

**Infrastructure SA** 

# **Impact Analysis Guide**

**Cost-Benefit Analysis** 

April 2022 | Version 1.0

infrastructure.sa.gov.au

## Document control and approval

ISA Document #:	ISAGMD-11-v1.0
Document Date:	April 2022
Date for Next Review:	March 2024
Current Version:	V1.0

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Links to reference documents:

Document	Location
ISAAF	infrastructure.sa.gov.au
ISA Justification Templates	infrastructure.sa.gov.au
ISA Assurance Review Guide	infrastructure.sa.gov.au

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### Introduction

#### **Introduction and scope**

Infrastructure SA (ISA) has been established under the *Infrastructure SA Act 2018* to improve infrastructure planning, prioritisation, delivery and operations. ISA's justification templates (Strategic Assessment, Options Analysis and Business Case) outline the overall approach to justifying infrastructure related initiatives.

# This Guide has been developed to support sponsor agencies/proponents undertake cost-benefit analysis, which is a key component of ISA's integrated assessment approach, *within* ISA's overall approach to justifying initiatives.

This Guide provides guidance on the approaches, parameters and sensitivities that should be considered when identifying and undertaking analysis of impacts.

The Guide can be referred to when sponsor agencies/proponents are:

- proposing infrastructure projects/programs that will be submitted for consideration in ISA's Capital Intentions Statement
- utilising/completing ISA's justification templates, and
- submitting initiatives for assurance in accordance with the ISA Assurance Framework (ISAAF).

It is important to note that this is **not a step-by-step procedure** for undertaking a cost-benefit analysis. ISA recommends that sponsor agencies/proponents develop and/or engage internal and external capability to expertly identify, understand and analyse potential impacts.

The Guide can also be referred to when ISA receives proposals for prioritisation and assurance. When ISA prepares its own strategies, statements and plans, it may have regard to the approaches in this guide if they are appropriate, noting it is not standard practice for cost-benefit analysis to be undertaken when developing strategies and plans.

#### **Benefits of this Guide**

This Guide fosters a consistent approach to impact identification and socio-economic appraisal across the various infrastructure sectors and between State and Commonwealth Governments so that decision makers can make informed decisions about relativities of projects. ISA is continuingly developing guidance to enable proponents to undertake comprehensive impact assessments and welcomes suggestions on improving this guidance and supporting impact assessment materials.

#### **Alignment with Infrastructure Australia**

This Guide has been developed with reference to <u>Infrastructure Australia's *Guide to economic appraisal*</u>. This ensures consistent guidance at both State and Commonwealth levels and provides confidence to proponents that should assessments and assurance be undertaken at either or both levels, these will be undertaken with reference to similar parameters.

#### **Alignment with Department for Treasury and Finance South Australia**

This Guide has been developed primarily for ISA's requirements and should be read in conjunction with the Treasurers Instructions 17 *Evaluation of and Approvals to Proceed with Public Sector Initiatives* and *Guidelines for the Evaluation of Public Sector Initiatives Parts A & B.* 

ISA and the Department for Treasury and Finance will work closely to ensure there is minimal duplication or conflict; however, where there are conflicts or difference in guidance, please contact ISA for advice.

# Context

#### Integrated assessment approach

ISA endorses an integrated assessment approach, which is a comprehensive socio-economic assessment approach that recognises impacts and risks that cannot be monetised, particularly for input into a cost-benefit analysis, are appropriately considered alongside monetised impacts during justification, definition and assessment of initiatives/proposals.

For further guidance, refer to ISA's justification templates.

The integrated assessment approach may incorporate the following.

#### Strategic merit test

Sponsor agencies are encouraged to liaise with ISA and consulting partners on undertaking a strategic merit test (SMT) on the initial options (sometimes referred to as the 'long long-list'). In short, this usually represents initial filtering of options against alignment with goals, objectives and strategic plans.

ISA will develop further guidance in the future.

#### **Multi-criteria analysis**

Multi-criteria analysis (MCA) can be an effective and efficient way to apply criteria to a filtered list of options, determine specific assessment scores and concisely present the individual and overall results of the analysis. Sponsor agencies are encouraged to consult with ISA and consulting partners on undertaking MCA on long and filtered lists of options.

ISA will develop further guidance in the future.

#### **Cost-benefit analysis**

Cost-benefit analysis (CBA) is a robust methodology that assesses monetised impacts (costs and benefits) that accrue to society as a whole. That is, it considers a broad range of socio-economic costs and benefits to the community, rather than costs and benefits that accrue solely to a government agency, the South Australian Government and/or an individual entity or firm undertaking the project.

A CBA seeks to systematically measure the effects of a proposal over time. The output presents these as the sum of the changes in consumer surplus, producer surplus and externality effects. The output is ultimately expressed in terms of a net monetised benefit expressed as a ratio/multiple of benefits compared to costs; this is termed a benefit-cost ratio (BCR).

#### **Integrated analysis**

Given not all costs and benefits can be objectively monetised in a BCA, an integrated analysis brings together the non-monetised (qualitative and quantitative) impacts and the results from the CBA to ensure all impacts are appropriately considered when selecting options for further development in the business case and, ultimately, the selection of a recommended option for investment decision.

Infrastructure Australia's *Guide to economic appraisal* offers further background on the theoretical basis for CBA (p16).

# Option definition

#### **Base case**

Integrated assessments should always include consideration of a base case option, as this remains a viable option for consideration in any investment decision.

A well-established base case provides a fundamental foundation for analysing the relative merits of prospective project case options. To ensure potential impacts of proposals can be appropriately identified and assessed, it is important to confirm the base case. An incorrectly specified base case can bias the analysis of different options by overstating the benefits and understating the costs. Alternatively, it may underestimate the future impact of the existing problem and understate potential project benefits.

The base case for the initiative should represent a 'do-minimum' situation, reflecting the continued operation of the current network or service under good management practices (i.e. 'business as usual' or 'keep safe and operational' situation). Importantly, the 'do-minimum' case is not the same as a 'do-nothing' case, as it should include relevant minor improvements to the current infrastructure network or services in the short to medium term that can reasonably be expected to occur in the absence of the project case. This will require careful consideration in rapidly developing areas or where significant investment is planned.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on identifying the base case (pp17-20).

#### **Project cases**

For guidance on the identification of project case options to be assessed in the CBA, please refer to ISA's justification templates.

# Impact assessment

#### **Identifying impacts**

Impacts are effects on someone (society) or something (environment) that arise as a result of an action/ intervention. Impacts can be positive (also described as a benefit) or negative (a cost or dis-benefit).

ISA requires sponsor agencies/proponents to consider all impacts (strategic, economic, social, environmental and financial) when developing strategies and initiatives. Further guidance is provided in ISA's justification templates. These are further supported by ISA's Impact Assessment sheets to assist proponents to consider potential impacts across a project's lifecycle.

- Economic Impact Assessment Sheet
- Environmental Impact Assessment Sheet
- Social Impact Assessment Sheet.

ISA recognises that impact identification and understanding develops as an initiative progresses through the strategy and project lifecycle; however, a general awareness of possible impacts (positive and negative) of potential infrastructure and non-infrastructure interventions in the service, asset and urban and natural environments, and their relativities against the Base Case, is expected.

#### **Categorising impacts**

Metrics by which impacts are assessed may be described in either qualitative, quantitative or monetised terms.

A key objective for sponsor agencies/proponents should be to **monetise (value costs and benefits in dollar terms) as many of the impacts as objectively possible** for inclusion in the CBA.

However, it is recognised that some impacts may be challenging or costly to monetise. These should then be considered as part of the broader integrated assessment approach and presented in qualitative and or quantitative terms.

	Category			Assessment	Noto	
	Qualitative	Quantified	Monetised	approach	Note	
	~	~	~	Include in CBA	Include `monetised value' in <b>CBA</b>	
Impact category	~	~		Include in quantitative assessment	Describe 'unit of measure' in broader integrated analysis	
	~			Include in qualitative assessment	Describe 'impacts in detail' in broader integrated analysis	

Maturity in identifying and monetising costs and benefits may vary depending on the initiative's progress through the project lifecycle. Some impacts may only be qualified or quantified in the strategic phase or early justification phase but may then be monetised in the latter stages of the justification or definition phases.

### Attachment 1 provides a comprehensive description of the level of impact analysis required at each phase of a project complete lifecycle.

It is important that impacts are not double counted and incorporated in two different categories across multiple assessments (MCA/CBA).

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on categorising costs and benefits in the CBA (p26-33).

#### **Demand forecasting**

Demand forecasts play a critical role in not only the definition of appropriate project case options, but also inform the extent of impacts (benefits and dis-benefits) on both base case and project case options.

Demand forecasting should include the underlying justification for assumptions and growth rates and sensitivity testing of central economic and project specific assumptions.

Proponents should present a detailed disaggregation – by year/date/user type – of the results of the demand modelling.

Assumptions that drive demand include:

- growth rates (population, demographics, employment, technological change) and how they may change over the appraisal period, and
- values (number of households, businesses, service changes (type and price), consumer preferences).

### ISA supports proponents utilising service sector projections where they provide a greater level of certainty for service planning and outcomes.

### For population projections, ISA endorses the use of central source, medium series projections from Planning and Land Use Services.

Project teams will need to select the most appropriate statistical areas from which to draw their population projects. For most population projection driven proposals with localised problems and solutions, Statistical Area 2 (SA2) is the most appropriate source of population projections to use. For proposals that have wider catchments, proponents should consider SA Levels 3 and 4.

Local Government Area/Council area generated project population projections should be avoided. It may be useful to consider low and high growth projections and economic policy population projections as a sensitivity.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on demand forecasting (pp35-39) and how to consider any induced demand (additional or new demand) that occurs as a result of a project (p40).

# Monetising impacts

#### Approach

As part of a CBA, monetisation of impacts (benefits/dis-benefits) should be applied to both base case and project case options.

In the justification and definition phases, impacts should be appropriately sourced and monetised in a way that is consistent with the guidance in Attachment 1: *Level of Impact Analysis by Project Phase.* 

There are a range of possible approaches to quantify benefits/dis-benefits.

In general, **valuations based on market prices** (or other observed consumer and producer behaviour) will provide more reliable estimates of benefit values compared to non-market valuation techniques. Where justified, ISA will support the use of rapid non-market valuation techniques.

Where market values are not available, proponents should provide the rationale for the technique/approaches chosen and the prediction of the scale of the benefits/dis-benefits relative to each specific proposal, so that each case can be assessed on its own merits.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on valuing approaches for monetising costs and benefits (p56-58).

#### **Direct costs and revenues**

Project case design, definition and cost estimation should be developed and matured in a way that is consistent with the guidance in Attachment 1: *Level of Impact Analysis by Project Phase.* 

Capital investment and operational costs of projects play a fundamental role in determining their social, economic and environmental value. It is therefore important that capital and operating expenditure estimates used in any financial and economic appraisal are robust and consistent.

### Base case and project case options should include all relevant capital, land acquisition, maintenance, replacement and operating costs.

Both the level of design and associated risks for base and project case options need to be considered when determining cost estimates over the project's lifetime. For instance, there could be larger upfront costs with smaller on-going operating and maintenance costs, or smaller upfront costs with larger on-going staged expenses.

ISA acknowledges that South Australian Government agencies may have their own internal or sector-specific guidance that may differ from ISA's preferred levels of design and cost at key points in the lifecycle.

Where sector guidance requires definition and cost estimation that exceeds the levels required by ISA, ISA will accept this for assessment and assurance.

Where sector guidance provides definition and cost estimation that does not meet the levels required by ISA, sponsor agencies/proponents will need to clearly justify why they cannot meet the expected levels.

Capital expenditure (or 'CapEx') estimates should be presented separately from operating expenditure (or 'OpEx') estimates. CapEx should be supported by significant in-depth analysis. The level of rigor in estimating principles applied should increase as planning progresses. Early range estimates may rely on a greater level of

benchmarking, while more detailed first principle estimating should be considered as proposals progress to shortlist assessments and funding requests.

Costs and revenues should also be expressed in 'real' terms for option analysis; meaning costs, revenues and cash flows must exclude general escalation of prices. However, real escalation of some prices (e.g. material costs, wages) may be appropriate.

Land and property costs and revenues should reflect their market value.

Project costs should only include cost elements that will be realised after the investment decision. Costs incurred to justify an initiative are considered '*sunk costs'* and should be excluded from the CBA.

Proponents should take care to not include extensive design (beyond the required percentages defined in Attachment 1), demolition, construction and land acquisition costs prior to an investment decision.

ISA recognises that the level of project case definition and design is also linked to the delivery model for the project. For example:

- Design-Bid-Build (traditional) models will require more design by the sponsor agency, noting this may occur as part of, or after the business case.
- Design and Construct (D&C) models (plus maintenance variants) requires a preliminary design to allow the D&C contractor to further develop and potentially innovate the design.
- Public Private Partnership (PPP) models requires only a preliminary design to allow the PPP Consortium to further develop and potentially innovate the design.

**ISA will ultimately accept a level of design and costing that is appropriate for the eventual delivery model.** Care should be taken to ensure appropriate levels of design and risks are recognised to inform all project case options and their delivery mechanisms during definition phase.

#### **Risk consideration**

Service or asset delivery risks need to be is properly identified, assessed and costed. ISA prefers sponsor agencies/proponents calculate the total project costs using detailed probabilistic cost estimates, which are based on the risk analysis undertaken for the project. This approach provides a more accurate cost estimate and can avoid the inclusion of large generic contingencies.

Capital cost estimates should be presented in terms of P50, P90 and/or Expected values. P50 and P90 costs are estimates of project costs based on 50% and 90% probability that the cost estimate will not be exceeded. The P50 cost value is the median of the cost distribution, while the Expected cost value reflects the mean value of the cost distribution.

Where initiatives are more mature in the project lifecycle, the Expected cost value may be appropriate. For less mature initiatives, where the extent of design has not reached anticipated levels, a risk adjusted P50 cost value would be recommended.

### ISA accepts central case results with a P50 cost estimate and with sensitivity testing using the P90 cost estimate.

### Where possible, particularly for proposals that will be assessed by Infrastructure Australia, the Expected cost should be used.

Should P50, P90 and Expected costs not be possible, sponsor agencies/proponents should engage with ISA to explore alternative approaches like deterministic risk assessments.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on costs (p60-64).

#### Service sector impacts

Monetisation of service sector benefits and dis-benefits will vary between sectors and may include consideration of asset performance, environmental impacts and socio-economic impacts. Proponents are encouraged to consider and identify monetisation of costs and benefits relative to their service or asset being proposed, and more broadly across their sector.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on potential costs and benefits for each service sector (p49-55).

Proponents are encouraged to liaise with ISA in respect to the service sector impacts and, in particular, the identification and monetising of benefits.

Proposals should also include all reasonable external costs, such as wider network impacts. Sponsor agencies/proponents are encouraged to consult with ISA on how to treat wider network impacts.

# Cost-benefit analysis (CBA)

CBA is typically applied in the justification and definition phases of the project lifecycle.

Depending on the maturity of the options being developed, a rapid or detailed CBA may be employed to inform decision-making as part of the broader integrated assessment approach.

#### **Rapid CBA**

A rapid CBA applies standard CBA principles and techniques to compare multiple options using the present value of benefits and costs.

They are typically used when there is a lower level of precision about design, costs and benefits (i.e. during the Options Analysis justification phase) and focus on **quantifying the most material socio-economic costs and benefits only, and has a lower level of precision about design, costs and benefits.** 

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on rapid CBA (p74-81).

A detailed CBA also applies standard CBA principles and techniques to compare multiple options using the present value of benefits and costs but are typically used when there is a higher level of precision about design, costs and benefits (i.e. during the Business Case definition phase). **Detailed CBAs focus on quantifying all objectively monetisable socio-economic costs and benefits**.

#### Key assumptions and parameters

The following provides sponsor agencies/proponents with guidance on key assumptions and preferred parameter values in developing their CBA models for South Australian proposals.

Where guidance is not provided, sponsor agencies/proponents will need to identify the most appropriate parameter values for their sector.

#### **Evaluation period**

The standard CBA evaluation period for evaluating project initiatives is **30 years (post-construction)**, in alignment with the long-term useful life of major infrastructure before significant rehabilitation/re-investment is required.

Shorter or longer periods may be acceptable for specific assets and investments. Proponents should consult with ISA to appropriately justify any deviation from the standard evaluation period.

#### **Discount rate**

The discount rate is the rate of return used to discount future cash flows back to their present value. This supports appropriate comparison of costs and benefits that accrue at different times and across different options and projects over the evaluation period.

**Sponsor agencies should undertake CBA in real terms.** Sponsor agencies should use a real discount rate to discount real cash flows in the CBA. For assessment purposes and comparability, **ISA recommends that appraisal summary results be presented for the following real discount rates:** 

- 4% per annum (low)
- 7% per annum (central case)
- 10% per annum (high).

#### Asset life and residual value

The useful economic life of assets and resulting residual values will need to be determined.

Where assets have an economic life that is shorter than the evaluation period, the costs of rehabilitating/replacing the asset should be included in the financial analysis and CBA in the final year of the asset's economic life.

Residual value refers to the components of the project that have significant economic life remaining at the end of the appraisal period, which can occur either through major rehabilitation at relevant intervals and/or the useful life of the asset being beyond the assessment term considered.

**ISA** recommends that residual value is calculated using the straight-line depreciation method. The residual value is treated as accruing in the final year of the appraisal for the purposes of discounting.

The residual value is calculated using the straight-line depreciation method, as expressed below.

Residual value = Total CapEx x (Asset life – Evaluation period) Asset life

#### **Net Present Value**

The Net Present Value (NPV) is the difference between the present value (PV) of benefits and the present value of costs. It should be calculated using the following formula:

#### NPV = PV of benefits – PV of costs

The NPV should be presented in real values in the current year, generally expressed in \$millions. A positive NPV indicates that the project has economic merit.

#### **Benefit-cost ratio (BCR)**

The BCR is calculated with the present value of benefits and costs and uses the following formula:

BCR = Benefits Investment costs + Net increase in operating costs

These benefit and cost measures are incremental to the base case and discounted over the evaluation period (i.e. present values).

ISA recommends BCRs use the P50 or the Expected cost value as the central case, with P90 values used as a sensitivity.

For projects to be assessed by Infrastructure Australia, BCRs should consider the expected cost value for the central case, with P50 and P90 used for sensitivity testing.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on undertaking the CBA (p66-68).

#### Sensitivity testing and analysing risk

To ensure that the monetised CBA process is robust to potential changes, ISA requests a series of sensitivity tests of the demand and cost modelling. ISA also recommends testing for robustness across a range of future scenarios, where appropriate.

Risk can also directly be incorporated CBA using scenario analysis.

Proponents are recommended to:

- identify risk and uncertainties that relate to the project
- test sensitivities to changes in assumptions and parameters
- apply additional approaches such as scenario analysis.

ISA recommends the following minimum standard sensitivity tests be undertaken on proposals:

Test	Ranges
Discount rate	7% (central case) Sensitivities 4% (low) and 10% (high)
Under/over-estimation of CapEx	+/- 20% of value used (expected value, P50 or P90)
Under/over-estimation of OpEx	+/- 20% around central case
Best case sensitivity tests	Simple: -20% total costs and +20% benefits Complex: upside adjustments for 4-5 key variables
Worst case sensitivity tests	Simple: +20% total costs and -20% benefits Complex: downside adjustments for 4–5 key variables
Deferral test	<i>If the proposal presents marginal value for money and first-year rate of return (FYRR) is less than the discount rate:</i> defer cost and benefit cash flows by five years to test whether the CBA results (net benefits) improve because of the deferral of the project.

Infrastructure Australia's *Guide to economic appraisal* offers further guidance on undertaking the CBA (p68-69).

#### **Understanding and reporting CBA results**

Sponsor agencies/proponents should document the methodology, assumptions for measuring costs and benefits, and results (including sensitivity analysis), and other recommendations.

The outcomes of a CBA are conventionally presented as measures of net benefit for each option, incremental to the base case. These include but are not limited to the NPV and BCR.

The NPV and BCR provide similar information about whether benefits exceed costs, or if costs are greater than benefits.

An NPV greater than zero and a BCR greater than one indicates that the benefits exceed the costs of a proposal and that the project case option has socio-economic merit (that is, the present value of benefits exceeds the present value of costs). This indicates that the project case option is potentially worthwhile from an investment perspective.

Where costs are greater than benefits, the option will result in an overall cost to broader society and the economy.

In saying this, BCR results for comparing shortlisted options should be considered in conjunction with supporting qualitative and quantitative information (i.e. integrated assessment approach).

Both the NPV and the BCR for all shortlisted options analysed should be included in the justification (Options Analysis) and definition (Business Case) phases. Results can be populated into the Initiative Registration, Options Analysis and Business Case templates. A detailed CBA report can be provided with the Options Analysis and Business Case.

The CBA model (in native file format) should be provided as part of submissions from sponsor **agencies.** This should include detailed calculations that are not 'hard coded'.

# Glossary

Term	Definition		
Base case	A proposal compares the costs and benefits of doing something (a 'project case') with not doing it (the 'base case'). The base case should identify the expected outcomes of a 'do-minimum' situation, assuming the continued operation of the network or service under good management practices.		
Benefit–cost ratio (BCR)	This is the ratio of the present value of socio-economic benefits to the present value of socio-economic costs. It is an indicator of the socio-economic merit of a proposal presented at the completion of a cost-benefit analysis.		
Cost-benefit analysis (CBA)	A socio-economic analysis technique for assessing the economic merit of an infrastructure proposal. It involves assessing the monetised benefits, costs and net benefits to society the proposal would deliver.		
Definition phase	The phase following the justification phase. The key activity that occurs in this phase is the development of Business Case and Gate 2 assurance review.		
Demand forecasting	The activity of estimating future demand (such as public transport patronage, vehicle volumes or water usage) in a particular year or over a particular period.		
Depreciation	The amount that an asset reduces in value due to wear and tear or environmental factors. Specifically, it could be defined as:		
	<ul> <li>Economic depreciation: A decline in the value of an asset over time due to general wear and tear or obsolescence.</li> <li>Financial depreciation: The allocation of the cost of an asset over a period of time for accounting and tax purposes.</li> </ul>		
	In an economic appraisal (using CBA), residual values are sometimes estimated based on the effects of economic depreciation.		
Discount rate	The interest rate at which future dollar values are adjusted to represent their present value (that is, in today's dollars). This adjustment is made to account for the fact that money today is more valuable than money in the future.		
	CBA should use real social discount rates.		
Expected value	The mean value of the cost distribution.		
	If the cost distribution is symmetrical, the Expected value will be equal to the P50 value. Where the cost distribution is positively skewed, the mean will be above the P50 value and may lie closer to the P90 value. (See P50 cost and P90 cost).		
Evaluation period	The number of years over which the benefits and costs of an infrastructure proposal are assessed in a CBA. A default value of 30 operational years plus construction time is generally used for infrastructure proposals.		

Financial analysis	The evaluation of the benefits and costs, measured in financial cash-flow terms, to a single entity (that is, not the community or the economy).		
Impact	An impact is an effect on someone (society) or something (environment) as a result of an action/intervention. Impacts can be positive (also described as a benefit) or negative (a cost or dis-benefit).		
Integrated assessment approach	ISA endorses an integrated assessment approach, which is a comprehensive socio-economic assessment approach that recognises impacts and risks that cannot be monetised, particularly for input into a cost. Cost-benefit analyses are appropriately considered alongside monetised impacts during justification, definition and assessment of initiatives/proposals.		
Integrated analysis	An integrated analysis brings together all the non-monetised impacts and the results from the CBA to ensure all impacts are appropriately considered when selecting options for further development in the business case and, ultimately, selection of a recommended option for investment decision.		
ISAAF	Refers to the Infrastructure SA Assurance Framework.		
Justification	A written justification for undertaking a public sector initiative, which evaluates the benefits, costs and risks associated with the public sector initiative and provides the rationale for proceeding with the initiative in the manner proposed (TI-17).		
Justification templates	Strategic Assessment, Options Analysis and Business Case templates.		
Justification Phase	The phase that follows the strategy/strategic phase and precedes the definition phase. The key activity that occurs in this phase is the development of a Strategic Assessment and Options Analysis and the Gate 1 assurance review.		
Market prices	The price at which assets or services are sold. Market prices provide a great deal of information concerning the magnitude of costs and benefits, as well as where they exist and if there is not a market failure. Market prices should be used as they provide more reliable estimates of benefit values compared to non-market valuation techniques.		
Monetised	Where a quantified impact has a corresponding dollar-value attached to it.		
Net present value (NPV)	The monetary value of benefits minus the monetary value of costs over the evaluation period, with discount rates applied.		
Nominal prices	A value or price at a given time. Nominal prices rise with inflation. In contrast, real prices are prices after the effect of inflation has been removed.		
Probabilistic project cost estimates	These estimates identify cost components, determine the probability distribution for each cost component and then undertake a simulation (often a 'Monte Carlo' simulation) to generate a probabilistic distribution of project costs (see cost distribution, expected value, P50 cost and P90 cost).		
Sponsor agency/proponent	An organisation or individual who prepares and presents infrastructure proposals.		
Proposal	An initiative put forward for prioritisation, assessment, assurance and, ultimately, an investment decision.		

P50 cost	An estimate of project costs based on a 50% probability that the cost estimate will not be exceeded.	
P90 cost	An estimate of project costs based on a 90% probability that the cost estimate will not be exceeded.	
Qualitative	A description of an impact that does not rely on quantitative or monetised information.	
Quantitative/Quantified	A description of an impact that utilises, presents or references values, numbers or statistics.	
Rapid cost-benefit analysis	A rapid CBA incorporates standard CBA principles and techniques but at a lower level of accuracy.	
Real prices	Prices that have been adjusted to remove the effects of inflation. They must be stated for a specific base year.	
Residual value	The value of an asset at the end of the appraisal period. Residual values are used in CBA calculations involving long-lived assets whose life extends beyond the end of the appraisal period.	
Risk	Events that have probabilities of occurrence that are predictable and outcomes that can be estimated with some confidence.	
Scenario analysis	Scenario analysis provides a framework for exploring the uncertainty about future consequences of a decision by establishing a small set of internally consistent future scenarios and assessing options against each of them. This form of analysis is especially useful for decision-makers faced with forms of uncertainty that are uncontrollable or irreducible (e.g. future technology change or increased climate variability).	
Sensitivity analysis	Changing one or more variables in a model or analysis to test how the changes affect the output or results.	
Strategy/Strategic phase	The phase that leads to the commencement of an initiative in the justification phase.	
Sunk cost	A cost that cannot be retrieved by resale in the market. More specifically, a sunk asset is one which, once constructed, has no value in any alternative use. Bridges and railway tunnels are typically, sunk assets. Sunk costs incurred in the past should be excluded from a CBA.	

# Attachment 1: Level of Impact Analysis by Project Phase

REQUIRED DOCUMENTAION OF IMPACTS							
Phase	Strategy	Justifi	cation	Definition	Delivery	Operations	
Usage	Strategy	Options development and shortlisting	Assessing shortlist options	Assessing shortlist options	Contract award	Benefits realisation review	
Document	Strategy and SAMF	Strategic Assessment & Options Analysis	Options Analysis	Business Case	Delivery	Benefits realisation	
Assurance	N/A	Gat	ie 1	Gate 2	N/A	Gate 5	
UNDERSTANDI	NG OF SERVICE	IMPACTS					
Demand	Awareness/ Understanding	Deta	ailed	Detailed	N/A	Review	
Service Planning	Concept/ Vision	Understating	Draft	Finalised	Approved	Review	
UNDERSTANDI	NG OF DESIGN	IMPACTS					
Design – movement, water, (``horizonal infrastructure")	0%	0-5% concept/sketch/ description	5%-15% draft concept(s)	20%-40% concept or preliminary schematic design	40%-90% depending delivery model	100% as built	
Design – buildings (``vertical infrastructure'')	0%	0-5% concept/ sketch/ description	1%-10% draft concept(s)	10%-20% concept or preliminary schematic design	20%-80% depending delivery model	100% as built	
Investigations	Clear demand understanding Clear system	Demand modelling System analysis	Network optimisation analysis Preliminary tech	Optimised solution Sufficient tech	Depending delivery model	n/a	
	understanding		investigation	Investigation			
UNDERSTANDI	NG OF BENEFIT	S & DISBENEFI	rs		,		
Identification, valuation and calculation	Stated	Primary/Major benefits stated	Primary/Major benefits Rapid CBA	All benefits are detailed and calculated in full CBA	Manage	Review	
UNDERSTANDING OF COSTS & REVENUES							
Cost and revenue estimate bases	Rough order of magnitude (ROM)	Rough order of magnitude (ROM) Comparable projects	Comparative/ benchmark rates	Principally first principles	Tender price Valuations and offers	Actual	
Estimate confidence	None	Low	Low	Moderate	High	Certain	
Cost ranging (Low)	N/A	-20%/-50%	-15%/-30%	-10%/-20%	-5%/-10%	0%/-5%	
Cost ranging (High)	N/A	+30%/+100%	+20%/+50%	+10%/+20%	+5%/+20%	0/+10%	

Quantified risk contingency	N/A	40%-70%	40%-70%	20%-40% (30%)	10%-30%	0%
Probalistic risk	n/a	n/a	P50/Expected value	P50/P90/ Expected Value	P50 & P90	n/a
LEVEL OF IMPACTS FOR INTEGRATED ASSESSMENT						
Overall	Awareness	Preliminary	Preliminary	Detailed	Manage	Review
CBA	Awareness	Awareness	Rapid	Detailed	Manage	Review

### Contact

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#### Acknowledgement of Country

Infrastructure SA acknowledges and respects Aboriginal people as the State's first people and nations and recognises Aboriginal people as traditional owners and occupants of South Australian land and waters. Infrastructure SA acknowledges that the spiritual, social, cultural and economic practices of Aboriginal people come from their traditional lands and waters, and that Aboriginal people maintain cultural and heritage beliefs, languages and laws which are of ongoing importance today.

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