Parliamentary Budget Office

Suburban Rail Loop

Cost-benefit analysis of East and North sections

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In brief

The Suburban Rail Loop (SRL) is a planned 90-kilometre orbital railway line that will connect Cheltenham in Melbourne's south to Werribee in the west. The Victorian Government plans to deliver the SRL in multiple sections over several decades. SRL East and North are 2 of these sections which the government plans to operate as a single rail transport system.

In this advice we consider the net benefit to society of investment in SRL East and North using:

1. our estimate of the cost to build and operate SRL East and North
2. the Victorian Government's estimate of the benefits expected from SRL East and North, taken at face value from the Suburban Rail Loop – Business and Investment Case (the SRL business case).

We discount costs and benefits to their present value in 2022 and compare them by calculating both a net present value (NPV) and a benefit-cost ratio (BCR). A positive NPV and a BCR greater than one indicates that investment in the project would result in a net benefit to society.

Our estimate

Our estimate of the NPV and BCR for SRL East and North is based on:

- a 7% real social discount rate – the central case rate in Infrastructure Australia's *Assessment Framework*
- the inclusion of conventional, urban consolidation and wider economic benefits.

We found that investment in SRL East and North would realise a net cost to society, specifically the:

- NPV is negative, between -$10.6 billion and -$7.4 billion
- BCR is less than one, between 0.6 and 0.7.

Sensitivity of our estimate

Consistent with Infrastructure Australia's *Assessment Framework*, we considered the sensitivity of our cost-benefit analysis results to both:

1. alternative real social discount rates of 4% and 10%
2. the inclusion of different categories of benefits.

We found that investment in SRL East and North would definitively realise a net cost to society unless we:

1. use a real social discount rate of 4% – the lower rate in Infrastructure Australia's Assessment Framework
2. include all expected benefits – conventional, urban consolidation, and wider economic benefits.

This scenario, which most closely matches the assumptions made in the Victorian Government's SRL business case, would result in:

- a positive NPV, between $7.1 billion and $17.3 billion
- a BCR greater than one, between 1.2 and 1.4.

Context

Request

On 13 July 2023, Mr John Pesutto MP, Member for Hawthorn, asked the Parliamentary Budget Officer to provide independent advice comparing the cost to build and operate the East and North sections of the Suburban Rail Loop (SRL) with the expected benefits of the project. For this cost-benefit analysis, the client requested the costs should be based on estimates in the most recently published PBO advice, while the benefits should be based on the Victorian Government's most recently published estimates for the project.

Scope

In this advice we consider the value, or net benefit to society, of investment in the East and North sections of the SRL, which is composed of:

- SRL East's single section from Cheltenham to Box Hill
- SRL North's 2 subsections:
  - Box Hill to Reservoir
  - Reservoir to Melbourne Airport.

Our evaluation uses cost-benefit analysis methodology which:

1. incorporates our independent assessment of the cost to build and operate SRL East and North, as stated in Suburban Rail Loop: cost to build and operate East and North sections
2. uses the Victorian Government's assessment of the benefits expected from SRL East and North, which we have taken at face value from the *Suburban Rail Loop – Business and Investment Case* (the SRL business case)
3. excludes costs incurred before 2022, when actual construction works commenced
4. discounts the real value – expressed in 2020 dollars – of the remaining costs and benefits to 2022, using real social discount rates of 4%, 7% (central), and 10%, as recommended by Infrastructure Australia's *Assessment Framework*.
5. calculates the project's net present value (NPV) and benefit-cost ratio (BCR) for each real social discount rate and for different categories of benefits.

We also consider how sensitive our analysis is to changes in cost and benefit factors, and to changes in the real social discount rate.

Our evaluation adheres to the Victorian Government's expectations for the commencement of operations. The Victorian Government expects SRL East services to commence in 2035. Under the government's Option A scenario for SRL North, services will extend to the Box Hill to Reservoir subsection from 2043, and services will extend to the Reservoir to Melbourne Airport subsection from 2053.

In addition to the build costs, our advice considers the costs incurred and benefits accrued during 50 years of operations – from the commencement of passenger services on SRL East at the beginning of 2035 to the end of 2084. This 50-year appraisal period is in line with that:

- used in the Victorian Government's SRL business case
- suggested for rail initiatives in the Australian Government's *Australian Transport Assessment and Planning Guidelines*.

Our evaluation includes fewer years of SRL North's operations than the 50 years for SRL East, as passenger services on the SRL North subsections are likely to commence in 2043 and 2053.

Similar to the SRL business case, we consider SRL East and North as a single project, and do not consider the costs incurred or benefits accrued from a standalone SRL East project in this advice.

We do not consider the costs incurred or benefits accrued from SRL Airport (Melbourne Airport Rail) and SRL West in this advice.

Limitations

Our estimates of the costs to build and operate SRL East and North are derived from our previous advice, Suburban Rail Loop: cost to build and operate East and North sections. Released in March 2024, that advice outlines the limitations and sensitivities of our cost estimates.

In this advice we exclude costs incurred before 2022, when actual construction works commenced. This follows best practice and is in line with the assumptions made in the Victorian Government's SRL business case. However, a consequence of this choice is that a significant amount of project planning and preparatory works costs – we estimate $574.2 million in nominal terms – are excluded from our cost-benefit analysis, as those costs were incurred before 2022.

Our estimates of the benefits expected from SRL East and North are taken at face value from the SRL business case, which was released by the Victorian Government in August 2021. The SRL business case included estimates of the costs and benefits of building SRL East and North and operating those sections for 50 years. As more than 3 years have passed since these estimates were developed, it is possible that they are now out of date.

The SRL business case presents expected benefit (and cost) amounts as a range. For example, it expects the total benefit from SRL East and North would be in a range between $48.5 billion and $58.7 billion, calculated using a 4% real social discount rate. As these estimates of benefits are published as a range, and we have chosen to take them at face value, in this advice we assess the limits of the range for each benefit category. Consequently, our assessment considers 2 estimates for each benefit category:

- Higher estimate for benefits – the upper limit of the SRL business case range, e.g. $58.7 billion for the total benefit expected from SRL East and North
- Lower estimate for benefits – the lower limit of the SRL business case range, e.g. $48.5 billion for the total benefit expected from SRL East and North.

Also, while we do not independently estimate SRL East and North project benefits, we do note that quantifying the value of expected social benefits is inherently less certain, more difficult, and more subjective than estimating financial flows.

We prepared this advice on 17 September 2024.

Background

In this section	This section provides an overview of the SRL, describing: ▪ the project and each of its sections ▪ the Victorian Government's business and investment case for SRL East and North ▪ key aspects of the project's financing arrangements.

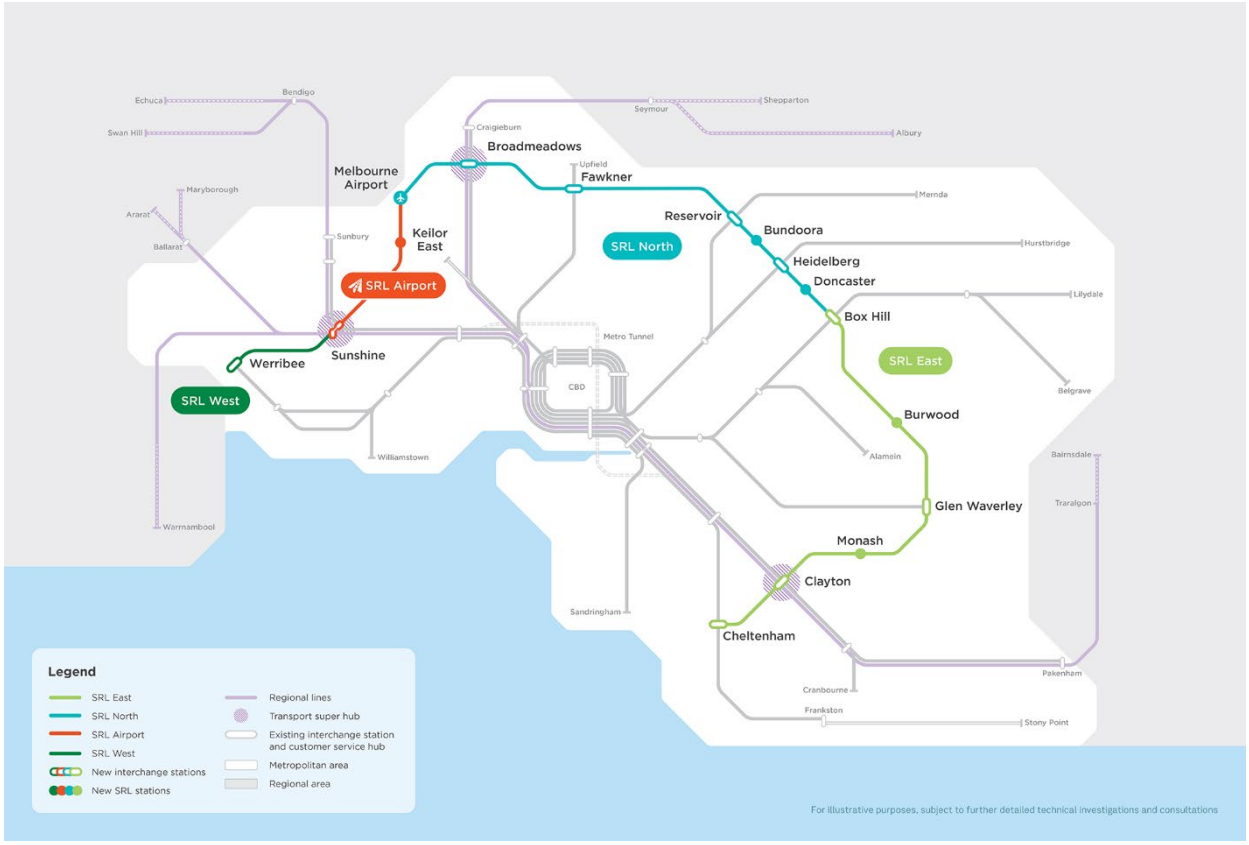
The SRL project

With the SRL project, the Victorian Government aims to build a 90-kilometre orbital railway line connecting major Melbourne metropolitan railway lines from the Frankston Line to the Werribee Line, through Melbourne Airport. The project intends to establish 3 transport super hubs at Clayton, Broadmeadows and Sunshine. These super hubs will connect SRL services with regional services, so passengers outside Melbourne would have less need to travel through the central business district.

The project scope and its staging have evolved over recent years. The SRL currently comprises 4 main sections which the Victorian Government plans to deliver in stages over several decades:

1. SRL East – Cheltenham to Box Hill
2. SRL North
    a. Box Hill to Reservoir
    b. Reservoir to Melbourne Airport
3. SRL Airport – Melbourne Airport to Sunshine
4. SRL West – Sunshine to Werribee.

Figure 1 – SRL network map



Source: Victoria's Big Build.

SRL East

SRL East will connect Cheltenham to Box Hill, via a new transport super hub at Clayton. Construction began in June 2022. The Victorian Government expects passenger services to commence on this section in 2035.

SRL North

SRL North will initially extend from Box Hill to Reservoir, and then to Melbourne Airport, via a new transport super hub at Broadmeadows. As the Victorian Government does not plan to commence construction of SRL North for some time, there is greater uncertainty around its scope of works and specifications.

The Victorian Government has examined 2 scenarios for SRL North:

- Option A – Box Hill to Reservoir section opening for services in 2043, and the Reservoir to Melbourne Airport section opening for services in 2053.
- Option B – Box Hill to Reservoir section opening for services in 2038, and Reservoir to Melbourne Airport section opening for services in 2043.

The Victorian Government has not confirmed which option it will implement. However, the SRL business case indicated that Option A was likely to have a higher BCR.

SRL Airport

SRL Airport will extend from Melbourne Airport to a new transport super hub at Sunshine.

The Melbourne Airport Rail (MAR) project proposed to build an electrified broad gauge heavy rail line between Melbourne Airport and south-eastern Melbourne, via Sunshine and the Metro Tunnel. Construction began in 2022, with completion originally targeted for 2029.

The Victorian Government released the *Melbourne Airport Rail Business Case* on 21 September 2022. This business case stated that MAR would be a key part of the SRL, with passengers that intended to pass through rather than terminate at Melbourne Airport interchanging at Melbourne Airport Station. Subsequently, the Victorian Government started referring to the MAR project as 'SRL Airport'.

The Victorian Government's design for SRL Airport included an elevated rail line and station at Melbourne Airport. Australia Pacific Airports, the owner and operator of Melbourne Airport, objected to these plans and reportedly sought compensation and the construction of an underground station. The Victorian Government cited this objection and ongoing negotiations with Australia Pacific Airports as reasons for delaying the SRL Airport build.

Consequently, the 2024–25 Victorian Budget states that the SRL Airport build will take at least 4 years longer to complete, which would mean that passenger services could not commence before 2033.

SRL West

SRL West will extend from the new transport super hub at Sunshine to Werribee. The Victorian Government's 2018 *Western Rail Plan* suggested that SRL West would make use of the existing Regional Rail Link/Wyndham Vale Line rail corridor. Alternatively, SRL West could be built as an underground rapid transit rail line that directly links Sunshine and Werribee.

The Victorian Government is yet to publish any information regarding its plans for the commencement of SRL West construction works. The start date for SRL West passenger services is also unknown.

Business and investment case

The Victorian Government released the SRL business case in August 2021. This business case sought to articulate the need for the SRL and build a case for investment in SRL East and North by:

- examining options for building SRL East and North
- defining the SRL East and North program of work and its sequencing, and estimating its costs
- assessing the benefits that would be derived from SRL East and North
- providing other information that was relevant to the SRL.

To inform this business case, the Victorian Government commissioned KPMG to independently evaluate the costs and benefits of SRL East and North.

Key parameters

Appendix C2 of the SRL business case was an *Economic Appraisal Report* prepared by KPMG in February 2021. Key input parameters for the KPMG economic appraisal included:

- a price base year of 2020 for real cost and benefit estimates
- a base year for discounting of 2022, to align with the first year of construction

- a real social discount rate of 4%, which was endorsed by the Victorian Government
- an evaluation period that included 50 years from the first year of operations, in line with Australian Government's *Australian Transport Assessment and Planning Guidelines*.
- an estimate of the residual value of assets being included as a benefit in the final year of the evaluation, in line with Infrastructure Australia and Department of Treasury and Finance guidelines, to account for the continuing value of these assets in the years beyond the evaluation period.

These key parameters were also included in the main body of the SRL business case.

Cost estimates

The KPMG economic appraisal assessed and detailed the economic costs of building SRL East and North and operating those sections for 50 years.

Figure 2 – SRL business case cost results for SRL East and North

($ billion)	Program Case Option A	Program Case Option B
Capital costs	24.1 to 40.2	27.1 to 45.1
Recurrent costs	6.3 to 10.6	7.6 to 12.6
Total cost	**30.7 to 50.5**	**35.1 to 57.6**

Notes: Values have been discounted to 2022 using a 4% real social discount rate. The value ranges for each line item are based on varying inputs and are not additive. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

These present value of cost results, calculated using a real social discount rate of 4%, were also included in the main body of the SRL business case. However, we do not use these cost estimates in this advice, as we have developed our own independent assessment of the cost to build and operate SRL East and North.

Benefit estimates

The KPMG economic appraisal also assessed the economic benefits expected from SRL East and North through to 2084. In this advice, we take at face value these estimates of expected benefits from the SRL business case and use them in our cost-benefit analysis.

Benefit categories

Benefits in the SRL business case were categorised as either:

- Conventional economic benefits – public transport and road user benefits, other societal benefits for non-users, and the residual value of assets at the conclusion of the evaluation (in 2084)
- Urban consolidation benefits – infrastructure cost savings, reduced non-urban land consumption, and benefits from improved social inclusion and equality
- Wider economic benefits – increased access to employment, increased labour supply, the ability to move to more productive jobs, and increased competition due to reduced transport costs
- Macroeconomic impacts – increased global competitiveness, labour productivity, economic output, and employment.

These benefits are all quantified in the SRL business case, though only conventional, urban consolidation and wider economic benefits are included in the cost-benefit analysis.

Total benefit

The KPMG economic appraisal detailed the economic benefits expected from SRL East and North through to 2084. These present value of total benefit results were also included in the main body of the SRL business case.

Figure 3 – SRL business case benefit results for SRL East and North

($ billion)	Program Case Option A	Program Case Option B
Conventional benefits	33.6 to 40.9	37.4 to 45.2
Urban consolidation benefits	3.2 to 4.6	3.7 to 5.3
Wider economic benefits	7.5 to 11.9	8.8 to 13.9
Total benefit	**48.5 to 58.7**	**54.7 to 65.8**

Notes: Values have been discounted to 2022 using a 4% real social discount rate. The value ranges for each line item are based on varying inputs and are not additive. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

Economic evaluation

The KPMG economic appraisal compared their estimated present value of the total cost incurred by building and operating SRL East and North for 50 years, with their estimated present value of the total benefit accrued from SRL East and North through to 2084. Using cost-benefit analysis, KPMG found the project was economically viable, as it would result in a positive NPV and a BCR greater than one.

Figure 4 – SRL East and North economic evaluation results

($ billion)	Program Case Option A	Program Case Option B
Total cost	30.7 to 50.5	35.1 to 57.6
Total benefit	48.5 to 58.7	54.7 to 65.8
Net present value (NPV)	3.0 to 22.9	2.4 to 25.2
Benefit-cost ratio (BCR)	1.1 to 1.7	1.0 to 1.7

Notes: Values have been discounted to 2022 using a 4% real social discount rate. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

These cost-benefit analysis results were also included in the main body of the SRL business case. Of the two options evaluated, Option A was found to be more likely to have a higher BCR. Assuming the Victorian Government chose Option A for SRL North, and using a 4% real social discount rate, the SRL business case estimated the:

- NPV for SRL East and North would be between $3.0 billion and $22.9 billion
- BCR for SRL East and North would be between 1.1 and 1.7.

Funding history

The Victorian Government expects the cost to build SRL East to range between $30.0 billion and $34.5 billion, and has committed $11.8 billion funding to date, across multiple budgets:

- The 2019–20 budget allocated $300 million for planning and development
- The 2020–21 budget allocated $2.2 billion for initial and early works
- The 2021–22 budget update allocated $9.3 billion for SRL East main works.

To date, the Australian Government has committed $2.2 billion for SRL East construction works. A Prime Ministerial press release stated that this amount would be invested over 5 years. However, the 2024–25 Victorian Budget, states that this will be invested over 3 years.

The Victorian Government has indicated it will seek additional funding for SRL East through:

- private sector investment
- value capture
- matching contributions from the Australian Government.

The Victorian Government is yet to publish any information regarding its plans for funding SRL North.

Infrastructure Australia's role

The Australian Government has indicated that Infrastructure Australia must independently assess the SRL project before additional funding can be provided. The Australian Government has asked the Victorian Government to provide Infrastructure Australia with all the information required to make their appraisal. Once it has this information, Infrastructure Australia would evaluate the project using 3 overarching assessment criteria from its *Assessment Framework*:

1. Strategic fit – which asks whether there is a clear rationale for the proposal, focusing on how it addresses a problem or opportunity of national significance, and how it compares to other options
2. Societal impact – which examines the value of the proposal to society and the economy, ideally through cost-benefit analysis
3. Deliverability – which asks whether the proposal can be delivered to the time, cost and scope required.

The cost-benefit analysis aspect of the societal impact criterion would:

- use real social discount rates of 4%, 7% (central), and 10%
- include conventional benefits, and if applicable, land use impacts and wider economic benefits
- calculate BCRs and NPVs for each real social discount rate and for the different categories of benefits.

In addition to the cost-benefit analysis outputs, the assessment of societal impact would also include a description of the project's qualitative, quantitative and monetised impacts.

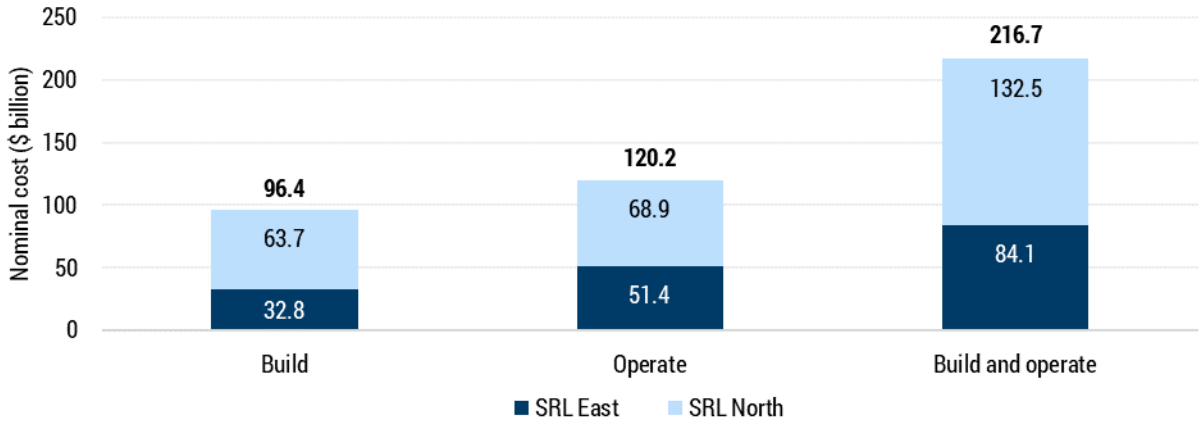
Cost to build and operate

In this section	This section summarises our estimates of the cost to build and operate SRL East and North between 2019 and 2084, as detailed in our previously published advice, Suburban Rail Loop: cost to build and operate East and North sections. We express these cost estimates in: 1. nominal terms 2. present value terms.

Nominal cost

In our previously published advice, Suburban Rail Loop: cost to build and operate East and North sections, we estimated the cost to build SRL East and North, and then operate these sections until the end of 2084 – 50 years after services commence on SRL East. We expected the nominal cost to build and operate SRL East and North would be $216.7 billion across 2019 to 2084. We estimated SRL East would cost $84.1 billion, while SRL North would cost $132.5 billion.

Figure 5 – Nominal cost to build and operate SRL East and North



Notes: For SRL East, the operate costs are for a 50-year period from the completion of construction, specifically from 2035 to 2084. For SRL North, the operate costs are for shorter periods to 2084 – from 2043 for the Box Hill to Reservoir subsection and from 2053 for the Reservoir to Melbourne Airport subsection.

Source: Parliamentary Budget Office.

For each of the SRL sections, we separately estimated the cost to build the section and the cost to operate services on the section. We expected build costs for SRL East and North would be $96.4 billion, with $120.2 billion to operate passenger services to 2084. SRL East accounts for around one-third of the build costs but more than 40% of the operate phase costs. This is because our evaluation included a longer operational period for SRL East, which will be built first.

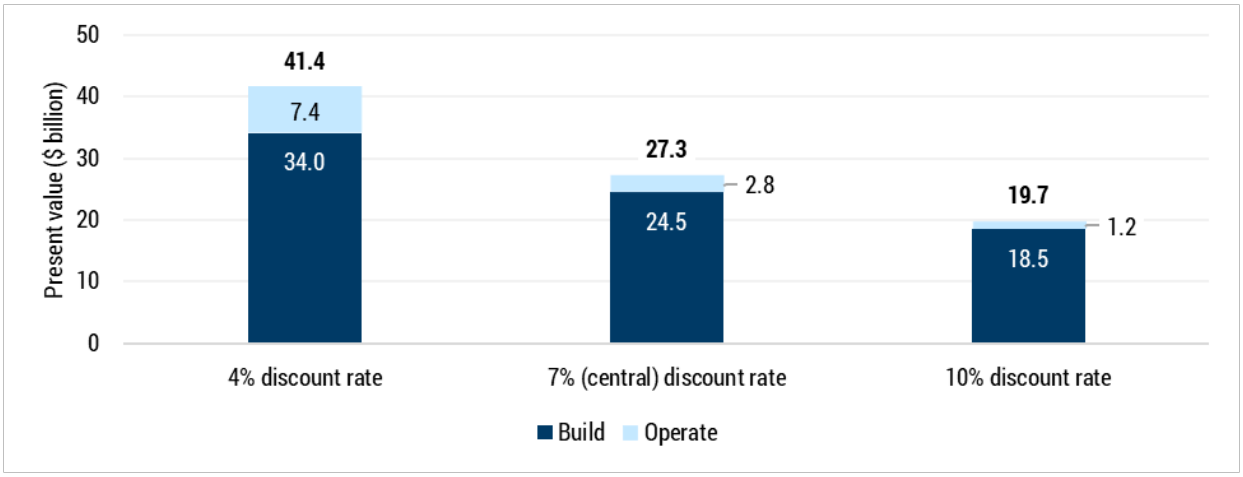
Present value of cost

In Attachment A of our Suburban Rail Loop: cost to build and operate East and North sections advice, we published our estimate of the cost to build and operate SRL East and North in present value of cost (net present cost) terms.

Key steps in our present value calculations were:

1. converting nominal costs to real costs by removing the effects of inflation – measured by CPI – since 2020
2. excluding costs incurred before 2022, when actual construction works commenced, as those costs are considered sunk
3. discounting the remaining real costs to 2022 using real social discount rates of 4%, 7% (central), and 10%, as recommended by Infrastructure Australia's *Assessment Framework*.
4. summing the results.

Figure 6 – Present values of the cost to build and operate SRL East and North



Source: Parliamentary Budget Office.

The results of our present value calculations reflected a large weighting towards build costs incurred near the start of the project, and a relatively smaller weighting towards operate costs incurred later. This is a feature of discounting long-term multi-generational infrastructure projects. The higher the discount rate, the greater the weighting towards earlier costs, and the lower the present value of total cost.

Expected benefits of the project

In this section	This section summarises the expected benefits to society of investment in SRL East and North, which we have taken at face value from the Victorian Government's SRL business case. We express these expected benefit estimates in present value terms.

Present value of benefit

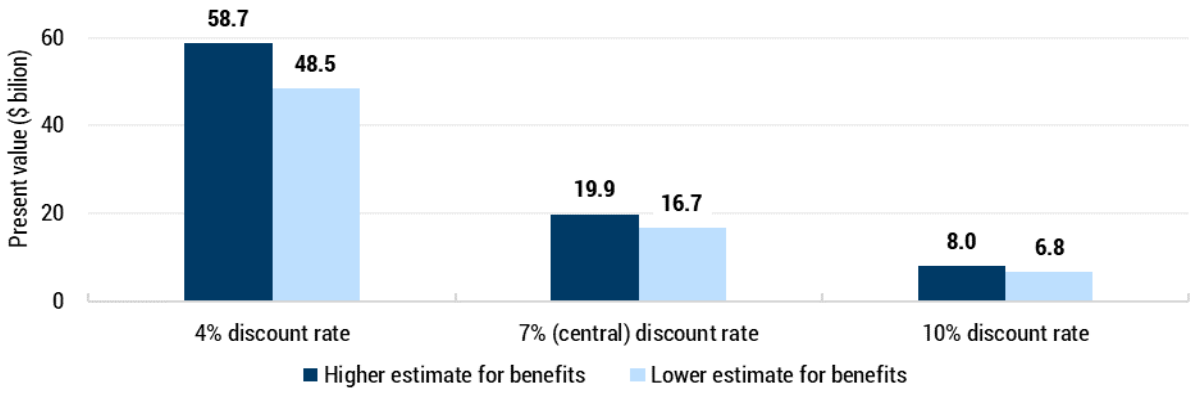
The SRL business case assessed the economic benefits expected from SRL East and North. We have taken these expected benefit estimates at face value and have used them to calculate present value of benefit estimates for the project.

Consistent with the Victorian Government's SRL business case, we have included quantified broader benefits – urban consolidation and wider economic benefits, in addition to conventional benefits – as more indicative of whether it is in the social interest to build and operate the SRL, rather than an assessment of whether it is financially or economically viable.

Key steps in our present value calculations, for both higher and lower estimates of benefits, are:

1. determining the year-on-year values, in real terms, of the different categories of expected benefits
2. discounting real benefit values to 2022 using real social discount rates of 4%, 7% (central), and 10%, as recommended by Infrastructure Australia's *Assessment Framework*.
3. summing the results.

Figure 7 – Present values of the total benefit expected from SRL East and North



Source: Parliamentary Budget Office.

The results of our present value calculations reflected a large weighting towards benefits expected near the start of the project, and the relatively smaller weighting towards benefits expected later. This is a feature of discounting long-term multi-generational infrastructure projects. The higher the discount rate, the greater the weighting towards earlier benefits, and the lower the present value of total benefit.

Cost-benefit analysis

In this section	This section summarises our estimates of the value, or net benefit to society, of investment in SRL East and North. We have estimated these net benefits using social cost-benefit analysis and express our results using 2 measures: 1. net present value (NPV) 2. benefit-cost ratio (BCR). This section also includes the results of break-even analysis we have undertaken to estimate the internal rate of return (IRR) and discounted payback period for SRL East and North. We have also considered how sensitive our cost-benefit analysis results are to simple variations in cost estimates and expected benefits.

In this section, we consider 2 measures, both of which discount estimated future costs and benefits into present values:

1. Net present value (NPV) – the value of the discounted benefits less the value of the discounted costs.
2. Benefit-cost ratio (BCR) – the value of the discounted benefits divided by the value of the discounted costs.

A positive NPV and a BCR greater than 1 indicates an expected net benefit to society. However, governments may target a larger positive NPV to deliver their policy objectives, or when choosing between multiple potential projects.

Our assessment

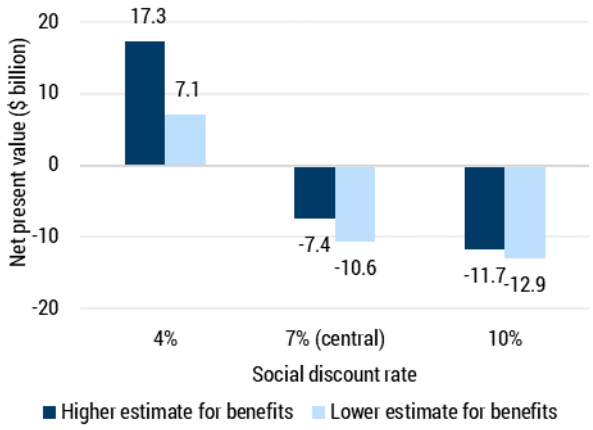
Using a 7% real social discount rate – the central case rate in Infrastructure Australia's *Assessment Framework* – we found that investment in SRL East and North would realise a net cost to society. Even with all categories of benefits – conventional, urban consolidation, and wider economic – included, we estimate the:

- NPV is negative, between -$10.6 billion and -$7.4 billion
- BCR is less than one, between 0.6 and 0.7.

Sensitivity to social discount rate

Consistent with Infrastructure Australia's *Assessment Framework*, we considered the sensitivity of our cost-benefit analysis results to real social discount rates of 4% and 10%.

Figure 8 – NPV of SRL East and North

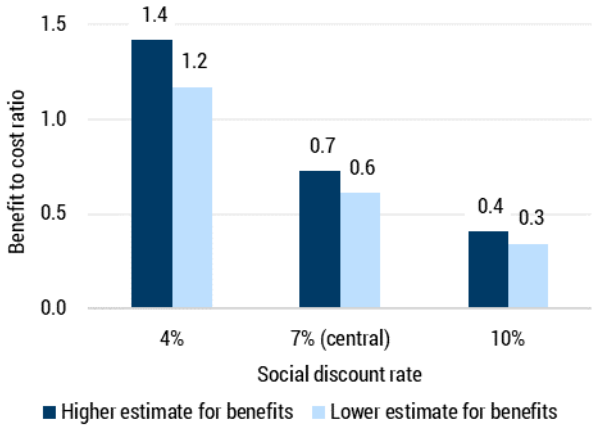


Source: Parliamentary Budget Office.

Using a 10% real social discount rate – the upper rate in the *Assessment Framework* – we estimate the NPV would be even more negative, between -$12.9 billion and -$11.7 billion. This implies a greater net cost to society compared to our assessment using the 7% central case rate.

Alternatively, using a 4% real social discount rate – the lower rate in the *Assessment Framework* and the SRL business case rate endorsed by the Victorian Government – yields a positive NPV estimate of between $7.1 billion and $17.3 billion, implying a net benefit to society.

Figure 9 – BCR for SRL East and North



Source: Parliamentary Budget Office.

Using a 10% real social discount rate – the upper rate in the *Assessment Framework* – we estimate a lower BCR (between 0.3 and 0.4). This implies that the costs of the project outweigh its benefits.

Alternatively, a 4% real social discount rate –the lower rate in the *Assessment Framework* and consistent with the SRL business case endorsed by the Victorian Government – yields a BCR estimate greater than 1, between 1.2 and 1.4. This implies that the benefits of the project outweigh its costs.

Sensitivity to the inclusion of categories of benefits

The SRL business case outlines and quantifies the different categories of benefits – conventional benefits, urban consolidation benefits (or land use impacts) and wider economic benefits. While our central case rate and social discount rate sensitivity analysis incorporates all these benefits, both the NPV and BCR are highly sensitive to the benefits included in the analysis.

Consequently, consistent with Infrastructure Australia's *Assessment Framework*, we considered the sensitivity of our cost-benefit analysis results to both:

1. real social discount rates of 4%, 7% (central), and 10%
2. the inclusion of different categories of benefits.

Figure 10 – SRL East and North cost-benefit analysis results

Benefits included	Discount rate:	4%	7% (central)	10%
Conventional benefits only	BCR:	0.8 to 1.0	0.4 to 0.5	0.2 to 0.3
	NPV ($ billion):	-7.8 to -0.5	-16.1 to -14.0	-15.3 to -14.5
Conventional and urban consolidation benefits	BCR:	0.9 to 1.1	0.5 to 0.6	0.3 to 0.3
	NPV ($ billion):	-4.6 to 4.1	-14.8 to -12.1	-14.6 to -13.6
Conventional, urban consolidation, and wider economic benefits	BCR:	1.2 to 1.4	0.6 to 0.7	0.3 to 0.4
	NPV ($ billion):	7.1 to 17.3	-10.6 to -7.4	-12.9 to -11.7

Source: Parliamentary Budget Office.

These results show that investment in SRL East and North would realise a net cost to society under:

- all scenarios based on a 7% or 10% real social discount rate
- a 4% discount rate with conventional benefits only.

Additionally, we found it is unclear whether a net cost or benefit to society would be realised using a 4% discount rate with conventional and urban consolidation benefits – at the lower estimate of the benefits this would realise a BCR of 0.9, but at the higher estimate, the BCR would be 1.1.

We found that investment in SRL East and North would only realise a net benefit to society at both the upper and lower bound of the benefits estimate range if:

1. a real social discount rate of 4% – the lower rate in the *Assessment Framework* – is used
2. all expected benefits – conventional, urban consolidation (i.e. land use impacts), and wider economic – are included.

These assumptions are consistent with those used in the Victorian Government's SRL business case, and they would result in:

- a positive NPV, between $7.1 billion and $17.3 billion
- a BCR greater than 1, between 1.2 and 1.4.

The results of our calculations based on these assumptions are similar to those published in the SRL business case, which included a NPV range between $3.0 billion and $22.9 billion, with a BCR between 1.1 and 1.7.

Break-even analysis

We conducted break-even analysis of SRL East and North by estimating the project's internal rate of return (IRR) and its discounted payback period.

Internal rate of return

While social discount rates allow us to compare the benefits and costs of a project, adjusting for the time value of money, the choice of social discount rate has a significant impact on the valuation. To examine this, we estimated the internal rate of return (IRR) or 'break-even rate' for this project. This is the value of the real social discount rate at which the present value of expected benefits equals the present value of estimated costs – i.e. the project's NPV equals zero and its BCR equals one.

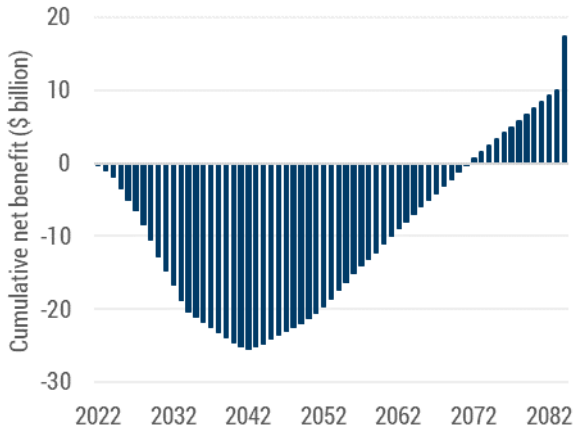
Assuming all benefits – conventional, urban consolidation, and wider economic – are included, we estimate the IRR for SRL East and North is:

- 5.5% for the higher estimate of benefits
- 4.7% for the lower estimate of benefits.

Discounted payback period

A net benefit to society can take considerable time to realise when there is a significant amount of initial investment. The discounted payback period is a measure of this – it is the amount of time a project will take to break even, calculated by discounting future values of expected benefits, less future values of estimated costs.

Figure 11 – Discounted payback period results – Higher estimate for benefits



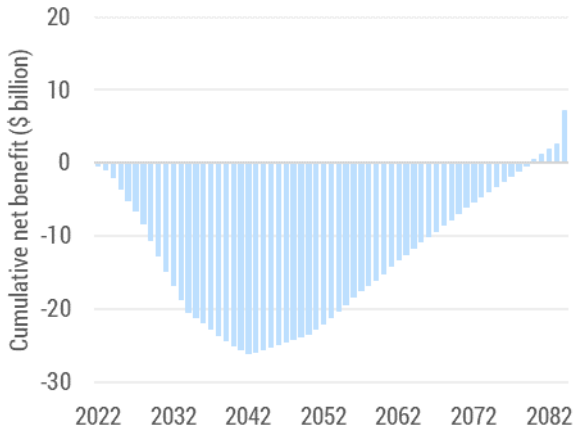
Note: Net benefit values have been discounted to 2022 using a 4% real social discount rate.

Source: Parliamentary Budget Office.

In this advice we have previously ascertained that investment in SRL East and North would realise a net cost to society when assessed using a 7% or 10% real social discount rate. Consequently, at these social discount rates, there is no discounted payback period for the project.

However, if we assess the project using a real social discount rate of 4% – the lower rate in the Infrastructure Australia *Assessment Framework* and the rate used in the Victorian Government's SRL business case – then we have found that SRL East and North would realise a net benefit to society. In this case, a discounted payback period can be calculated for the project.

Figure 12 – Discounted payback period results – Lower estimate for benefits



Note: Net benefit values have been discounted to 2022 using a 4% real social discount rate.

Source: Parliamentary Budget Office.

The significant initial build costs for SRL East and North mean that the project will not realise a net benefit to society for decades.

For both higher and lower estimates for benefits, the project's net cost to society would peak in 2042, when SRL East and the Box Hill to Reservoir segment of SRL North would have been built, but only SRL East would be carrying passengers.

As the SRL North segments come online for passenger services, the project's net cost to society would start to decrease. Using the 4% real social discount rate, the project would realise a net benefit to society in:

- 2072 for the higher estimate for benefits
- 2080 for the lower estimate for benefits.

Further sensitivity analysis

Our cost-benefit analysis is reliant on the accuracy of:

- our estimates of the cost to build and operate SRL East and North
- the SRL business case estimates of the benefits expected from SRL East and North, which we have taken at face value.

Through sensitivity analysis, we can consider the uncertainty surrounding our cost-benefit analysis results by testing how changes in our parameters influence the BCR. We undertake this analysis by altering the values, in real terms, of one major variable at a time:

- build costs
- operate costs
- build and operate (i.e. all) costs
- all benefits – conventional, urban consolidation, and wider economic – other than the residual value of assets.

We have tested likely variations to the values of these parameters to see the effect on our economic evaluation.

Figure 13 – SRL East and North sensitivity analysis results

Scenario	Change	BCR		
	Discount rate:	4%	7%	10%
Program case		1.2 to 1.4	0.6 to 0.7	0.3 to 0.4
Build costs	-20%	1.4 to 1.7	0.7 to 0.9	0.4 to 0.5
	+20%	1.0 to 1.2	0.5 to 0.6	0.3 to 0.3
Operate costs	-20%	1.2 to 1.5	0.6 to 0.7	0.3 to 0.4
	+20%	1.1 to 1.4	0.6 to 0.7	0.3 to 0.4
Build and operate costs	-20%	1.5 to 1.8	0.8 to 0.9	0.4 to 0.5
	+20%	1.0 to 1.2	0.5 to 0.6	0.3 to 0.3
All benefits	-20%	1.0 to 1.2	0.5 to 0.6	0.3 to 0.3
	+20%	1.4 to 1.7	0.7 to 0.9	0.4 to 0.5

Notes: All benefits – conventional, urban consolidation, and wider economic – are included under all scenarios. There is no change in the estimated residual value of assets under all scenarios. Program case refers to the scenario in which there is no change in build or operate costs, and no change in benefits.

Source: Parliamentary Budget Office.

The results of the sensitivity analysis show:

- There is no case for investment in SRL East and North under any scenario when a real social discount rate of 7% or 10% is used.
- There is a case for investment in SRL East and North under all scenarios when a real social discount rate of 4% is used.
- Variations in build costs have a greater effect than variations in operate costs.
- When a real social discount rate of 4% is used, investment in SRL East and North would become marginal if either:
  - build costs increase by more than 20%
  - build and operate costs increase by more than 20%
  - the value of all benefits, other than the residual value of assets, decreases by more than 20%.

Attachment A – Choice of discount rate

Discount rates allow us to compare the benefits and costs of a project, adjusting for the time value of money. The choice of social discount rate for assessing public sector projects can be contentious.

The discount rate affects the present value of cost and benefits, and therefore the net present value estimate. Employing a lower social discount rate will result in a higher estimate of the present value of future costs, but also a higher estimate of the present value of future benefits. Generally, most of the benefits of an infrastructure project flow after large initial build costs, so a lower social discount rate will value those benefits more than a higher social discount rate would.

Projects in which benefits generally flow after costs are incurred, such as this project, are materially affected by the choice of social discount rate. For such a project with a BCR of one, the discounted benefits and costs are in balance, while a BCR of less than one indicates the costs outweigh the benefits. If the project would achieve a BCR of one using a 4% discount rate, the BCR would be less than one using a 7% or 10% discount rate.

Jurisdictional choices

In Australia, different real social discount rates are used, depending on the jurisdiction and project's purpose. Some jurisdictions, such as Victoria and South Australia, account for project-specific risk in the social discount rate used, with riskier projects having a higher rate. Other jurisdictions, such as New South Wales, use a single rate for all projects, and account for project-specific risk by adjusting project cost and benefit amounts.

Figure 14 – Recommended real social discount rates in Australia

Authority	Categories	Recommended rates
Victorian Department of Treasury and Finance	Traditional core service delivery areas of government, for which benefits cannot be easily quantified (e.g. schools, hospitals, police stations), and also for potentially catastrophic scenarios	4% with sensitivity testing
	Traditional core service delivery areas of government, for which benefits are more easily quantified (e.g. public transport, roads, public housing)	7% with sensitivity testing at 4% and 9%
	Commercial investments with risks similar to that of the private sector	Depends on the project
South Australian Department of Treasury and Finance	All initiatives	Depends on the initiative – should be calculated using the risk-free rate plus a market risk premium, with ±2% sensitivity testing

Authority	Categories	Recommended rates
NSW Treasury	All sectors, all projects	5% with sensitivity testing at 3% and 7%
Queensland Government	All proposals	7% with sensitivity testing at 4% and 10%
Infrastructure Australia	All assessments	4%, 7% (central case) and 10%
Office of Impact Analysis	Most proposals	7% with sensitivity testing at 3% and 10%
	Environmental evaluations, where analysis of more than 30 years is required	Declining long-term discount rate: ▪ 7% for years 1-30 ▪ 5.4% for years 31-75 ▪ 4.8% for years 76-125 ▪ 4.3% for years 126-200 ▪ 4.0% for years 201-300 ▪ 3.7% for years 301+

Source: Victorian Department of Treasury and Finance, South Australian Department of Treasury and Finance, NSW Treasury, Queensland Department of State Development, Infrastructure, Local Government and Planning, Infrastructure Australia, and Office of Impact Analysis.

The 4% real social discount rate used in the SRL business case is consistent with:

- the Victorian Department of Treasury and Finance recommendation for projects where the social benefits are difficult to quantify
- the lower end of the range of rates recommended by the Victorian Department of Treasury and Finance for public transport projects
- the lower end of the range of rates used in the Infrastructure Australia *Assessment Framework*.

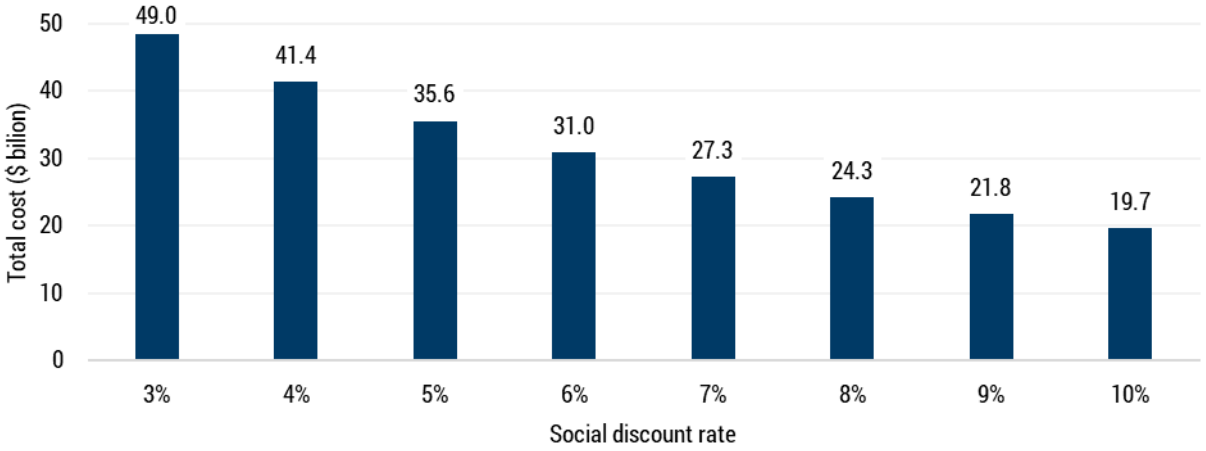
Effect on our evaluation

In addition to the 4%, 7% and 10% real social discount rates used in the main body of our advice, we have elected to consider the effect of rates between 3% and 10% to encompass all possible rates used by governments in Australia.

Cost

We have updated our present value of cost calculations for SRL East and North, to include all real social discount rates between 3% and 10%.

Figure 15 – Present values of the total cost to build and operate SRL East and North



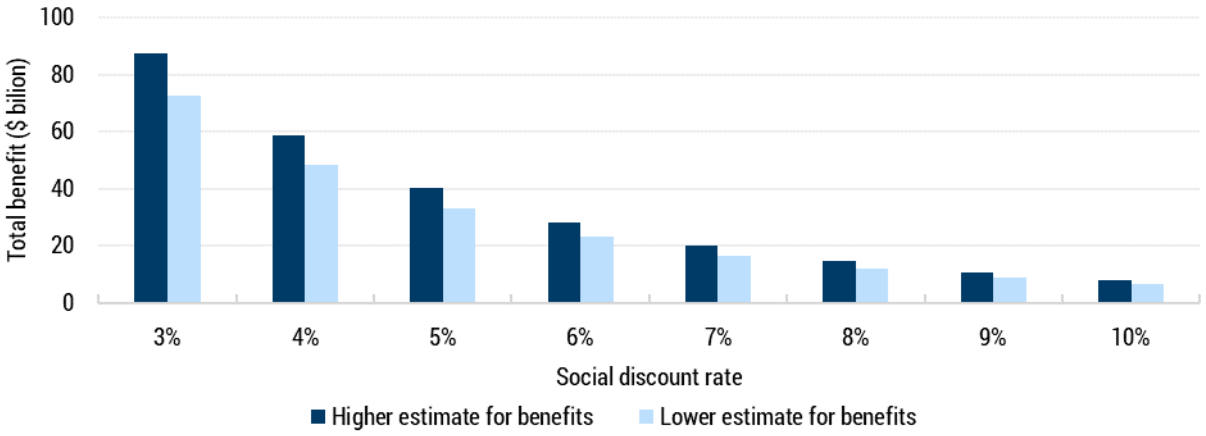
Source: Parliamentary Budget Office.

As expected, these results show higher present value of cost amounts for low social discount rates, and lower present value of cost amounts for high social discount rates.

Benefit

We have updated our present value of benefit calculations for SRL East and North, to include all real social discount rates between 3% and 10%.

Figure 16 –Present values of the total benefit expected from SRL East and North



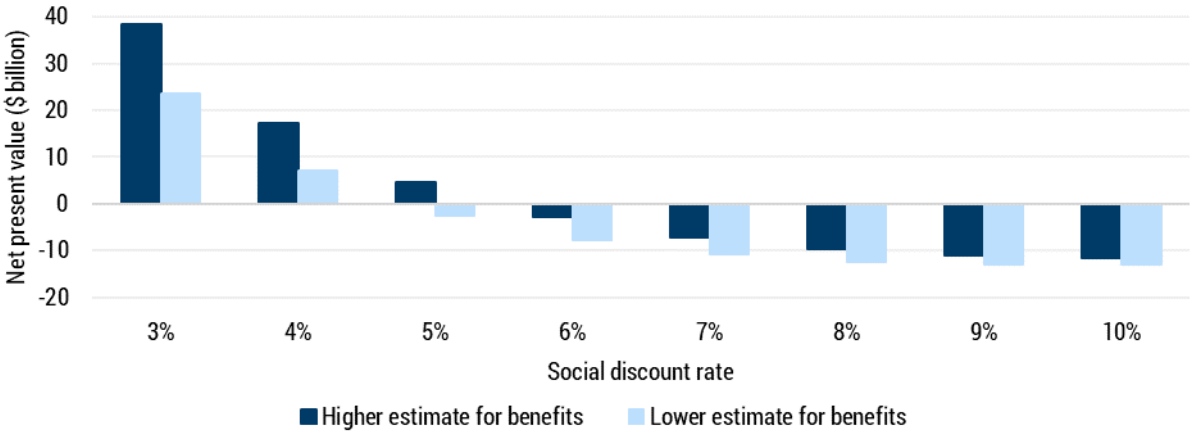
Source: Parliamentary Budget Office.

As expected, these results show higher present value of benefit amounts for low social discount rates, and lower present value of benefit amounts for high social discount rates.

Cost-benefit analysis

We have updated our NPV estimates for SRL East and North to include all real social discount rates between 3% and 10%.

Figure 17 – Net present value estimates for SRL East and North



Source: Parliamentary Budget Office.

As expected, these results show higher net present value amounts for low social discount rates, and lower net present value amounts for high social discount rates.

For each estimate of benefits used in the analysis, there is a social discount rate inflection point between the project being assessed as a net benefit to society and a net cost to society:

- for the higher estimate for benefits, this inflection point is between social discount rates of 5% and 6% – this aligns with our previously calculated IRR of 5.5%
- for the lower estimate for benefits, this inflection point is between social discount rates of 4% and 5% – this aligns with our previously calculated IRR of 4.7%.

Declining discount rate

The Office of Impact Analysis (OIA) provides information on the appropriate social discount rates to use based on the evaluation period of the project. For project evaluations of up to 30 years, the OIA recommends a real discount rate of 7% as their central case. For project evaluations, particularly environmental project evaluations, of more than 30 years, the OIA proposes the use of a declining discount rate. For example, for evaluating a project over 65 years, they recommend using a 7% discount rate for the first 30 years and a 5.4% discount rate for the next 35 years.

Using the OIA declining long-term discount rate, we found that investment in SRL East and North would realise a net cost to society. Even with all categories of benefits – conventional, urban consolidation, and wider economic – included, the:

- NPV is negative, between -$8.3 billion and -$4.5 billion
- BCR is less than 1, between 0.7 and 0.8.

Attachment B – Victorian Government estimates

In this section	This section considers the Victorian Government's published estimates of the: ▪ cost to build and operate SRL East and North ▪ benefit expected from the project ▪ cost-benefit analysis results for the project.

Cost estimates

The KPMG economic appraisal assessed the economic costs of building SRL East and North and operating those sections for 50 years. Costs considered included those for:

- transport infrastructure – capital and recurrent costs
- precinct initiatives – capital and recurrent costs
- social costs incurred during construction, such as disruption and environmental costs – these were only discussed qualitatively.

Based on the SRL business case's key parameters, the KPMG economic appraisal's estimates of economic costs were expressed in different terms, including real costs and the present value of costs.

Figure 18 – Different bases for expressing cost and benefit values

Terms	Description
Nominal	These are the actual cost and benefit values of a given initiative as they would appear in the year in which they are incurred or accrued. This basis is consistent with how the government reports initiative funding and actual and estimated costs in budget papers. These dollar values incorporate the effects of inflation and can include cost escalation for asset works that exceed more general measures of inflation. Further, these values do not account for the opportunity cost of investing in the given initiative instead of other possible initiatives.
Real	These are the nominal dollar values of a given initiative that have been adjusted to remove the effects of inflation. Expressing costs (and benefits) in real terms makes it easier to compare the estimated costs (and benefits) that would be incurred (or accrued) during each year of an analysis. While these dollar values have been adjusted to remove the effects of inflation, they still do not account for the opportunity cost of investing in the given initiative instead of other possible initiatives.

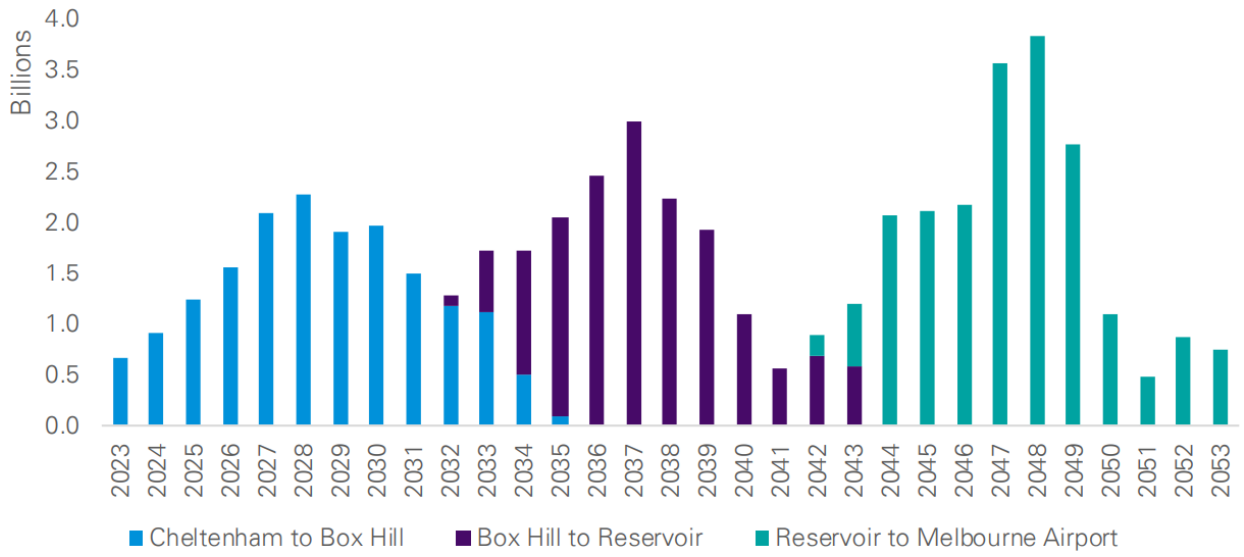
Terms	Description
Present value	These are the real dollar values of a given initiative that have been discounted to their value in a base year, using a real social discount rate. If these present values are then summed, and both costs and benefits are being examined, then the results are net present values (NPV). Discounting future dollar values in this way accounts for the long-term opportunity cost of investing in the given initiative, instead of other possible initiatives. The discount rate can be thought of as the minimal acceptable rate of return on an alternative use of the initiative's funds. This method of discounting enables appraisal of project costs against project benefits through cost-benefit analysis, and comparisons with other projects and policies on a fair and consistent basis. Higher discount rates result in a greater weighting towards costs incurred and benefits accrued earlier in an initiative, and lower net present values overall. For example, future expenditure has a relatively lower present value with a 7% discount rate than it does with a 4% discount rate.

Source: Parliamentary Budget Office.

Cost profile

The KPMG economic appraisal included charts showing estimates of the capital cost profiles for SRL East and North. These were real cost estimates – expressed in 2020 dollars – of the year-on-year costs to build SRL East and North.

Figure 19 – KPMG rail capital cost profile for SRL East and North



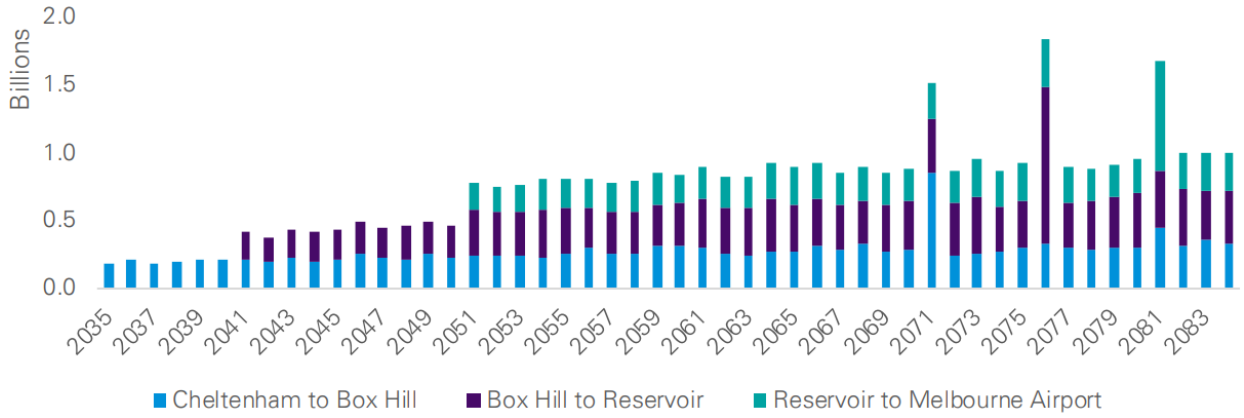
Notes: Values are real cost estimates, expressed in 2020 dollars, of the Option A scenario for SRL North. Precinct initiative costs are not included.

Source: KPMG, based on information sourced from WTP.

The estimated build expenditure profile for each section of SRL East and North reflects the profile of comparable major transport infrastructure projects. There are steady increases and decreases in year-on-year capital costs over 30 years as each SRL East and North section is built.

The KPMG economic appraisal also included charts showing estimates of the recurrent cost profiles for SRL East and North. These were real cost estimates – expressed in 2020 dollars – of the year-on-year costs to operate SRL East and North for 50 years between 2035 and 2084.

Figure 20 – KPMG recurrent cost profile for SRL East and North



Notes: Values are real cost estimates, expressed in 2020 dollars, of the Option A scenario for SRL North.

Source: KPMG, based on information sourced from WTP.

The estimated profile of SRL East and North operations expenditure shows a gradual increase in operations and maintenance expenses, with step changes as passenger services commence on additional SRL sections. There are also 3 peaks in asset renewal expenditure as rolling stock replacements are required.

Total cost

The KPMG economic appraisal detailed the economic costs of building SRL East and North and operating those sections for 50 years. These present value of cost results, calculated using a real social discount rate of 4%, were also included in the main body of the SRL business case.

Figure 21 – SRL business case cost results for SRL East and North

($ billion)	Program Case Option A	Program Case Option B
Capital costs	24.1 to 40.2	27.1 to 45.1
Recurrent costs	6.3 to 10.6	7.6 to 12.6
Total cost	**30.7 to 50.5**	**35.1 to 57.6**

Notes: Values have been discounted to 2022 using a 4% real social discount rate. The value ranges for each line item are based on varying inputs and are not additive. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

These published results explicitly state the estimated present value of the cost to build SRL East and North – being the capital costs – and present value of the cost to operate SRL East and North – being the recurrent costs. Assuming Option A was chosen for SRL North and using a 4% real social discount rate, the Victorian Government's estimated present value of the cost to:

- build SRL East and North would be between $24.1 billion and $40.2 billion
- operate SRL East and North, over 50 years, would be between $6.3 billion and $10.6 billion
- build and operate SRL East and North would be between $30.7 billion and $50.5 billion.

Benefit estimates

The KPMG economic appraisal also assessed the economic benefits expected from SRL East and North through to 2084. In this advice, we take at face value these estimates of expected benefits from the SRL business case and use them in our cost-benefit analysis.

Benefit categories

Benefits in the SRL business case were categorised as either:

- Conventional economic benefits
- Urban consolidation benefits
- Wider economic benefits
- Macroeconomic impacts.

Figure 22 – Categories of benefits expected from SRL East and North

Type of benefit	Description
Conventional economic benefits	
User benefits (public transport and road users)	▪ Reductions in crowding and waiting times on public transport ▪ Travel time savings ▪ Vehicle operating cost savings for commercial vehicles due to people taking public transport instead of driving
Other societal benefits (externality effects)	▪ Decrease in car crashes, greenhouse gas emissions ▪ Improved health due to people taking public transport instead of driving ▪ The value Victorians place on having a suburban rail link, such as those who may not be immediate users of the SRL but value the option of using the SRL, and 'feel-good' benefits
Infrastructure residual value	▪ Recognising that SRL infrastructure will have an economic life beyond the end of the evaluation period, residual value is an estimate of the economic benefit of infrastructure from the end of the evaluation period to the end of the economic life of the asset

Type of benefit	Description
Urban consolidation benefits	▪ More consolidated land use form and the changes to socio-economic circumstances that result in a more equitable and inclusive community
Wider economic benefits	▪ Growth of major employment centres outside of the Melbourne central business district (CBD) and increased employment density in precincts; increased labour supply options facilitating better skills matching, and higher productivity ▪ Increase in production or output of goods or services due to a reduction in transport costs
Macroeconomic impacts	▪ Increased global competitiveness, labour productivity, economic output, and employment.

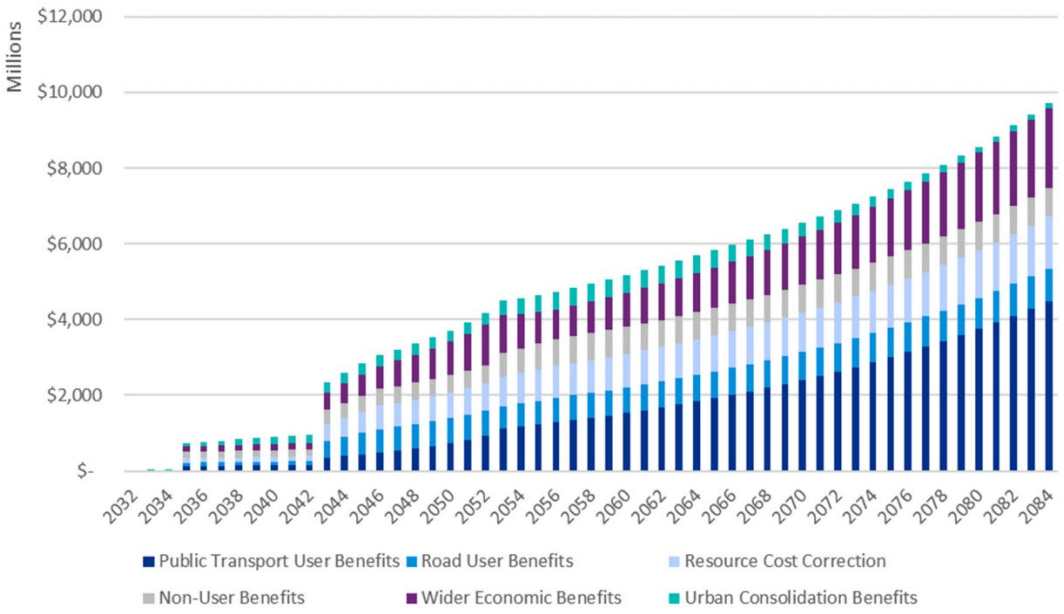
Source: KPMG.

User benefits, other societal benefits and infrastructure residual value are examples of conventional benefits that are included in what the SRL business case would describe as conventional cost-benefit analysis. The SRL business case analysis also included urban consolidation benefits and wider economic benefits, which are usually included in social cost-benefit analysis of public projects. The SRL business case also examined and quantified the macroeconomic or economy-wide impacts of SRL East and North but did not include these impacts in its cost-benefit analysis.

Benefit profile

The KPMG economic appraisal included charts showing estimates of the expected benefit profiles for SRL East and North. These were real value estimates – expressed in 2020 dollars – of the year-on-year economic benefits expected from SRL East and North.

Figure 23 – KPMG expected benefit profile for SRL East and North



Notes: Values are real benefit estimates, expressed in 2020 dollars, of the Option A scenario for SRL North. The residual value of assets is not included.

Source: KPMG.

The profile of expected benefits from SRL East and North shows:

- a small amount of urban consolidation benefits are expected in the 3 years prior to the commencement of passenger services on SRL East in 2035
- more substantial benefits are expected from 2035, the first year of passenger services on SRL East
- expected benefits more than double in 2043 when passenger services are extended to include SRL North – Box Hill to Reservoir
- expected benefits increase rapidly between 2043 and 2053, when passenger services are extended again to include SRL North – Reservoir to Melbourne Airport
- there is an initially slow, but increasingly rapid increase in expected benefits after 2053 – this is a result of a decision to extrapolate the value of benefits between 2056 and 2084, the final year of the SRL business case evaluation.

Total benefit

The KPMG economic appraisal detailed the economic benefits expected from SRL East and North through to 2084. These present value of total benefit results were also included in the main body of the SRL business case.

Figure 24 – SRL business case benefit results for SRL East and North

($ billion)	Program Case Option A	Program Case Option B
Conventional benefits:		
▪ Public transport user benefits	14.9 to 19.8	16.6 to 21.7
▪ Road user benefits	10.0 to 12.3	11.7 to 14.3
▪ Non-user benefits	3.5 to 3.7	4.2 to 4.6
▪ Option and non-use value	1.1 to 5.4	1.2 to 5.7
▪ Residual value of assets	3.8 to 6.4	3.6 to 6.0
Total conventional benefits	**33.6 to 40.9**	**37.4 to 45.2**
Urban consolidation benefits:		
▪ Essential infrastructure cost savings	2.0 to 3.3	2.3 to 3.7
▪ Reduced non-urban land consumption	0.01 to 0.02	0.01 to 0.02
▪ Improved social inclusion and equality	1.0 to 1.6	1.2 to 1.9
Total urban consolidation benefits	**3.2 to 4.6**	**3.7 to 5.3**
Wider economic benefits:		
▪ Agglomeration economies	6.0 to 9.7	6.3 to 10.3
▪ Labour market deepening	1.1 to 1.8	1.8 to 3.0
▪ Imperfect markets	0.4 to 0.5	0.5 to 0.6
Total wider economic benefits	**7.5 to 11.9**	**8.8 to 13.9**
Total benefit	**48.5 to 58.7**	**54.7 to 65.8**

Notes: Values have been discounted to 2022 using a 4% real social discount rate. The value ranges for each line item are based on varying inputs and are not additive. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

Assuming Option A was chosen for SRL North and using a 4% real social discount rate, the Victorian Government's estimated present value of:

- conventional benefits expected from SRL East and North, over 50 years, would be between $33.6 billion and $40.9 billion
- urban consolidation benefits expected from SRL East and North would be between $3.2 billion and $4.6 billion
- wider economic benefits expected from SRL East and North, over 50 years, would be between $7.5 billion and $11.9 billion
- total benefit expected from SRL East and North would be between $48.5 billion and $58.7 billion.

Economic evaluation

The KPMG economic appraisal also compared their estimated present value of total cost incurred by building and operating SRL East and North for 50 years, with their estimated present value of total benefit accrued from SRL East and North through to 2084. Using cost-benefit analysis, KPMG found that the project was economically viable, as it would result in a positive NPV and a BCR greater than one.

Figure 25 – SRL East and North economic evaluation results

($ billion)	Program Case Option A	Program Case Option B
Total cost	30.7 to 50.5	35.1 to 57.6
Total benefit	48.5 to 58.7	54.7 to 65.8
Net present value (NPV)	3.0 to 22.9	2.4 to 25.2
Benefit-cost ratio (BCR)	1.1 to 1.7	1.0 to 1.7

Notes: Values have been discounted to 2022 using a 4% real social discount rate. Program Case Option A and B refer to the SRL North scenarios examined in the SRL business case.

Source: KPMG.

These cost-benefit analysis results were also included in the main body of the SRL business case. Of the two options evaluated, Option A was found to be more likely to have a higher BCR. Assuming the Victorian Government chose Option A for SRL North, and using a 4% real social discount rate, the SRL business case estimated the:

- NPV for SRL East and North would be between $3.0 billion and $22.9 billion
- BCR for SRL East and North would be between 1.1 and 1.7.

Scenario and sensitivity analysis

The KPMG economic appraisal also included the results of scenario and sensitivity testing of their inputs and assumptions. Key scenarios tested included:

- COVID-19 sensitivity – in which population and employment growth is delayed, there is increased rates of working from home, and less air travel
- high autonomous vehicle (AV) and electric vehicle (EV) use – in which there is higher private vehicle use and more ride sharing
- transport network pricing – in which the public transport fare system is changed and road distance pricing is implemented
- changes in the amount of public transport benefits expected from the project
- changes in the amount of road user benefits expected from the project
- an alternative extrapolation method for the estimation of benefits – in which there would be no growth in the real value of benefits after 2056.

This analysis suggested that:

- COVID-19 could reduce the value of the project, but not by enough to make the project a net cost to society.
- higher than expected AV and EV use would have a detrimental impact on the value of the project, especially if it led to more ride sharing.
- the alternative transport network pricing system could increase the project's net benefit to society.
- changes in the amount of public transport benefits would have a greater impact than changes in the amount of road user benefits, and either change could make investment in the project marginal.
- the alternative, more conservative extrapolation method for the estimation of benefits, could make investment in the project marginal.

Attachment C – Assumptions and approach

In this section we provide the assumptions and approach we used to conduct our social cost benefit analysis of SRL East and North.

Assumptions

When preparing this advice, we made the following assumptions:

1. Our independent assessment of the cost to build and operate SRL East and North, Suburban Rail Loop: cost to build and operate East and North sections, identifies all quantifiable costs for SRL East and North.
2. Costs incurred before 2022, when actual construction works commenced, should be excluded from cost-benefit analysis of the project.
3. The Victorian Government will choose Option A for the build of SRL North.
4. The SRL business case identifies all quantifiable benefits for SRL East and North.

Approach

When preparing this advice, we:

Costs

- used our independent assessment of the cost to build and operate SRL East and North
- calculated present values by discounting cash flows at various social discount rates
- calculated the impact of changed cost estimates on our economic evaluation

Benefits

- assessed the SRL business case evaluation of the expected benefits from SRL East and North
- estimated the cash flow values for each of the reported benefit categories
- calculated present values by discounting cash flows at various social discount rates
- calculated the impact of changed benefit estimates on our economic evaluation

Cost-benefit analysis

- calculated NPVs for different scenarios and social discount rates by subtracting the present value of costs from the present value of benefits
- calculated BCRs for different scenarios and social discount rates by dividing the present value of benefits by the present value of costs
- calculated IRRs for different estimates for benefits by iteratively solving for a NPV of zero.

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