Treasury and Finance infrastructure and/or public transport investments are classified as Category 2 investment and 7% discount rate is recommended when calculating the net present value (NPV). The convention was followed.

5. Findings

5.1 Cost benefit analysis

Three sets of findings are provided based on differing assumptions about the increase in passenger numbers under the Project Case being, a doubling, a 2.5x increase and a tripling, relative to the Base Case patronage assumptions.

The CBA results report on the net present value (NPV), which is the total benefits net of the total costs; and the benefit cost ratio (BCR), which is the total benefits divided by the total costs.

A BCR of greater than 1 suggests the Project Case would result in a net benefit to the community, whereas a BCR of less than one suggests a net loss. The magnitude of the net benefit or net loss is reflected by the NPV.

Findings based on a doubling of passenger numbers

The table below presents the findings of the cost benefit analysis assuming that patronage doubles (a 100% increase) in the Project Case. The net present value is a loss of $85 million and the benefit cost ratio is 0.58.

TABLE 10. CBA RESULTS – DOUBLING OF PATRONAGE RELATIVE TO THE BASE CASE

Cost and benefits	Value	Proportion of costs/benefits
Rolling stock – PV	$66,721,000	33%
Upgrade works – PV	$85,866,000	42%
Operating costs – PV	$51,424,000	25%
Total costs – PV	$204,011,000	100%
User benefits: mode shift passengers (business trips) – PV	$45,087,000	38%
User benefits: mode shift passengers (leisure trips) – PV	$12,587,000	11%
User benefits: induced travel passengers – PV	$41,753,000	35%
Travel time savings (existing passengers) – PV	$5,604,000	5%
Reduced VKT externalities – PV	$9,014,000	8%
Saved infrastructure costs – PV	$1,937,000	2%
Business agglomeration – PV	$1,344,000	1%
Human capital improvements – PV	$451,000	0%
Health benefits – PV	$799,000	1%
Total benefits – PV	$118,576,000	100%
Net Present Value	$(85,435,000)	
Benefit Cost Ratio	0.58	
Base Case passengers per annum by year 8*	157,126	
Base Case passengers per annum by year 8*	314,252	

PV = Present Value *4 years after completion of upgrades and introduction of new rolling stock.

Findings based on a 2.5 times increase in passenger numbers

The table below presents the findings of the cost benefit analysis assuming that patronage increases 2.5 times (a 150% increase) in the Project Case. The net present value is a loss of $31 million and the benefit cost ratio is 0.85.

TABLE 11. CBA RESULTS – 150% INCREASE IN PATRONAGE RELATIVE TO THE BASE CASE

Cost and benefits	Value	Proportion of costs/benefits
Rolling stock – PV	$66,721,000	33%
Upgrade works – PV	$85,866,000	42%
Operating costs – PV	$51,424,000	25%
Total costs – PV	$204,011,000	100%
User benefits: mode shift passengers (business trips) – PV	$67,631,000	39%
User benefits: mode shift passengers (leisure trips) – PV	$18,880,000	11%
User benefits: induced travel passengers – PV	$62,630,000	36%
Travel time savings (existing passengers) – PV	$5,604,000	3%
Reduced VKT externalities – PV	$13,521,000	8%
Saved infrastructure costs – PV	$1,937,000	1%
Business agglomeration – PV	$1,344,000	1%
Human capital improvements – PV	$451,000	0%
Health benefits – PV	$1,198,000	1%
Total benefits – PV	$173,196,000	100%
Net Present Value	$(30,815,000)	
Benefit Cost Ratio	0.85	
Passengers per annum by year 8*	392,815	

PV = Present Value *4 years after completion of upgrades and introduction of new rolling stock.

Findings based on tripling of passenger numbers

The table below presents the findings of the cost benefit analysis assuming that patronage triples (a 200% increase) in the Project Case. The net present value is positive, at $23 million, and the benefit cost ratio is 1.12.

TABLE 12. CBA RESULTS – TRIPLING OF PATRONAGE RELATIVE TO BASE CASE

Cost and benefits	Value	Proportion of costs/benefits
Rolling stock – PV	$66,721,000	33%
Upgrade works – PV	$85,866,000	42%
Operating costs – PV	$51,424,000	25%
Total costs – PV	$204,011,000	100%
User benefits: mode shift passengers (business trips) – PV	$90,174,000	40%
User benefits: mode shift passengers (leisure trips) – PV	$25,173,000	11%
User benefits: induced travel passengers – PV	$83,507,000	37%
Travel time savings (existing passengers) – PV	$5,604,000	2%
Reduced VKT externalities – PV	$18,028,000	8%
Saved infrastructure costs – PV	$1,937,000	1%
Business agglomeration – PV	$1,344,000	1%
Human capital improvements – PV	$451,000	0%
Health benefits – PV	$1,597,000	1%
Total benefits – PV	$227,816,000	100%
Net Present Value	$23,804,000	
Benefit Cost Ratio	1.12	
Base Case passengers per annum by year 8*	471,378	

PV = Present Value *4 years after completion of upgrades and introduction of new rolling stock.

Summary

The main benefits are the user benefits they would acrrue to the tree categories of new passengers. In each of the three patrongae scenarios these benefits total around 85% of the total benefits. Reduced externalities associated with vehcile usage are also a significant benefits at 8% of the total benefits.

The findings suggest that if the improved rail service attracted additional passengers in the order of 175% of the Base Case patronage the total benefits of the proposed upgrade would outweigh the total costs. This would be around 400,000 passengers per annum by 2030.

5.2 Sensitivity tests

The base CBA assumes that rail patronage under the Base Case will continue to increase with population growth and does not includes option and non-use value. Sensitivity analyses were undertaken to consider the impact on the findings of changing these assumptions.

Base Case patronage assumptions

The Base Case assumes patronage will increase at that same rate as population growth. However, given patronage appears to have been declining in recent years and it is plausible that the current service has achieved peak patronage. The first sensitivity test assumed that patronage in the Base Case does not increase over time. This has the effect of increasing the difference in patronage between the Base Case and Project Cases.

Option and non-use value

The second sensitivity test is includes option and non-use value benefits. Option and non-use value refers to the benefits experienced by the members of the community that do not use the service but value the *option* to use it and its value to others. A literature review by Laird et al (2009) suggested that option and non-use benefits can range from between 20% to 50% of the total economic value (TEV) of a good or service. They also found that option and non-use benefits were higher in more remote locations where populations placed a higher value on connectivity to the metropolitan core.

This test assumed that the option and non-use value benefit were just 20% of the TEV (the lower end of the range identified by Laird et al) and, therefore, the benefits identified in the base analysis would constitute 80% of the TEV.

Test combined

A third sensitivity test combined both test 1 and 2.

Findings

The table below summarises the results of applying the sensitivity tests for each patronage scenario.

Test 1, where it is assumed that Base Case patronage does not increase, provide a slight improvement to the BCR compared to the initial analysis. Test 2, the inclusion of option and non-use value, results in more significant improvements to the BCR. The combined test result in even higher BCRs.

TABLE 13. RESULTS OF SENSITIVITY TESTS

Patronage scenario relative to Base Case	Base results	Test 1: Base Case patronage does not increase	Test 2: Include non-use and option value benefits	Test 3: Tests 1 and 2 combined	Annual passengers by year 8*
	BCR	BCR	BCR	BCR	
2x patronage	0.58	0.63	0.73	0.79	300,000
2.5 patronage	0.85	0.90	1.06	1.13	400,000
3x patronage	1.12	1.17	1.40	1.46	500,000

* Four years after the introduction of the improved passenger rail service.

5.3 Distributional impacts

The benefits of an improved rail service will flow to passengers (and non-users) that have access to the service at the four affected stations: Shepparton, Mooroopna, Murchison East and Nagambie.

Without more detailed data on current and potential patronage it was not possible to provide a detailed assessment of the distributional impacts of the proposal.

The costs of the improvements will be borne by the State Government and therefore by the entire Victorian community.

5.4 Financial analysis

While the purpose of the CBA is to show which option is best from a whole community perspective, the financial analysis allows relevant parties to make a decision on whether or not this option is realistic from a financial perspective.

The financial costs and benefits of the project to the state are summarised in the table below.

Financial costs include the new rolling stock, infrastructure upgrades and additional operating costs. Financial benefits are and additional revenues from fares. The average fare revenue assumed to be $25 per trip.

TABLE 14. FINANCIAL ANALYSIS ($ MILLIONS)

	2018	2019	2020	2021	2021-2047	Total
Rolling stock - PV	$-	$-	$(34)	$(32)	$-	$(67)
Upgrade works - PV	$(24)	$(22)	$(21)	$(19)	$-	$(86)
Operating costs - PV	$-	$-	$-	$-	$(51)	$(51)
Total costs - PV	$(24)	$(22)	$(55)	$(52)	$(51)	$(204)
Revenue from fares - PV	$0	$0	$0	$0	$53	$54
Total benefits - PV	$0	$0	$0	$0	$53	$54
Net present value	$(24)	$(22)	$(55)	$(52)	$2	$(150)

Note: Figures in brackets are negative.

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