TRANSPORT

TfNSW Cost Benefit Analysis Guide

For all TfNSW Divisions and Agencies

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transport.nsw.gov.au

NSW GOVERNMENT

OFFICIAL

Foreword

Customers are at the centre of everything we do at Transport for NSW (TfNSW). The investment decisions we make today will deliver benefits to the community for decades to come.

When making investments for the people of NSW we need to use an evidence-based economic appraisal which considers all costs and benefits. Cost-benefit analysis (CBA) does exactly that. It balances a complex set of community considerations against limited resources and is the government's key tool for promoting value-for-money decision-making.

The Transport for NSW Cost-Benefit Analysis Guide (Guide) sets out the principles, concepts, methodology and procedures to use when conducting CBA for NSW Transport cluster initiatives. Importantly, the Guide steps through a robust framework for decision-making, as well as how to organise and present the evidence that supports them. It is supported by a suite of products including user-friendly models and recommended economic parameter values.

The Guide links project evaluation to the Future Transport Strategy outcomes, promoting their consideration from project inception. The use of this guide is encouraged to ensure we consistently put value-for-money and outcomes for the community at the centre of our expenditure decisions.

The Guide is being continuously improved. Values are regularly updated, and methods periodically reviewed. We welcome all feedback that can help us improve this document. Please direct this to the TfNSW Economic Advisory team at: EconomicAdvisory@transport.nsw.gov.au

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1. Introduction

1.1 Cost-benefit analysis

Cost-benefit analysis (CBA) is the preferred evaluation method of the NSW Government and the NSW Transport cluster in appraising the value for money of a project. An economic appraisal is required as part of a business case to support funding proposals, in line with NSW Government policy. It aims to measure the full impacts - economic, social and environmental - of a decision on the NSW community, including individuals, firms and the government. CBA considers both qualitative and quantitative impacts of an initiative and estimates the costs and benefits, wherever practicable, in monetary terms.

CBA measures the incremental costs and benefits involved in an initiative, relative to a situation without the proposed action.

1.2 Objective of this document

The NSW Transport cluster needs to make robust expenditure decisions in maintaining and evolving the transport network and delivering benefits to the community of NSW for decades to come. The Transport for NSW Cost-Benefit Analysis Guide[1] (Guide) provides a consistent, best-practice framework to help the NSW Transport cluster conduct evaluations.

This document is intended to support clear thinking, good judgement and informed decision-making. It includes recommendations for CBA as part of business cases and evaluations within the NSW Transport cluster but is not intended to enforce absolute compliance with a particular approach where it is not appropriate. It is meant to guide, support, complement and enhance, rather than replace, the user's independent thought and understanding.

1.3 Alignment to other guidance documents

This document aligns with the high-level guidance in NSW Treasury's NSW Government Guide to Cost-Benefit Analysis and provides specific advice tailored to transport initiatives.

The Australian Government coordinates a national approach to project assessment, with the States and Territories, through the Australian Transport Assessment and Planning (ATAP) Guidelines. ATAP aims to provide nationally consistent and best practices guidelines and recommendations, although these may not always be appropriate in the NSW context.

For initiatives seeking Federal Government funding, it is recommended that the Infrastructure Australia Assessment Framework (IAAF), the ATAP guidelines and this document be read in conjunction. Projects seeking federal funding need to

[1] This document was previously the 'Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives' (often referred to as the 'Guidelines').

align with IAAF. Requirements for smaller projects may differ.

The Notes on Administration for Land Transport Infrastructure Projects provide administrative guidance for managing projects to be funded under the National Partnership Agreement.

1.4 How to use this document

The Guide is a framework for conducting CBA for transport initiatives and forms part of a suite of products. The target audience for the Guide is management, senior project representatives and project teams. This document is not targeted towards experienced CBA practitioners - who may find themselves familiar with much of its content. However, key recommendations the CBA practitioner needs to comply with can be found throughout this document in **bold text** for ease of use.

Other CBA guidance products are tailored towards CBA practitioners, such as the TfNSW Economic Parameter Values (previously Appendix 4 of the Principles and Guidelines: Economic Appraisal of Transport Investments and Initiatives) and can be found on the TfNSW website.

Table 1: Structure of this document

Section	Key Audience	Focus
2. Why is a cost-benefit analysis needed?	Senior project representatives	What is needed and why
3. The scope of a cost-benefit analysis	Those new to CBA or refreshing knowledge Project teams and CBA practitioners	Core concepts for economic appraisals, common concepts and issues, and an overview of the process for undertaking CBA Recommendations for CBA practitioners to be aware of are in **bold text**
4. Cost-benefit analysis concepts		
5. The key steps in doing a cost-benefit analysis		
6. Common mistakes and lessons learnt		
7. When to ask for help		

Feedback or questions regarding the Guide should be directed to the Transport for NSW (TfNSW) Economic Advisory team at: EconomicAdvisory@transport.nsw.gov.au

1.5 Key changes from the previous version of the TfNSW CBA Guide

The 2024 TfNSW CBA Guide incorporates several enhancements and updates to reflect changes to CBA requirements within NSW Government. Key updates relate to ex-post CBA in economic evaluations, the Economic Concurrence Review undertaken by TfNSW Economic Advisory, the impact of the COVID-19 pandemic on patronage assessment, valuation of carbon emissions, treatment of prior cost in transport CBA, disaster cost-benefit framework, first nations

investment framework and social value.

Key updates are summarised in Table 2.

Table 2: Key updates from the previous TfNSW CBA Guide

Item	Update
Ex-post CBA in economic evaluations	Reference to NSW Treasury's *Policy and Guidelines: Evaluation (TPG22-22)* has been included. TPG22-22 sets out mandatory requirements, recommendations and guidance to plan for and conduct evaluations. Economic evaluation is a component of evaluation and can be undertaken using different methods. CBA (ex-post) is the preferred method for economic evaluation.
Economic Concurrence Review	As part of compliance to NSW Government CBA Guides, TfNSW Economic Advisory undertakes Economic Concurrence Review to assess the compliance and quality of TfNSW CBAs. The outcome of the Economic Concurrence Review is documented in an Economic Concurrence Report, which is issued to the project team at the end of the review period. It is also used in the close-out process.
Patronage assessment post COVID-19 pandemic	Recent developments in transport demand forecasting considers population and travel behaviour in a post-COVID-19 world. These impacts are part of the NSW Common Planning Assumptions (CPA) and are incorporated in the latest version of Travel Zone Projections (TZP22) and the Sydney Strategic Travel Model (STM3.9). This has implications for the previous requirements to undertake COVID-19 impact sensitivity testing. Projects with transport modelling informed by STM3.9 released in December 2022 already include the impacts of COVID-19, and therefore will form the project's core analysis. In this case, additional COVID-19 impact sensitivity testing will not be required unless WFH data is available and is expected to be materially different from modelled outputs, or if project-specific land uses are developed for the project study area.
Carbon emissions valuation	There are new requirements to account for carbon emissions. In April 2024, INSW released the *Decarbonising Infrastructure Delivery Policy* and the *Embodied Carbon Measurement for Infrastructure Technical Guidance* (the Policy and Measurement Guidance). The Policy and Measurement Guidance recommends consideration of whole of life carbon where feasible. As a minimum, the INSW Policy and Measurement Guidance requires estimation of upfront carbon emissions for each option within a CBA. Projects must estimate upfront carbon emissions using the appropriate carbon values, noting there are separate national and NSW carbon values.
Treatment of prior cost in transport CBA	The recommendations around the treatment of prior cost have been updated to provide clarity around cost items to be included in CBA. In general, any cost directly attributable to a project's proposed scope should be included in the BCR calculation. If a cost stems from a necessary activity to get to the final product, it should be included in CBA.
Disaster cost-benefit framework	Reference to NSW Treasury's *Disaster Cost-Benefit Framework (TPG23-17)* has been included. The Disaster Cost-Benefit Framework provides guidance and the framework on how to undertake CBA for disaster resilience initiatives.

Item	Update
First Nations Investment Framework	Reference to NSW Treasury's First Nations Investment Framework has been included. The First Nations investment framework is a guide to good practice in the design, appraisal and evaluation of initiatives that impact on First Nations people and communities.
Social value	Social value has been highlighted as an emerging practice within TfNSW focussing on achieving social wellbeing and generating public benefit. Reference to capturing social inclusion benefits in CBA has also been included.

2. Why is a cost-benefit analysis needed?

CBA is a NSW Government compliance requirement for establishing value-for-money within a business case. It is also good practice for supporting informed decision-making.

2.1 What is cost-benefit analysis?

CBA considers the economic, social and environmental costs and benefits of an initiative. It measures them in monetary terms, wherever practicable, and determines if the benefits outweigh the costs. It aims to measure the full impact of the initiative on the community of NSW, including firms, individuals and government. When costs or benefits do not have a readily observable monetary value, CBA valuation principles are used to estimate the impact of the initiative.

2.2 What is a business case?

A CBA is a crucial component of a business case. A business case is a documented proposal to meet the Government's objectives that is used to inform an expenditure or policy decision. A CBA provides evidence to support the narrative in a business case about why change is needed and why a particular option is proposed.

A robust business case will ensure resource allocation decisions are well timed, offer value for money and consider and mitigate risks.

Ideally, a business case will move from the assessment of a list of alternative solutions (options) in the strategic business case for consideration of one or more detailed options in the final business case. CBA is an important part of the process for assessment and selection of preferred options as the project team moves through this process.

For further information refer to the TfNSW Business Case Guide.

2.3 When is a cost-benefit analysis required?

CBA is a necessary part of compliance with government assurance as well as funding approval requirements for major initiatives. Compliance requirements for NSW Transport cluster initiatives are outlined in Table 3.

Table 3: Compliance requirement for CBA[2]

Government entity	Compliance requirement
NSW Transport cluster	A CBA is required to ensure value-for-money, to meet external assurance and funding requirements, to manage internal resources and risks, and to seek internal funding.
NSW Treasury	It is mandatory to undertake CBA when producing a business case to support a government funding or regulatory proposal. CBA is thus required for capital, recurrent and ICT proposals with an estimated total cost of $10 million or higher.
NSW Cabinet	A CBA, as part of a business case, is required for major policy and expenditure decisions.
Infrastructure Australia (IA)	A business case is required for initiatives of national significance ≥$250m. An assured business case is required for Cabinet funding approval*.
Australian Government – Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA)	A Project Proposal Report (PPR) is required in that the outputs of economic appraisal should be summarised for the discount rates at 4 & 7 per cent.

* A CBA is a critical component of a business case

However, CBA brings value to a project and should not be thought of as simply a compliance exercise. Project teams will find that a CBA brings value to the development of options, management of delivery, and assessment of benefits realisation.

Even for smaller projects where a CBA is not a compliance requirement, providing evidence of thinking about value-for-money for the customer, monetising costs and benefits, and evaluating a wide range of options is good practice. It helps ensure an initiative delivers value-for-money for the community of NSW in line with NSW Government and NSW Transport cluster strategies and objectives.

A CBA is required for all major investment decisions. This is still the case when a single or limited number of options are being considered, for example as part of a ministerial commitment. In such situations, government decisions should be implemented but a CBA ensures project risks are diligently identified, superior solutions are not overlooked, benefits are documented, and a basis created for ex-post evaluation and improvements to future initiatives.

Further information can be found in the NSW Government Business Case Guidelines and INSW Infrastructure Investor Assurance Framework.

[2] Source: NSW Treasury, Infrastructure Australia, Department of Premier and Cabinet. Note: The requirements in this table are under review by a number of Government entities and may change in the future.

2.4 What is a CBA used for?

The CBA informs the selection of a preferred option in a business case. It also demonstrates whether a project is value-for-money and should be considered for further investigation or funding.

A CBA should demonstrate that the preferred option is aligned to the NSW Government and NSW Transport cluster strategic objectives. The Future Transport Strategy provides a framework for planning and investment to support a modern, innovative transport network. The CBA can be used to quantify the impacts that a project will have towards achieving these outcomes.

The CBA is also a critical part of NSW Government compliance and assurance process; for example, passing through INSW Gates 1, 2, 3 and 6.[3] At each of these stages, the CBA will be assessed to ensure it is fit for purpose and may be required to address minor issues or undergo major rework in order for the project to proceed.

NSW Transport cluster project teams should engage early and often with the Economic Advisory team in CBA and business case development to ensure they meet the relevant compliance requirements of the responsible stakeholders.

2.5 Ex-post CBA in economic evaluations

NSW Treasury's Policy and Guidelines: Evaluation (TPG22-22) sets out mandatory requirements, recommendations and guidance to plan for and conduct evaluations. Evaluation (ex-post) is a process to assess an initiative's appropriateness, effectiveness, efficiency and net social benefits after it has been implemented. Evaluation components include process, outcome and economic.

An economic evaluation is used to identify and report key economic, social, environmental, and cultural impacts of an initiative. Economic evaluation can be in different forms and undertaken using different methods including CBA and cost-effectiveness analysis (CEA). Amongst them, an ex-post CBA is the most rigorous method preferred for TfNSW evaluation programs.

Where an ex-ante CBA was undertaken as part of the business case, ex-post CBA can be used to test the accuracy of cost and benefit forecasts presented in the business case, thereby building evidence to support the delivery of outcomes.

Under NSW Treasury TPG22-22, TfNSW is required to nominate initiatives annually in the evaluation schedule, which is jointly managed between TfNSW and the NSW Treasury. All projects and programs nominated in the annual evaluation schedule require an economic evaluation, however not all of them may necessarily be suitable for an ex-post CBA.

For further details on the requirements and process for managing an economic evaluation, including guidance for undertaking an ex-post CBA, refer to Guide to economic evaluation and ex-post CBA for TfNSW evaluation programs.

[3] INSW Gateway Reviews: range of options analysed (Gate 1), ability of the preferred option to meet the service need (Gate 2), market readiness (Gate 3) and benefits realised (Gate 6).

3. The scope of a cost-benefit analysis

The CBA should reflect NSW Government and NSW Transport cluster strategies. The size and detail in the CBA should be scaled to the risk, value and complexity of the initiative.

3.1 Ensuring strategic contribution to the Future Transport Strategy

The initiative or proposal assessed in the CBA must contribute to the Future Transport Strategy. The Future Transport Strategy outlines the NSW Government's vision for transport in NSW and provides the frameworks and planning approaches to achieve them.

The Future Transport Strategy acknowledges the vital role transport plays in land use and the economic development of towns and cities. It includes plans that shift the focus away from moving vehicles to moving people and reshaping our transport networks from a collection of disparate modes into an integrated multimodal system. It also sets a new benchmark for resilience and sustainability, expands connectivity across cities and regions and envisages new levels of digital and technological innovation.

This has implications for the development of business cases and CBA. It impacts the transport problems to be solved and the types of solutions that are considered. Importantly, the CBA should be linked to achieving one or more of the three strategic outcomes listed in the Future Transport Strategy (**Figure 1**).

Figure 1: Strategic Outcomes – The Future Transport Strategy[4]

[4] Source: pp.3-5, Future Transport Strategy, September 2022, TfNSW

While the Future Transport Strategy sets the longer term vision, the 10 Year Blueprint lays out where we need to focus in order to best respond to the challenges and opportunities we are seeing and lays out our desired outcomes, ambitions and strategic priorities for the next 10 years. Refer to the 10 Year Blueprint page 24 for details on 10-year ambitions and key things to measure.

3.1.1 A flexible and agile planning process

The Future Transport Strategy sets the long-term vision guiding transport investments. The strategy promotes flexibility and agility in the investment planning process by emphasising five activities:

- Optionality: business cases need to test a range of scenarios, as well as embedding flexibility into the design of infrastructure projects
- Short-term goals for long-term change: the initial focus should always consider changes in services, policy, demand management or technology with shorter lead times – and without significant capital investment
- Collaborating with our customers and stakeholders: project development should include embedding continuous and close consultation with industry, the technology sector, customers and communities to maximise benefits
- Committing to continuous improvement: the Future Transport Strategy is a 'living' strategy that allows adjustment and changes as needed
- Planning for outcomes: transport planning will move away from individual modes and focus on delivering flexible, integrated solutions for customers and the broader community.

Flexibility and agility need to be built into the investment planning approach and reflected in the CBA. This includes a shift towards multi-modal, customer-focused outcomes that consider movement and place, rather than single mode, single solution approaches.

The CBA should also reflect the impacts of changing transport technologies on the NSW community. For example, increased use of connected and autonomous vehicles (CAVs) may have implications on realising future safety and sustainability benefits estimated in a CBA.

3.1.2 The movement and place framework

Movement and Place is a key process for understanding places and transport's contribution to their success. The Future Transport Strategy provides directions for applying the Movement and Place Framework. The Movement and Place Framework is a tool to manage the transport network so that it supports safe, efficient and reliable journeys while enhancing the liveability of places (**Figure 2**).

Figure 2: The Movement and Place Continuum[5]

The Movement and Place Framework acknowledges corridors and places as both a destination and as a means to move people and goods. For a CBA, it impacts the potential options being considered as well as the types of costs and benefits which are included in the analysis.

There are several ways to quantify the benefits of place making, including the assessment of improved land value and urban amenity..

In March 2023, NSW Government released an update to the *Practitioner's Guide to Movement and Place* which established a cross-disciplinary, place-based approach to the planning, design, delivery and operation of transport networks. Economic Advisory in TfNSW also released the *Movement and Place Evaluation Guide: Estimating Placemaking Impacts of Transport Projects in Business Case*, to provide a framework and methodologies for estimating placemaking benefits at the project level.

3.2 Determining the scope of analysis

The CBA should be fit for purpose as a tool for investment decision-making. The level of analysis, the documentation that is required, and the number of options considered in a CBA depends on the:

- Scale, type and reason of the initiative
- Level of uncertainty with relation to the costs, delivery and outcomes
- Stage in the planning and assessment process the initiative is at
- Time and resources available to develop alternatives
- Clarity of the link between the benefits from the initiative and the specified outcomes.

The level of analysis can be reduced to align with the value and risk of the initiative. For example, for a smaller project, input data may be from a traffic count rather than a simulated forecast.

[5] Source: NSW Movement and Place Framework

3.2.1 Determining the base case

CBA compares the costs and benefits of doing something (i.e. the project options) against a base case (the 'business as usual' or 'do minimum' scenario).

The base case is a realistic assessment of what would be done in the absence of the project case. It is not a 'worst case' or 'do nothing' option and should include a reasonable level of the expenditure required to maintain the existing level of service. This will generally include not only relevant initiatives that are already committed and funded, but also carefully consider the minimum initiatives that are needed to maintain the level of service in an area – particularly in areas impacted by rapid population growth.

Specifying the base case is important because it impacts on the attribution of estimated benefits and costs to the project options being assessed. A poorly specified base case will bias the assessment of the project options, compromise the analysis and distort the investment decision being made.

3.2.2 Assessing the project options

At strategic business case stage, a long list of options should be assessed using strategic merit test, multi-criteria analysis, rapid economic appraisal or value management workshop to shortlisted project options. **At the strategic business case stage, the short list should include two to five options.** A full economic appraisal is required for each of the short-listed options with costs and benefits estimated and reported with BCRs and NPVs.

At final business case stage, a full economic appraisal should be carried out for a short list of options. **At least two realistic options should be assessed at the final business case stage.** A full economic appraisal of an option will usually include concept design, cost estimation, transport demand analysis and economic modelling. This process will involve a high level of resource, cost and take a longer-period of time. In situations where there is only one realistic and practical project option, a full economic appraisal for one option may be acceptable on a project-by-project basis. In these circumstances, the economic appraisal should contain a section on the option development process, providing details of a long list of options, the short-listing process, and an indicative BCR for alternative options estimated at strategic business case.

3.3 Determining a preferred option

The most common measure for comparing options is the Benefit Cost Ratio (BCR). The BCR shows the relationship between total costs and benefits, with a value over 1.0 indicating a project provides a net benefit to the community. An equally important key measure, Net Present Value (NPV), measures the extent to which the total benefits are larger or smaller than the total costs of the project.

The BCR and NPV should both be considered to determine the preferred option. CBA is an important tool to assist in decision-making but should not prevent flexibility where other factors are considered important to the community. This includes qualitative factors and other considerations, such as equity concerns.

3.4 Additional resources

3.4.1 Other strategies and priorities

The Future Transport Strategy is the primary strategy document for the NSW Transport cluster. However, other strategy documents exist which may help to inform the strategic contribution of business cases and CBA, including the:

- State Infrastructure Strategy 2022-2042 that sets out INSW's independent advice to the NSW Government on the State's needs and strategic priorities for infrastructure over the long term.
- Greater Sydney Region Plan for transforming Greater Sydney into three distinct but connected cities.
- The Regional Development Framework that provides an overall government vision for services and infrastructure in regional NSW.
- The 10 Year Blueprint which lays out the desired outcomes, ambitions and strategic priorities for the next 10 years.

3.4.2 Other CBA guidance

The basic theory, principles and approach to CBA are well established and recognised across NSW government and the NSW Transport cluster. General guidance can be found in the sources below, in textbooks[6] and are widely available on the internet. While informed by theory and practice from other guidelines, this document differs from other sources as it is focused on the practical application of CBA to decisions in the NSW Transport cluster.

[6] For example: Boardman et. al. (2018) Cost-Benefit Analysis: Concepts and Practice

Table 4: Supporting guidance and framework

Document	Owner	Focus
NSW Government Guide to Cost-Benefit Analysis	NSW Treasury	Applied across the NSW Government, including the NSW Transport cluster, and has broader recommendations on the application of CBA.
Investor Assurance (Gateway)	Infrastructure NSW	Gateway assurance, independent of the project team. There are three Gateway Coordination Agencies (GCAs) who each have developed relevant frameworks: • Infrastructure NSW (INSW) for capital investments • Digital NSW for ICT investments • NSW Treasury for major recurrent expenditure.
Infrastructure Australia Assessment Framework 2021 (IAAF)	Infrastructure Australia	Initiatives seeking Federal Government funding must align to the IAAF. The IAAF sets out the process IA uses to consider initiatives for inclusion in the Infrastructure Priority List. Three relevant guides: • Guide to economic appraisal, IA, 2021 • Guide to program appraisal, IA, 2021 • Guide to multi-criteria analysis, IA 2021 • Stage 4 of the Assessment Framework – Post Completion Review, IA, 2021
Australian Transport Assessment and Planning (ATAP) Guidelines	Transport and Infrastructure Council	ATAP provides a comprehensive framework for planning, assessing and developing transport systems and related initiatives. The ATAP Guidelines have been referred to for best-practice throughout this document. ATAP aims to be nationally consistent, however some recommendations may be addressed more suitably in a NSW context

4. Cost-benefit analysis of transport projects

This chapter explains concepts and principles commonly used in CBA, and how they apply to transport initiatives. It also provides an illustrative example which demonstrates many of the concepts.

4.1 Cost-benefit analysis concepts

There is a view that CBA, and economics in general, focuses on the theoretical and abstract rather than on practical considerations. This is not so. A CBA involves a structured way of thinking about, measuring and presenting evidence to support an informed decision.

Based on applied microeconomics and welfare economics, the CBA approach finds monetary values to support pragmatic decisions about what is in the best interests of the community.

4.1.1 Opportunity cost

Opportunity cost is the value forgone by society from using a resource in its next best alternative use. The opportunity cost of making a decision is the value of the second-best option, which would have been chosen if the preferred option was not taken. For example, the value of a commuter's travel time is linked to what else they could have been doing - the additional income they could have earnt from working, or the enjoyment they could have had from leisure.

4.1.2 Resource cost

CBA uses the resource cost, which is the opportunity cost of resources used, measured from the point of view of society as a whole. Differences between perceived and resource costs arise when, for a given cost, the opportunities forgone are different for the individual incurring the cost than for society as a whole.

Perceived costs reflect the costs taken into account for decision making, e.g. the behavioural costs used in demand modelling. Taxes, subsidies, tariffs, externalities, and non-competitive pricing can all cause resource costs to differ from perceived costs.

CBA uses resource costs to determine the net benefit to the community, and so excludes taxes and subsidies, which are financial transfers that do not reflect net changes in welfare. CBA practitioners must also incorporate externality impacts (e.g. air pollution, greenhouse gas emissions, noise) into the measures of consumer and producer surplus in order to capture the full resource costs of a project.

CBA practitioners must occasionally correct for the differences between

perceived and resource costs to ensure that only real welfare changes, and not transfers, are included in the CBA. These adjustments are sometimes referred to as 'resource cost corrections'.

4.1.3 Valuation principles

The values used in CBA can be based on either observed market prices, estimated from people's behaviour or found by surveying and asking people what they value.

In a competitive market the price of a good or service should represent the value placed on it by a consumer. Market-based valuations can provide much of the information required in a CBA for a transport initiative, particularly for estimating cost.

Where a competitive market price is not available then valuation methods can be used to find the consumers' willingness-to-pay (WTP). WTP is the amount an individual would be willing to pay for a good or service or to avoid an undesirable outcome. For example, a reduction in travel time for a commuter means they can spend more time at work or on leisure activities but the value a commuter places on reduced travel time does not have a readily available market price.

The stated preference method asks people for their preferences through surveys. Done carefully, this provides a measure of what the community values. For example, stated preference surveys are used to value travel time savings, to value seating over standing on public transport, and the cost of having to change modes as part of a trip (for example from train to bus).

Revealed preference methods examine consumers' behaviour to estimate their WTP. For example, the price premium on house prices in a suburb near a railway station, compared to a similar suburb away from rail transport, could reveal how much people value and are willing to pay to live near a rail link. Similarly, the amount of time and cost people are willing to spend to travel to a remote national park can reveal how much they value the park. Done carefully with appropriate data, revealed preference methods can be used in a CBA to measure what the community values.

4.1.4 Referent group

The referent group is a group of individuals deemed by the decision-maker to be relevant for the purpose of CBA. For NSW Transport cluster CBA analysis, the **referent group is the community of NSW**, consistent with NSW Treasury guidelines.

In practical terms, all parties are considered in the CBA. Given the nature of the economic activity and transport patterns in NSW, it is expected that some interstate and overseas parties will be involved in most projects. However, it is practically difficult to identify overseas and interstate users in transport demand modelling and for most initiatives, these impacts will not be material. Hence explicitly specifying the referent group and excluding non-NSW parties is usually not practical. In transport economic appraisal, all transport users should be treated as part of the NSW community.

It should be noted that there are projects which involve significant costs and benefits to non-NSW parties (this may include cross-border, interstate, international and non-traditional transport projects). In these situations, the benefits to referent groups should be explicitly investigated.

4.1.5 Transport modelling and forecasting

Transport models provide forecasts of future travel. These forecasts are important inputs into the CBA and may determine the majority of economic benefits of a project. Modelling is done to forecast impacts under the base case and options and needs to be both internally consistent and aligned with strategic forecasts.

In NSW, there are several transport models used as inputs to CBA. These include:

- Sydney Strategic Travel Model (STM)
- Public Transport Project Model (PTPM)
- Sydney Strategic Motorway Planning Model (SMPM)
- Enhanced Train Crowding Model (ETCM)
- Strategic Traffic Forecasting Model (STFM)

4.1.6 Appraisal period

The **appraisal period of a CBA should reflect the expected economic life of an asset or initiative** (including the initial development and delivery time). The expected economic life of the asset is the operating phase of the asset until an asset needs replacement or the cost of operation exceeds the benefits it delivers.

The decision on appraisal period also needs to consider the comparability of Benefit Cost Ratios (BCRs) between projects for prioritisation and investment decision purposes.

By default, all infrastructure projects should be evaluated for 30 years starting from the date of open to traffic or public transport operation. Alternative appraisal periods may be appropriate:

- ICT projects: Appraisal period of 3-10 years depending on the economic life.
- Technology and business services: Appraisal period of 5-30 years depending on the economic life.
- Rail infrastructure projects, large bridges and tunnels: Appraisal period of 50 years.
- CBA should not use an appraisal period greater than 50 years.

The Project Development Team should discuss with Economic Advisory if the preferred appraisal period departs from the default 30-year evaluation period.

If the asset economic life is longer than the appraisal period, a residual value based on replacement cost or the present value of future benefits can also be included in the final year of the appraisal period.

For recurrent expenditure, agencies are advised to seek advice, as the relevant analysis period could range from a single year for an ongoing program, to multiple years if there is a known project end date.

The appraisal period start date is measured from the completion of capital works, or from the start of full operations, and should be kept consistent between all alternative options that are assessed.

For projects seeking federal funding, the IAAF requires a justification for the proposed asset life evaluation period that involves long-term modelling of the transport network.

4.1.7 Real prices, escalation and inflation

CBA values should be calculated and reported in real prices (with inflation impacts removed). That is, excluding increases in prices due to inflation. This is because inflation is a change in the unit of measure, the value of money, not in underlying values. Inflation causes costs and benefits that occur later to appear artificially higher. A CBA should specify the common base year on which real dollar values will be compared, for example real 2024 dollars.

In some cases, real costs and benefits need to be adjusted for changes in relative values where a specific input or output price is expected to change at a rate significantly different from the general inflation rate. In such cases the CBA should document the assumptions used.

4.1.8 Social discount rate

The discount rate adjusts for people's preference to consume goods and services today, rather than in the future. Discounting allows for decisions to be made today about initiatives that have costs and benefits in the future. This discounting is separate from adjustments made for inflation, which should be done before discounting cash flows.

TfNSW, in alignment with the NSW Government Guide to Cost-Benefit Analysis, recommends a central or reference discount rate of 5 per cent (in real terms) with sensitivity testing undertaken at 3, 4 and 7 per cent. The 3 and 7 percent discount rates are required for NSW funding submissions. The 4 per cent discount rate is a requirement for a Project Proposal Report (PPR), a document used for Federal funding submission.

A standard 5 per cent discount rate allows for consistent comparison across NSW government initiatives, and values of 3 to 7 per cent represent a meaningful range to test whether the outcome of a CBA is very sensitive to the choice of discount rate.

The nature of a project is also important to consider when using discount rate sensitivity testing to inform a decision. The narrative supporting the decision on a project with a short term and a commercial focus may place considerable focus on the upper 7 per cent discount rate outcome. The narrative supporting the decision for major projects which have long lives, large impacts and a strategic focus may place more emphasis on the project's value to society in the future, as reflected in the lower 3 per cent discount rate values and BCR.

The social discount rate only reflects systematic, unavoidable market risk. Should a project have a higher degree of risk than another, this should be reflected in the quantification of costs and benefits using expected values.

4.1.9 Discounted Cash Flow and Present Values

A CBA requires costs and benefits to be evaluated on a common basis. This requires discounting future values to present values to allow a comparison of values over time from a common base year.

Discounted Cash Flows are streams of costs and benefits which have been converted into present values through removing the impact of inflation, adjusting for price escalation and discounting using a social discount rate. This allows for comparison of options where the costs and benefits occur at different points in time.

For CBA, present values are used to calculate both the BCR of an initiative and the NPV, which are decision criteria used to compare options and assess value-for-money once a CBA has been undertaken.

4.1.10 Net Present Value and Benefit Cost Ratio

The NPV and BCR show, for a given discount rate, when the benefits exceed the costs of an initiative. Where the NPV and BCR result in a different ranking of alternative project options, the preferred portfolio approach is to rank options based on the BCR because NPV is correlated with the project size.

The NPV is the sum of the discounted project benefits that have been valued, less discounted project costs. An initiative may be worthwhile if the NPV is positive, indicating that it results in an overall benefit to the community. The NPV can be used to compare projects but should be viewed together with the overall size of the initiative, risk and non-quantified factors.

The BCR is generally expressed as the ratio of the present value of benefits to the present value of costs. Based on the assumptions made and data available, a BCR greater than 1.0 indicates that the project results in a net benefit to the community.

The existence of funding constraints and mutually exclusive options should be considered when comparing NPV and BCR results.

4.1.11 The cost-benefit analysis as a living document

Ideally, a CBA should be a living document updated as projects, risks and circumstances evolve and change. A CBA, and the business case it informs, are a compliance requirement to support an investment decision and obtain funding for a project. However, a compliance view limits the value CBA can add to the Transport cluster and the community of NSW.

The CBA process should help shape and document a decision being made and continue to support a decision in delivery and in operation (including benefits realisation management). A CBA and business case should be updated to reflect material changes in assumptions, scope, timing costs and benefits.

4.1.12 Financial appraisal

A business case contains both a financial appraisal and a CBA. It is important not to confuse them. The financial appraisal measures only the direct effects on

an organisation's investment portfolio and includes financial, rather than economic, costs and benefits.

A financial appraisal should be prepared for a project that generates a financial benefit, for example, from toll collection, farebox, user charges, rent or other revenue streams. However, financial appraisals are useful for all types of initiatives, including proposals that do not generate significant revenue streams, to understand the direct financial impacts on the organisation and state budgets. For further detail refer to NSW Government Business Case Guidelines.

The results of a CBA alone are not sufficient to ensure a project will proceed. Ensuring financial sustainability of a project is an essential consideration and should influence the development and choice of options in a CBA. As such, a financial appraisal is required for each shortlisted option in both the strategic business case and final business case stages.

Ensuring financial sustainability requires having a view about the longer-term impact of the project on the cluster cost and revenue base and its opportunities to contribute to an improved cost recovery level within the cluster in addition to delivering customer outcomes. Refer to the TfNSW Business Case Guide for further guidance on financial sustainability.

4.1.13 Depreciation and interest

Depreciation and interest payments are not relevant to a CBA. This is because using a discounted cash flow approach removes the need to include financing charges. These concepts are relevant to the financial appraisal analysis.

4.2 Transport cost benefit analysis

4.2.1 Compliance to NSW Government CBA Guides

All project economic appraisals prepared for transport investments should comply with the NSW Government Guide to Cost-Benefit Analysis (TPG23-08).

NSW Treasury provides a Business Case Quality Assessment Tool which incorporates CBA requirements. The Centre for Evidence and Evaluation uses the Tool for CBA compliance assessment when a project business case is submitted to Treasury. A non-compliant grading indicates that the Economic Appraisal must be amended.

TfNSW Economic Advisory undertakes **Economic Concurrence Review** to assess the compliance and quality of TfNSW CBAs. The outcome of the Economic Concurrence Review is documented in an **Economic Concurrence Report** which is issued to the project team at the end of the review period. The Economic Concurrence Report is also used in the close-out process. The Economic Concurrence Review assesses alignment with the mandatory and quality requirements set out in the following CBA guidance:

- NSW Government Guide to Cost-Benefit Analysis (TPG23-08)
- Transport for NSW CBA Guide 2024 (i.e., this Guide)
- Transport for NSW Economic Parameter Values 2024

- Other technical guidance within the Transport for NSW CBA Guide Ecosystem

The project team, its economic advisor and consultant are encouraged to refer to the Economic Concurrence Report Fact Sheet which provides an overview of the Economic Concurrence Report, the Economic Concurrence Review process and CBA quality requirements.

4.2.2 Consistency with national guides and investment administrative requirements

Economic appraisals should comply with relevant national guides including:

- Infrastructure Australia's 2021 Assessment Framework, Guide to Economic Appraisal 2021 and Guide to Program Appraisal 2021. Infrastructure Australia (IA) reviews projects where the Federal funding requirement is $250 million or above.
- Notes on Administration (NoA) for Land Transport Infrastructure Projects 2019-2024. The NoA is relevant to preparing the Project Proposal Report (PPR).
- Australian Transport Assessment and Planning (ATAP).

The TfNSW CBA Guide intends to comply with all relevant national and NSW Government guides, however, there are some instances where recommended approaches differ for contextual reasons. In cases of conflict or inconsistency, IA's Assessment Framework and the NoA should take precedence if the business case has a Federal funding component. If an economic parameter value differs between ATAP and the TfNSW Economic Parameter Values, the TfNSW values take precedence as they are estimated from NSW specific circumstances.

4.2.3 Patronage assessment post COVID-19 pandemic

The impact of the COVID-19 pandemic on the transport network has had an unprecedented multi-faceted effect on travel demand patterns in Greater Sydney. These can largely be broken down into the following shorter and longer-term impacts:

- Short-term: Reductions in public transport and car trips, reductions in public transport capacity, increased second-hand car purchases, increased intrastate visitation, reduction in public transport preference, increased online shopping and deliveries, reductions in overseas and interstate visitors.
- Longer-term: Reduction in overseas migration, leading to a decrease in population growth rates, reducing overall projected travel demand; reduced commuter trips due to more people working from home, changing spatial distribution of inter-peak / daily non-commute trips.

Recent developments in transport demand forecasting considers population and travel behaviour in a post-COVID-19 world. These impacts are part of the NSW Common Planning Assumptions (CPA) and are incorporated in the latest version of Travel Zone Projections (TZP22) and the Sydney Strategic Travel

Model (STM3.9). Impacts included in STM3.9 include:

- Higher rates of working from home (WFH) compared to pre-COVID-19, particularly in tertiary professions with office-based work.
- More local travel associated with WFH.
- Changes to tertiary student travel patterns, with less travelling to lectures if some of them are delivered remotely.
- Adjustments to air travel demand.

Projects with transport modelling informed by the Sydney Strategic Travel Model (STM3.9) released in December 2022 already include the impacts of COVID-19, and therefore will form the project's core analysis. In this case, additional COVID-19 impact sensitivity testing is not required unless WFH data is available and is expected to be materially different from modelled outputs, or if project-specific land uses are developed for the project study area.

Projects that are based on transport modelling prior to STM3.9 are considered 'transitional projects'. These projects are required to continue using the approach of conducting a sensitivity test as part of the CBA to assess the potential impact of COVID-19. Either in-model or out-of-model adjustments are accepted.

In April 2023, TfNSW Economic Advisory released the updated Technical note on assessing the impacts of COVID-19 for business cases. It provides recommended approaches and further guidance to assess the potential impacts of COVID-19 as a sensitivity test on the value-for-money case of TfNSW projects.

4.2.4 Construction disruption costs

Disruption costs are construction externalities imposed by transport projects on transport users, businesses and local community during construction. Examples of disruption costs include higher travel times from reduced road capacity, speed limit reductions and replacement public transport services. These can also include negative impacts to property, business, the environment and noise.

Prior to 2022, disruption costs have typically been omitted from CBAs due to difficulties in understanding and quantifying these impacts. However, with growing recognition of the potential materiality of disruption costs on CBA results, it is recommended that these are assessed for all projects. This is consistent with ATAP, IAAF and the NSW Treasury Business Case Assessment Tool.

The first step is to assess the scale and significance of disruption costs. For projects in rural and greenfield locations, where the disruption costs are expected to be small / immaterial, a qualitative assessment is acceptable. For large projects in high density areas, disruption costs should be modelled and estimated from traffic volume, forecast delay impacts, exposed local businesses and other impacted communities. The estimated disruption costs should be included in the CBA as a disbenefit.

The assessment of construction disruption cost should be strategic and proportionate to the size of the expected disruption. Material impacts should be estimated using an evidence-based model.

4.2.5 Cost of carbon emissions

Ideally, a CBA should assess whole of asset life carbon emissions. However, conventionally, transport CBA only assessed carbon emissions from users' utilisation of infrastructure.

In April 2024, INSW released the Decarbonising Infrastructure Delivery Policy and the Embodied Carbon Measurement for Infrastructure Technical Guidance (the Policy and Measurement Guidance). The Policy and Measurement Guidance recommends consideration of whole of life carbon where feasible, covering all stages as shown in Figure 3.

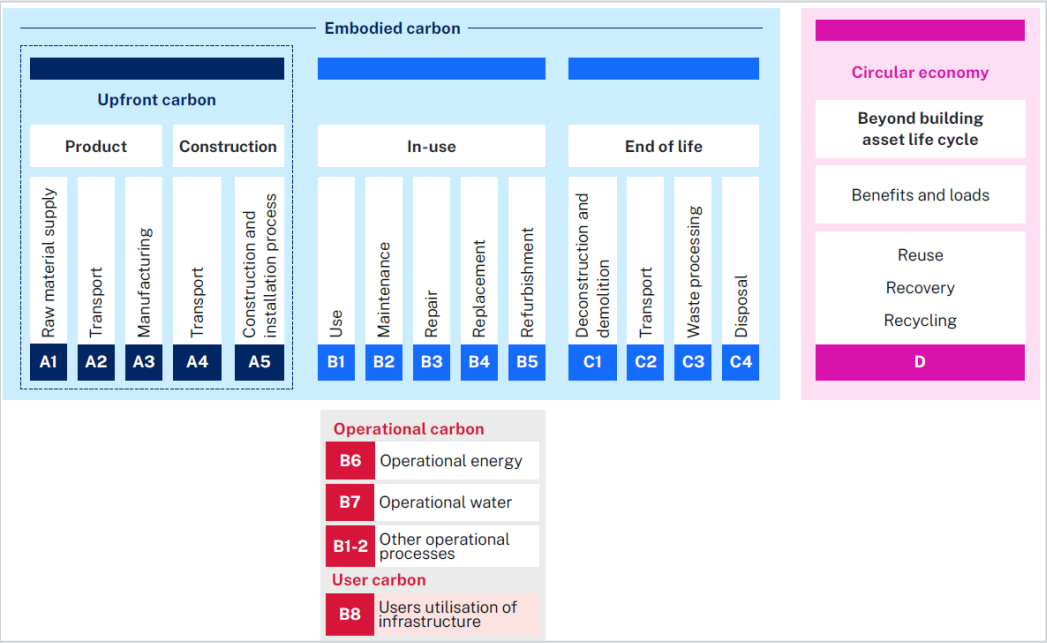

Figure 3: Sources of whole of life carbon emissions[7]

The Policy and Measurement Guidance requires assessment of carbon volumes under the following categories:

- Upfront carbon in the construction phase (A1-A5): Embodied carbon in materials, products, manufacturing and transporting construction products to construction sites, and carbon from construction and installation.
- Embodied carbon during the asset use phase (B1-B5): Embodied carbon from maintenance, repair, rehabilitation and refurbishment.
- Operational carbon during operational phase (B6-B8): Operational carbon from energy and water use and users generated carbons (e.g., from cars, trucks, and trains).
- Embodied carbon during the end of asset life (C1-C4): Asset demolition and disposal carbon during the end-of-life phase.
- Opportunities for carbon offset from circular economy by asset reuse and recycle (D).

[7] Source: p.14, Decarbonising Infrastructure Delivery Policy, April 2024, INSW

As a minimum, the INSW Policy and Measurement Guidance requires estimation of upfront carbon emissions for each option within a CBA. Projects must estimate upfront carbon emissions using the appropriate carbon values, noting there are separate national and NSW carbon values.

A 'TfNSW Technical note on carbon value in cost-benefit analysis' is being developed and will be published to provide further details on the carbon values to be used to assess carbon emission impacts in CBAs.

4.2.6 Treatment of prior cost in transport CBA

Prior costs are not the same as sunk cost. Sunk cost is defined as past expenditure that cannot be recovered.[8] The emphasis is that sunk cost is not recoverable.

When assessing whether a prior cost is sunk or whether it should be included in a project's CBA, it is recommended that consideration is given to whether the specific cost has already incurred and cannot be recovered. Generally, any cost directly attributable to a project's proposed scope is considered recoverable and should be included in the calculation of the project's BCR.

A project's planning, and design and development costs, such as geotechnical studies, concept design and option development, related to its current project scope should not be considered a 'past' cost and therefore should not be defined as sunk. Additionally, non-spent funding should not be treated as sunk cost. These costs should be included in a project's CBA.

Costs incurred on completely scrapped project components should be considered as sunk if the component does not contribute to the final product. However, it is important to take care to not simply exclude all costs related to scrapped project components. Some of those components may have been necessary to get to the final product (e.g. costs incurred while analysing options that are scrapped as part of the usual project development process). Generally, this means excluded costs will be the result of fundamental scope change rendering them wholly unrelated to the final product.

Costs associated with corridor preservation and protection at the program level is generally considered to be sunk.

If a cost stems from a necessary activity to get to the final product, it should be included in CBA. In general, all project related costs contribute to the final product or infrastructure and therefore should not be considered as sunk or not recoverable.

Refer to the separate 'Technical note on the treatment of prior costs in transport CBA' for further details.

4.2.7 Disaster cost-benefit framework

NSW Treasury's Disaster Cost-Benefit Framework (TPG23-17) provides

[8] In Infrastructure Australia's Guide to Economic Appraisal, sunk cost is defined as cost that cannot be retrieved by resale in the market. Refer to p.97, Infrastructure Australia Guide to Economic Appraisal, Technical guide of the Assessment Framework, July 2021

guidance and the framework on how to undertake CBA for disaster resilience initiatives. It applies to disasters resulting from natural hazards such as floods, bushfires and drought.

The Disaster CBA Framework ensures disaster resilience CBAs are consistent, and support decision making and well targeted investment. It identifies guiding principles to support development of initiatives that support disaster resilience, as well as methods, data sources and standard parameters to support the appraisal.

Disasters occur with a low-frequency but have high-consequences, and therefore accurately forecasting disasters is generally not possible. Estimates of the severity, likelihood, and frequency of disasters are sensitive to assumptions of risk, which are themselves often uncertain. Risk and uncertainty should be considered throughout a disaster resilience CBA, starting from problem definition and base case development.[9]

A CBA is required when seeking funding for a disaster resilience initiative with an estimated cost of $10 million or higher. Where there is insufficient time to complete a CBA prior to receiving funding due to emergency situations where there is a need to respond to a disaster quickly, an evaluation, including an ex-post CBA must be completed within a reasonable period.

Refer to the Disaster Cost-Benefit Framework (TPG23-17) for further details on undertaking a CBA for disaster resilience initiatives.

4.2.8 First Nations investment framework

The First Nations investment framework is a guide to good practice in the design, appraisal and evaluation of initiatives that impact on First Nations people and communities. It sets out key steps for working with First Nations people to strengthen the evidence on what works and better inform how initiatives are designed, prioritised and funded.[10]

The First Nations investment framework includes a technical appendix which outlines how the framework can be applied to CBA and how the value of First Nations cultures can be incorporated in CBA where appropriate. The framework considers how culture can be identified as an input that supports the outcomes an initiative delivers, and how this can be included in CBA.

The NSW First Nations Investment Framework will be available on NSW Treasury's website.

4.2.9 Social value

Social value is an emerging practice within TfNSW which focuses on achieving social wellbeing and generating public benefit to deliver immediate and long-term social outcomes.

Currently, the social implications of an initiative can be investigated when undertaking distributional analysis as part of the CBA. This is done by examining

[9] Source: p.8, NSW Treasury Disaster Cost-Benefit Framework TPG23-17, October 2023

[10] Source: p.7, NSW Treasury NSW First Nations Investment Framework (draft in 2024)

which groups in the community bear costs or receive benefits, thereby informing the impact on social equity within various groups in the community.

Regarding social inclusion, there is ongoing research around the benefits associated with reducing the risk of social exclusion, particularly in relation to its link to transport mobility.[11] In transport CBA, social inclusion benefits may be estimated when a new public transport service is introduced in an area where there is no other existing mode of public transport. .

4.2.10 Assessment of land use benefits of transport projects

Interest in including land use benefits within a transport CBA is increasing as projects take a more holistic approach to the assessment of transport initiatives. To include land use benefits in a CBA, it must first be established that a project is expected to result in land use change. Not all transport projects will result in land use change. There should be clear justification for why the transport project will directly result in significant land use change. In general, only large transport, precinct, or urban renewal projects will result in land use change.

Projects that give rise to land use change may result in a range of land use benefits which can be estimated and included in a CBA. The estimation of land use benefits, however, is a complex and resource intensive activity. Land use benefits are subject to a high level of uncertainty and forecasting land use change requires specialised expertise. Project teams should determine if land use benefits should be quantified within a CBA based on the expected significance of land use change, balanced against the cost and resources required for quantifying this impact.

For further guidance on assessing land use benefits within a CBA, refer to ATAP 08 Land Use Benefits.

4.2.11 CBA model minimum requirements

An economic model is required for Economic Concurrence Review. The economic model must be fully functional, and formulae driven. The model must not be password protected or rely on excel macros, to enable TfNSW to verify the calculations and undertake scenario and sensitivity analysis.

The model should generate the standard tables specified in TfNSW Business Case template.

4.2.12 Sensitivity test requirements

Sensitivity tests are essential to understand how the project is impacted by key risks and assumptions made. Sensitivity tests that should be measured in a CBA include the following scenarios:

- Costs increased or decreased by 20% and 40%.

[11] Stanley, J., Hensher, D. and Stanley, J. (2022). Place-based disadvantage, social exclusion and the value of mobility, Transportation Research Part A, 160, 101-113.

- Benefits increased or decreased by 20% and 40%.
- Discount rates at 3%, 4% and 7%.
- P90 cost if P50 cost is used in the core analysis.
- A prolonged project development and construction period that delays the project opening by 1-year and 3-years.
- Lower patronage growth rates such as no annual growth rate and half of the estimated growth rate.
- Any other significant assumptions that have a material impact on the analysis.

4.2.13 Report on economic appraisal results

The CBA analysis should be reported in a well written economic appraisal report that includes the following components:

- An introduction of the project such as location, current road condition, project objectives, previous economic appraisals.
- Economic appraisal methodology summarising the cost benefit analysis framework adopted for the project, key assumptions and economic and financial parameter values used.
- Definition of the base case and the project case.
- Summary of the transport modelling approach and the modelling output used in the economic appraisal. State if there is any induced demand.
- A transport safety analysis showing current crash rates (based on the most recent 5-year crash data), the project case's expected crash reduction, and how the crash reduction was estimated.
- Summarise P50 capital, maintenance and operating costs in the base case and the project case.
- Estimate the project benefits. Information should be sufficient for reviewers to understand how the benefit was determined and calculated.
- Sensitivity test results.

The economic appraisal results of the preferred option should be clearly summarised in the Executive Summary and result sections, ideally in a consolidated table that shows P50 and P90 outturn costs, discounted capital and operating costs, discounted benefits, BCR and NPV.

If a project has assessed land use benefits and WEBs, the following CBA result presentation is recommended:

- CBA results for transport benefits only
- CBA results for transport + land use benefits
- CBA results for transport + land use and WEBs

For detailed Guidance on Wider Economic Benefits, refer to ATAP T3 – Wider Economic Benefits.

4.3 Worked example: road congestion reduction

The starting point for any transport CBA is identifying the problem. This hypothetical example considers a bridge reaching its capacity which is experiencing increasing congestion in peak hour.

Analysis of the traffic crossing the bridge reveals that commuters spend an

additional 15 minutes in traffic every morning due to the congestion – time that could have been spent eating breakfast with the family or finishing off a report in the office. Because these things have been given up to accommodate the additional travel time, they are the **opportunity cost** of the extra time needed to get across the bridge.

A project team is formed to investigate solutions that will decrease congestion. These solutions are not infrastructure or mode-specific, and include building a new bridge, adding a toll, or improving bus services and active transport connections for communities on each side of the bridge. When reviewing previous work done, they find that a geological survey of the riverbed was undertaken to test feasibility for a new bridge at a significant cost.

To compare the three alternatives, they choose a base year of 2024 and a consistent **appraisal period** of thirty years for the CBA, reflecting the long asset life of the new bridge option. All the alternatives are assessed with the same appraisal period. The team uses **transport modelling** to estimate the transport network outcomes under a business-as-usual scenario (the base case) as well as the three alternatives over the entire appraisal period.

The demand modelling suggests that the options will impact travel times and mode choice for users across the city, not just for those using the bridge, because they lead to widespread changes in travel behaviour. The benefits and disbenefits for all NSW community members (**the referent group**) are estimated, even if they never use the bridge in the base case or alternative options.

The project team calculate the benefits of each option using estimates of the value of travel time taken from TfNSW Economic Parameter Values (EPV), which are based on willingness to pay surveys undertaken several years prior. These need to be **escalated** to June 2024 dollars so that they are consistent with the **real prices** used in the rest of the CBA. Other research is used to value the lower convenience of having to travel in buses versus private vehicles, in line with CBA **valuation principles**.

Capital and operating cost estimates are prepared for the base case and alternative options. Two sets of costs are prepared – real cost estimates for the economic analysis, and nominal costs including **inflation** to be used in the **financial appraisal**, to inform funding decisions.

With transport demand and cost data available, the project team has enough information to undertake the CBA, using a **discounted cash flow** model to assess the capital and operating costs, and the economic, social, and environmental impacts for all years in the appraisal period.

While one alternative will deliver benefits in the early years of the appraisal, the others have much higher benefits later on. A **social discount rate** of 5 per cent, reflecting the time value of money, is used to convert all values into a comparable **NPV**, so that all options can be compared on an equal basis in discounted, real 2024 dollars.

In this hypothetical example, the solution providing improved bus services has the highest **BCR** and is selected as the preferred option for a Final Business Case.

5. The key steps in doing a cost-benefit analysis

Following a structured CBA process ensures the analysis is robust and meets the requirements of the NSW Transport cluster.

5.1 The cost-benefit analysis process

The steps involved in a CBA are shown in Figure 4. While the process is shown in sequential steps it should be viewed as a logical sequence rather than a strict ordering of activities. A CBA, in coordination with the business case and project development, may evolve through many iterations, moving between and revisiting steps as the project matures.

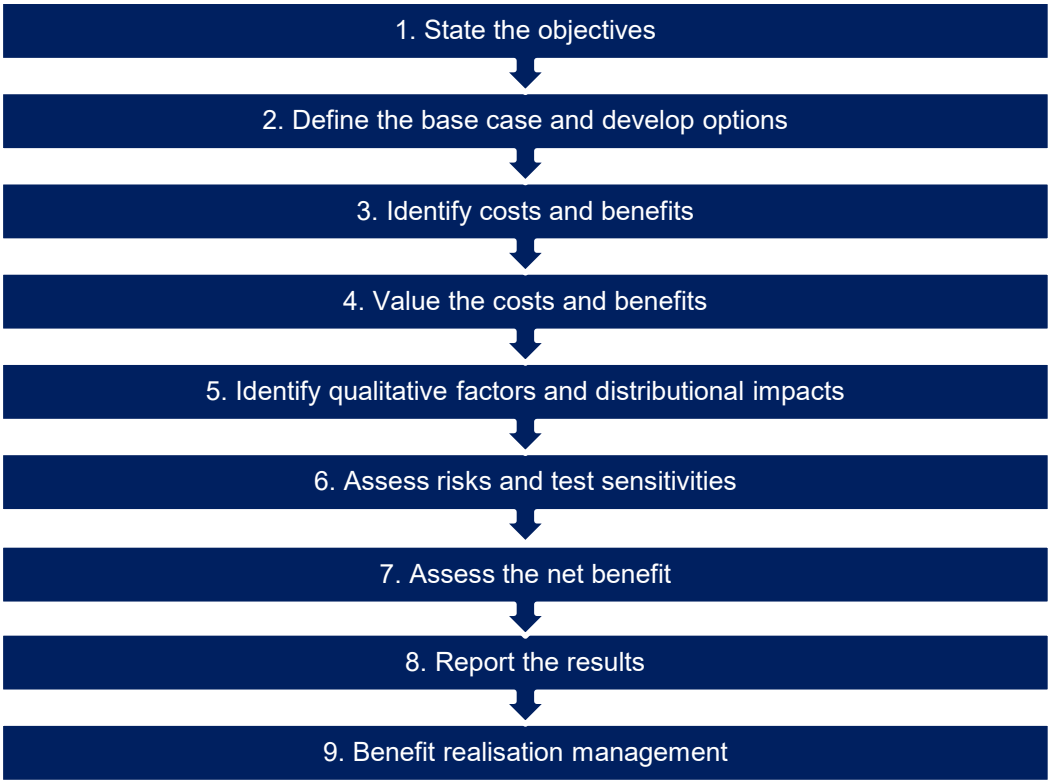

Figure 4: The cost-benefit analysis process[12]

[12] Source: TfNSW based on NSW Treasury (2017).

5.2 Step 1: State the objectives

5.2.1 Define the case for change

Any evaluation of a proposed initiative should begin by defining the problem that the project is designed to alleviate. To justify an initiative, it is important to have a clear understanding of the need for investment, as this will help to inform the project objectives and range of potential options.

In some cases, a project team will have a preferred solution before conducting the CBA. However, before a solution is chosen it is important to first:

- Consider the outcomes for the customer which the project is trying to achieve
- Consider how the project fits with the strategic direction of the NSW Transport cluster
- Define the problem to identify the extent of the issue, any timing considerations, and to gather evidence for a case for change
- An Investment Logic Map (ILM) can be prepared which will assist in defining the objectives of the project based on an understanding of the problems intended to be solved. This helps to ensure that the proposed project will deliver the forecast benefits identified in this business case.

5.2.2 State the project objectives and ensure contribution to the Future Transport Strategy

Once a problem statement has been defined, the evaluation of a proposed initiative should consider the project's objectives. When stating the objective, it is important to specify outcomes (reduced congestion, travel time savings, increase in mode choice options or services) rather than outputs (e.g. more vehicles supplied) or inputs (e.g. additional kilometres of roads built).

In some cases, the objective of a proposed project may appear to be self-evident; nevertheless, a project's objective must be explicitly stated and contribute to the NSW Government's strategies. It is important that all transport projects contribute to one or more of the strategic outcomes outlined in the Future Transport Strategy:

- Connecting customers' whole lives: with multimodal customer journeys that are seamless, personalised and enabled by data and technology
- Successful places for communities: where transport enhances amenity, liveability and economic success
- Enabling economic activity: by powering NSW's future $1.4 trillion economy and enabling economic activity across the state

5.2.3 Scope the proposal and determine the level of evaluation needed

Often the solution to a problem can involve many components. It is important to determine the level of aggregation to use in the CBA. For example, the upgrade of a rail corridor can include adding car parks and changes to the bus network.

In these circumstances the evaluation of the overall project is critical, not just an

evaluation of the individual components. However, if the analysis is too aggregated, some components of the project may be justified not on their own merit but because of the combined benefits of other components.

All expenditures necessary for the achievement of the project's objective need to be in the evaluation. This includes multi-modal impacts, for example arterial roadworks may also cause changes to public transport operating costs, which would need to be reflected in the CBA.

5.3 Step 2: Define the base case and develop options

5.3.1 Specify the base case

CBA compares the costs and benefits of doing something (i.e. the project options) against a base case (the 'business as usual' or 'do minimum' scenario). The base case is important because it impacts on the attribution of estimated benefits and costs to the project options being assessed. A poorly specified base case will bias the assessment of the project options, compromise the analysis and distort the investment decision being made.

Care should be taken to specify a realistic base case in the CBA. The base case is not a 'worst case' or 'do nothing' option. It should include a reasonable estimate of the expenditure required to maintain the existing level of service. This will generally include, at a minimum, relevant initiatives that are already committed and funded. It should reflect expected changes to population growth and distribution, government policy, and technology. For example, including expected increases in Electric Vehicle use may be an important consideration when specifying the base case for particular initiatives.

Defining the base case transport network and land use assumptions are particularly important for transport projects, as they can have material implications for the CBA results. Accountability to a project sponsor for correctly specifying these assumptions is held by the project manager, but should be informed by relevant guidance from TfNSW Economic Advisory, Infrastructure NSW, NSW Treasury, and Infrastructure Australia, as well as advice from demand modelling and CBA practitioners.

It is not sufficient for project managers to adopt publicly available information without assessing whether that information is current and suitable for use in the base case. Clear thinking and good judgement should inform decision-making when specifying the base case for a NSW Transport cluster CBA. For example, broad assumptions from NSW Government land use forecasts or transport network strategies may not necessarily be appropriate for use in particular projects. NSW Treasury, Infrastructure Australia, and Australian Transport Assessment and Planning Guidelines provide additional guidance to assist with specifying the base case for a transport CBA (Table 5).

Table 5: Guidance for specifying the base case[13]

Category	Guidance
General definition of the base case	• A 'real world assessment' of what would be done in the absence of the project case (IAAF and ATAP). • The scenario in which current arrangements are maintained (Productivity Commission). • The 'business-as-usual' or 'keep safe and operational' situation (IAAF). • In general, the base case will be a 'no policy change' scenario (NSW Treasury).
Cost requirements	• Be of modest cost (IAAF). • Include ongoing maintenance of associated assets for structural integrity and public safety (ATAP). • Not include significant asset enhancement, save where incremental capacity enhancements may need to be assumed in order to obtain realistic future demand estimates within the technical limitations of transport models (IAAF). • May involve deferral of replacement and continued maintenance and/or eventual replacement with a new asset of comparable standard to that being replaced (NSW Treasury).
Service level requirements	• Maintains the existing service levels possible or avoids further degradation in service levels (IAAF). • The option that is most effective at maintaining level of service at least cost (ATAP).
Other network investments	• Include relevant initiatives elsewhere in the network where funding for those initiatives is approved, committed or expected (ATAP). • Includes any known and funded changes to infrastructure or services that will have occurred in the absence of the project case (IAAF).
Base case land use	• Base case and project case land use may differ where there is a land use response to an infrastructure investment (IAAF). • Good understanding of exogenous land use forecasts (e.g. from NSW Department of Planning, Industry & Environment) is required when specifying land use inputs. If exogenous forecasts already consider the provision of future transport infrastructure, they may be more appropriate for use in the project case rather than the base case (IAAF).

[13] Source: TfNSW based on NSW Treasury, Infrastructure Australia Assessment Framework (IAAF), and the Australian Transport Assessment and Planning Guidelines (ATAP), Productivity Commission

5.3.2 Specify the project options

CBA is a mandatory part of a business case, which is required for capital, recurrent and ICT proposals with an estimated total cost of $10 million or higher.

A long list of potential options should be developed in the strategic business case. Non-infrastructure options such as demand management solutions have mostly been investigated before or at Gate 0 planning phases. At strategic business case, these options may be re-investigated only if the client division has instructed these options should be still considered as part of business case development. **Between two to five alternative options should be included in the short list in the strategic business case.** An iterative approach should be adopted to reduce the number of options from the long list. Initially, high-level analysis can be used to screen out the least promising options using techniques and tools such as strategic merit test, multi-criteria analysis or value management workshops and then a refined list of options is developed for a rapid CBA. It is not sufficient to consider only one option in-depth and other options superficially. The short list of options should reflect NSW Government and the NSW Transport cluster strategic policy, and particularly the outcomes identified in the Future Transport Strategy. Within the business case, this strategic direction should be used to articulate a case for change and when determining the corresponding objectives of the initiatives. The business case objectives should then be reflected in the options and in the CBA.

In the final business case, at least two realistic alternative options should be assessed in a full economic appraisal. In some special situations, where this is not practicable, one option can be assessed if it is accompanied by suitable justification. This is also discussed in Section 3.2.2.

For smaller projects (below the $10 million threshold), the CBA can be undertaken for the base case and preferred option only. A CBA summary sheet may be used instead of a full economic appraisal report, to present the results supporting the funding decision in a fit-for-purpose/light final business case.

When assessing multiple options, it is recommended that a range of alternatives are represented in terms of technology, mode, demand, or timing. Only technically and economically feasible options should be considered in the analysis.

Project options should be innovative and consider multimodal approaches as well as movement and place. The Future Transport Strategy encourages the use of scenario testing to discover solutions. For any transport problem there will be a range of potential solutions. For example, road congestion can be eased through building wider roads, encouraging a mode shift to public transport, smart road infrastructure to manage congestion ‘pinch points’, or encouraging road users to re-time their discretionary travel.

As with the base case, poor specification of project options will compromise the analysis and distort the investment decision being made.

5.4 Step 3: Identify costs and benefits

To systematically identify impacts, it is useful to categorise costs and benefits

into discrete categories. The identified costs and benefits should relate directly to the changes outlined in the project option. Table 6 presents common costs and benefits found in transport initiatives, and a detailed list of benefits is provided in Section 7.3.

Increasingly, non-traditional benefits are being included in CBA such as the impacts of a transport initiative on movement and place. It is important to ensure that these non-traditional benefits represent real increases in welfare and not the transfer of initial benefits from one party to another.

Table 6: Common transport cost and benefit items[14]

Category	
Benefits	
User benefits	travel time savings vehicle operating cost savings reliability improvements reduced crowding
Social benefits	environmental externalities health benefits from active transport safety benefits decongestion benefits
Government benefits	incremental fare-box revenue avoided capital costs avoided recurrent costs residual value
Disbenefits	additional crowding increased walk or transfer time construction disruption costs cost of carbon emissions
Other benefits	wider economic benefits high value land use option values and non-use values improvements to place
Costs	
Capital costs	direct construction costs asset replacement costs major periodic maintenance site remediation
Recurrent costs	operating costs maintenance costs

5.4.1 Undertake transport modelling

In almost all cases a proposed transport initiative will be designed to address customer demand. For this reason, transport modelling or forecasting is frequently needed to determine the impacts of an initiative on customer usage

[14] Source: TfNSW based on NSW Treasury, Infrastructure Australia, and the Transport and Infrastructure Council.

and therefore pivotal in providing monetised inputs to the CBA.

Transport models provide forecasts of future travel. These forecasts are important inputs into the CBA and may determine the majority of the economic benefits of a project. Forecasts must be done for the base case and project options and need to be both internally consistent and aligned with strategic forecasts. Forecasts do not always require a complex transport model – for some smaller projects, simple forecasts may be projected from base travel data, using assumed changes in population or trip incidence.

Different types of transport models may produce estimates of travel demand (e.g. the desired amount and location of travel from transport users, unconstrained by network capacity) or of traffic (e.g. the operational performance of a highway up to its maximum capacity).

In NSW, there are several transport models used as inputs to CBAs. These include the Sydney Strategic Travel Model (STM), the Public Transport Project Model (PTPM), the Sydney Strategic Motorway Planning Model (SMPM), and the Enhanced Train Crowding Model (ETCM). There is also a more general road traffic model for Sydney greater metro area - Strategic Traffic Forecasting Model (STFM).

Many of these models produce estimates of travel for an AM peak period only - where this is the case, CBA practitioners must use 'expansion' factors to estimate the impacts for a full day, and 'annualisation' factors to estimate the impact for the entire year. The choice and application of different factors is a major assumption for the CBA (guidance for this can be found in the TfNSW Economic Parameter Values). Transport models may only be used to forecast travel at a selection of points in the future, and the results for other years must be interpolated or extrapolated in order to estimate benefits for the full appraisal period.

Transport modelling questions, as well as questions on network assumptions, are best answered by TfNSW Advanced Analytics and Insights (AAI).

5.5 Step 4: Value the costs and benefits

5.5.1 Value the incremental cost of the project

A robust CBA needs comprehensive and accurate cost estimates that are easily and clearly traced, replicated and updated. These expenses are generally estimated by a quantity surveyor, construction economist, or cost manager.

The standard for cost estimation can be found in the Cost Estimation Guidance by the Australian Government of Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA). For large projects, especially those seeking federal funding, DITRDCA's cost estimation guidance should be followed and requires highly accurate estimates, including probabilistic cost estimation and itemised costing from first principles.

The cost estimates used in a CBA differ from the cost estimates used in a financial appraisal. CBA uses costs in real dollars, discounted to present values using the social discount rate. Financial appraisals tend to report costs in nominal

dollars and may use a different discount rate to the CBA.

5.5.2 Level of accuracy

The NSW Government recommends the use of probabilistic modelling approaches to be informed by actual experience of project managers, service delivery officers, legal or other experts who are able to identify and place a value on salient risks (NSW Treasury 2023).

In practice, the accuracy of project estimates should increase during the decision-making process in keeping with available information about the project options. At the planning stage, estimates are likely to be less accurate than final out-turn costs. While early estimates may not be as accurate as final cost, planning estimates are generally accurate in relative terms so they provide a reasonable basis for the ranking and initial screening of options.

The cost of gaining greater accuracy should also be considered. For early-stage investigations and unfunded transport projects the amounts spent on accurate cost estimations should be enough to support an informed choice and not necessarily be definitive.

TfNSW recommends that P50 cost estimates are used in the core economic appraisal results, and P90 cost estimates reported as a sensitivity. P90 cost estimates may be used in the core results for projects that are high value, high risk, or that have identified factors that could increase the likelihood that costs would exceed the P50 estimate. Project teams that use P90 costs for their core results should consult with TfNSW Economic Advisory and provide additional evidence to support the decision in the economic appraisal report. The project risk profile, life cycle phase, delivery strategy and the expertise available to the project team also need to be considered in deciding on the accuracy of cost estimates.

Cost estimates in a CBA should be clear in stating the level of coverage, completeness and accuracy involved, with particular care exercised in the public release of cost estimates that are preliminary or likely to be revised.

5.5.3 Value the incremental benefits of the project

In CBA, an economic benefit is any positive or negative consequence to the lives of a person in the referent group that will result from the project. When determining the value of a benefit, the principle guide is the dollar amount that individuals would be willing to pay for them. In some cases, individuals do not accurately perceive prices, or do not perceive all of the costs or benefits of a good – where this is the case, resource costs for an impact may be determined using another approach.

A large body of academic research and practical guidance exists that provides standard, accepted approaches to the valuation of transport impacts. For NSW Transport cluster CBAs, the TfNSW Economic Parameter Values (EPV), provides recommended values appropriate for the NSW context.

5.6 Step 5: Identifying qualitative factors and distributional impacts

5.6.1 Undertake distributional analysis

Distributional analysis looks at the impact of the initiatives on equality in the community. For example, improved public transport in remote areas could reduce travel cost and improve access to education for isolated communities but be more expensive than improvements in city suburbs.

TfNSW supports undertaking distribution analysis as a supplementary analysis in a CBA. A CBA should present a distributional analysis (this can be quantitative, qualitative or a combination of both) to support informed decision making.[15] A high level distributional analysis is to provide benefits accrued to the following groups:

- Transport users from private and commute trips
- Business users from business trips
- Freight industry
- Government from maintenance and operating cost savings and residual value
- Communities from environmental impacts, placemaking benefit, resilience and sustainability
- Other group for any other benefits.

5.6.2 Identify qualitative benefits

A CBA should use dollars as a common unit of comparison wherever practicable. Wherever possible, qualitative benefits should also be included. This gives decision-makers a comprehensive understanding of the proposed initiative and allows qualitative factors to be assessed against any differences in monetised costs and benefits. While often challenging, monetising and quantifying impacts makes the choices more transparent and allows benefit and costs to be tracked and managed.

Qualitative factors to consider may include real or perceived benefits that are difficult to accurately measure or impacts that are not yet defined accurately enough to enable quantification. However, if a qualitative factor is the principal reason for a choice, then effort should be made to quantify a result or discuss implied values in the sensitivity analysis.

5.7 Step 6: Assess risks and test sensitivities

All infrastructure projects have risk, even after risk mitigation measures have been applied. A CBA should include an understanding of the risks and

[15] Refer to p.38 and pp.85-90 NSW Treasury's cost-benefit analysis guide 2023.

uncertainties involved in the decision being made.

Understanding risk and uncertainty needs to be a central element of a CBA, rather than an add-on after central estimates are calculated. Risk assessment involves identifying risk factors, as well as estimating their consequence and likelihood.

Key steps in a risk assessment include:

- Determining a range of values of risk factors and uncertainties
- Calculating the effects on the decision criteria (NPV and BCR)
- Testing the interrelationships and key assumptions.

Risk can be included in a CBA by deterministic or probabilistic methods. The deterministic method is a simple approach that applies a percentage to either individual cost elements or to the aggregate cost estimate. The probabilistic method uses Monte Carlo simulation to assess contingency requirements. Monte Carlo simulation generates a very large sample of possible project outcomes and the frequency of occurrence of each.

TfNSW, in line with the NSW Government, recommends the use of probabilistic modelling approaches to be informed by actual experience of project managers, service delivery officers, legal or other experts who are able to identify and place a value on salient risks (NSW Treasury, 2023). Monte Carlo Analysis methodology can be used for high-risk projects in addition to sensitivity testing. The best method may be influenced by the project risk profile, life cycle phase, delivery strategy and the expertise available to the project team.

Sensitivity analysis should show where risks and opportunities exist to change options and improve outcomes. Deterministic approaches, such as looking at a 10 per cent change in costs, need to also be considered in regard to how they will impact decision criteria, if lower risk options should be preferred or a preferred option needs to be changed to mitigate risk.

If Federal funding is sought, specific requirements apply and should be checked. For further detail see the Guidance Note 3A Probabilistic Contingency Estimation by The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA).

5.8 Step 7: Assess the net benefit

The key decision criteria for a transport CBA are the BCR and the NPV. This is also informed by other qualitative considerations.

5.8.1 Calculate the net present value

NPV is the difference between the present value of benefits and the present value of costs. A positive net present value indicates that the project is likely to have economic merit.

The NPV can be used to compare mutually exclusive options for the same initiative, alternative combinations of related initiatives (where implementation of one affects the benefits and/or costs of another), and alternative timings for the same initiative.

$$NPV = \sum_{t=0}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

t *is time in years*

n *is number of years during which benefits and costs are included*

r *is the discount rate*

B_t *is benefits minus disbenefits in year* t

C_t *is infrastructure capital and operating costs in year* t

5.8.2 Calculate the benefit cost ratio (BCR)

The **BCR** is calculated by dividing the present value of benefits by the present value of costs. An initiative is potentially worthwhile if the BCR is greater than one, that is, the present value of benefits is greater than the present value of costs. The BCR is also used to rank initiatives.

$$BCR = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

t *is time in years*

n *is number of years during which benefits and costs are included*

r *is the discount rate*

B_t *is the benefits minus disbenefits in year* t

C_t *is infrastructure capital and operating costs in year* t

5.9 Step 8: Report the results

The CBA results should be used as part of the narrative informing the decision being made in a business case. Key results should be represented in a results table similar to the example in Table 7.

Table 7: Example CBA results table

Costs and benefits	Present value ($m 202x)
Capital costs	
Operating costs	
Total costs	
Travel time savings	
Vehicle operating cost savings	
Transport safety benefits	
Environmental benefits	
Maintenance cost savings	

Costs and benefits	Present value ($m 202x)
Other benefits	
Total transport benefits	
Economic appraisal result – Transport benefit only	
BCR	
NPV	
Higher value land-use benefits	
Second-round transport benefits from land-use change	
Other land-use benefits (e.g. sustainability, public health)	
Total land use benefits	
Economic appraisal result – Transport benefit + land use benefits	
BCR	
NPV	
Agglomeration WEBs	
Labour market tax WEBs	
Imperfect competition WEBs	
Total WEBs	
Economic appraisal result – Transport benefit + land use benefit + WEBs	
BCR	
NPV	

The following should also be presented:

- The conclusion and recommendation of the CBA
- An itemised list of the PV of all benefits and costs
- Key parameters and assumptions
- Sensitivity analysis on the assumptions, risks and uncertainty
- Sensitivity analysis on the discount rates at 3%, 4%, and 7%
- Qualitative benefits or costs
- Distributional impacts.

The size and detail of a CBA will vary depending on the risk and value of the decision being addressed. However, useful information that may assist decision makers compare the base case and options should include:

- Supporting tables

- Charts demonstrating discounted cash flows and NPV values
- The difference between the value of options.

When calculated, land use benefits and wider economic benefits (WEBs) should be included as part of the sensitivity analysis.

5.9.1 Recommend a preferred option

The preferred option is identified by:

- Comparing options by NPV and BCR
- Comparing results of sensitivity analysis
- Assessing the qualitative factors for each option.

In general, for a CBA for transport initiatives, the monetised benefits of the project should be greater than or equal to the cost of the project. If major factors are not able to be monetised and risks and uncertainness quantified, then informed judgement is required to determine the preferred option.

5.10 Step 9: Benefits realisation management

Applying rigour in the development of a CBA, as outlined above, allows TfNSW to manage delivery of benefits throughout a project and monitor if expected benefits were realised after the project has been completed.

It allows the project sponsor and benefit owner to understand if the project achieved its intended outcomes, solved the problems it proposed it would, or had unexpected consequences.

If a project did not meet its intended outcomes the reasons should be documented and incorporated into lessons for future investment decisions.

The following guides are useful benefit realisation tools:

- INSW Gate 6 Assurance Review
- NSW Treasury Policy and Guidelines: Evaluation (TPG22-22)
- Infrastructure Australia Assessment Framework
- TfNSW Benefit Realisation Management and Evaluation Guidelines.

6. Common mistakes and lessons learnt

The following are common mistakes to avoid when conducting a CBA. Early engagement with the CBA process in project development is recommended to avoid these or other issues.

6.1 Unclear objectives and missing options

It is important to clearly state the objectives of the project. The CBA should have a strong narrative describing why government action is needed. If the objective is not correctly stated, the options considered and the decision made may not deliver the desired outcomes.

It is not sufficient to consider a narrow set of options, or to include poorly scoped options that were never intended to be seriously considered. Doing this restricts the NSW Transport cluster's ability to deliver value-for-money to customers. Missing options can include: non-infrastructure solutions, alternative modes, active transport, information and education campaigns, timing and staging differences, pricing, technology solutions, behavioural change and demand management.

6.2 Setting the base case

Specifying the base case is important because it impacts on the attribution of estimated benefits and costs to the project options being assessed. A poorly specified base case will bias the assessment of the project options, compromise the analysis and distort the investment decision being made.

There are several ways that a poorly specified base case may impact the CBA. Use of a 'do nothing' or 'worst case' base case may unrealistically exaggerate the problem a project is intended to solve, making the project appear better value-for-money than it really is.

Inaccurate base case population or transport network inputs may impact the CBA by reducing or increasing demand for a new service, leading to an inaccurate patronage forecast. This may sway whether a project is economically viable.

6.3 Optimism bias and justification versus evaluation

A cognitive bias is a systematic pattern of deviation from norm or rationality in judgment.[16] A common cognitive bias for project proponents is optimism bias which unintentionally advantages a preferred option over credible alternatives.

[16] (Haselton, et al., 2005)

The most appropriate way of addressing this issue, particularly for projects that have not been undertaken before, is to ensure that the cost and benefit assumptions and data used are reasonable by comparing them with actual data from similar, recently completed projects.

Ways to avoid cognitive bias when developing transport initiatives include thinking in terms of outcomes, exploring a wide range of option early in development, and avoiding the preferring of an option without the necessary evidence.

6.4 Transfers, netting and double counting

Care is needed to avoid double counting and to ensure any potential transfers are netted out. Explicitly including a cost in one area of the analysis can require an offsetting change in benefits in another area, for example, a fare or a toll is a cost to a customer but a revenue benefit to the supplier and therefore needs to be netted out.

Because taxes are transfers from customers and businesses to government, they are normally excluded from CBA analysis. Subsidies should also be excluded.

Costs and benefits can be transferred between parties. For example, the benefits of travel time savings for commuters can be transferred to landlord in higher rents on properties near new transport links. Including both travel time savings and full land value uplift may result in double counting.

6.5 Confusing real, nominal, and discounted prices

A CBA is undertaken on a real basis, without inflation, at the present point in time (i.e. real cash flows and real social discount rates are used). This is because CBA is concerned with comparing community welfare on a consistent basis over time.

Within a business case, a variety of numbers may be presented that refer to economic, financial and budgeting values. These numbers have different purposes and are calculated on a different basis so are not readily comparable. It is good practice to always make clear the basis for values provided, for example $10 million (real, FY2024).

6.6 Misalignment of scope, costs, and benefits

The costs and benefits included in the CBA should reflect the scope of the project as outlined in the business case. Infrastructure or service changes needed in order to realise the economic benefits should be included in both the CBA costs and the business case. Similarly, benefits should not be included in the CBA unless they are clearly aligned to an outcome of the business case and are the direct result of a scoped item.

6.7 Confusing costs and benefits

Sometimes there is confusion over whether something is a cost or a benefit.

Increased local employment can be seen as a benefit for a regional community but is a cost to a project. A CBA uses the NSW community as the referent group for determining costs and benefits but allows for different perspectives to be incorporated in distributional analysis, sensitivity testing and the narrative attached to a business case.

6.8 Treatment of cost savings

Whether cost savings are treated as a negative cost or benefit can have a material impact on the BCR and may even change the preferred option; the NPV however will remain constant. The preferred approach is to treat cost savings as a benefit and be included as a separate category within benefits. For example, recurrent cost savings may occur where operating and maintenance costs are lower under the initiative than in the base case.

6.9 Treatment of benefits

Whether a negative value is treated as a cost or disbenefits can have a material impact on the BCR and may even change the preferred option; the NPV however will remain constant. The preferred approach is to treat impacts resulting from the project as 'benefits', regardless of whether they are positive or negative. For example, a road project may have negative environmental impacts if it results in more car use – these impacts should be included as a disbenefit, rather than as a cost.

6.10 Use of marginal and average values

Average values are commonly used in making most comparisons and decisions. However, CBA decisions are usually about incremental changes compared to a base case and so marginal values, the values attached to changes, should be used. Confusion can occur over average and marginal values and a CBA needs to be specific and internally consistent about how marginal costs and benefits are treated.

7. When to ask for help

Because it measures and values different things using different means, the economic perspective in a CBA is not the same as an engineering, accounting or project management view. This section explains when those unfamiliar with economics or CBA or faced with particular technical issues may benefit from assistance.

7.1 Where and when advice is most useful in the CBA process

The best time to get advice is early on in the process of doing a CBA. Issues only identified during a review, particularly for a final business case, can be difficult, time consuming and costly to address. This is particularly true of setting assumptions, establishing the base case and ensuring appropriate options are explored.

Asking for help to supplement advice in this guide can be useful for initiatives where:

- The objective is unclear or multiple objectives are involved
- Options need to be developed or expanded – particularly non infrastructure, multi-modal, behavioural, timing or staging approaches
- Identifying, measuring and valuing of benefits is difficult
- The base case is complex or hard to specify
- An initiative has network, placemaking, city shaping, national building or wider economic benefit (WEB) impacts
- Assets have long lives (over 30 years)
- Overseas or interstate users are a significant part of the project
- New technology is involved
- Federal funding is sought.

7.2 Who to ask?

The Economic Advisory team supports investment decisions by providing frameworks, tools and advice that support informed decision-making.

It provides consistent economic evaluation values that can be used in mainstream transport projects. Part of the team's role is to understand and value impacts of initiatives not typically found in mainstream transport projects. Greater emphasis on place making in business cases, a key focus of the Future Transport Strategy, is one of the focus areas for further work.

Resources and advice, including experience from recent CBA, is available by contacting the TfNSW's Economic Advisory team at: EconomicAdvisory@transport.nsw.gov.au.

Typical transport benefits

Table 8 provides a summary of commonly estimated transport benefits. Further detail on the estimation of these benefits can be found in TfNSW Economic Parameter Values (EPV).

Table 8: Summary of commonly estimated transport benefits

Benefit	Description
Travel time savings	Travel time savings refers to the benefits of faster travel as a result of a transport initiative. It is valued by multiplying the time savings with the value of travel time.
Vehicle Operating Costs (VOC) savings	VOC refers to the variable costs incurred to operate a vehicle. VOCs are incurred on both roads and public transport and include basic running costs such as fuel, repairs, maintenance, depreciation and other additional running costs. VOCs vary by operating conditions, such as road surface, gradient and vehicle speed. VOC savings occur when a project improves traffic flow or operational efficiencies.
Reliability benefits	Travel time reliability refers to the variability (typically measured using variations around the mean) of a user's travel time. Reliability benefits occur when there is a reduction in travel time variations as a result of a transport improvement project. Variability of travel (or unreliability) is an economic cost on travellers, so a reduction in journey time variations will result in reliability benefits.
Amenity benefits	Amenity benefits are improvements to the existing environment. Amenity benefits are measured by improvements to the customer's rating of station/vehicle quality attributes, such as seating, information, cleanliness and lighting and in vehicle attributes such as air conditioning, design, on board information and announcements.
Active transport benefits	Active transport such as cycling and walking can result in reduced congestion and better health outcomes.
Fare-box revenue	Fare-box revenue is the additional revenue generated through the public transport network as a result of the transport initiative. This is due to users changing their route, mode, frequency or destination.
Accessibility for different levels of mobility	Accessibility infrastructure, such as lifts and ramps, can significantly improve the lives of people with different levels of mobility.
Environmental externalities	An externality is a consequence of an economic activity experienced by unrelated third parties. For example, building cycleways could lead to people switching from driving cars to cycling. Reduced use of private vehicles leads to reduced carbon emissions, and decrease in air, water, and noise pollution which benefits members of the community who do not use the cycle path. Details on the full range of environmental benefits can be found in TfNSW Economic Parameter Values (EPV).
Safety benefits	A significant benefit of transport initiatives is increased safety. Safety benefits are estimated by comparing the crash or

Benefit	Description
	casualty reduction in the base case with each option, which is valued by crash cost values.
De-crowding and decongestion benefits	Overcrowding at stations or on-board vehicles can create discomfort for users. Changes in on board crowding (e.g. increasing service frequency or introducing new services) can be measured using multipliers which penalise travel time in a more crowded environment. Road projects can also generate decongestion for the broader network.
Avoided costs	Avoided costs are those that are incurred in the base case but not in the project case. Avoided costs can be calculated by the reduction in recurrent costs when the project is operational compared to the base case. For example, an upgrade to a road could result in reduced routine maintenance costs.
Residual value	Residual value refers to the components of the investment (e.g. assets) that have significant life remaining at the end of the evaluation period, meaning that the assets still have the capacity to accrue benefits. Residual value captures this remaining capacity as a benefit.
Wider economic benefits	Wider economic benefits are indirect improvements to economic welfare from transport and urban development proposals. They are captured in CBA as a sensitivity analysis. The main types of wider economic benefits are agglomeration economies, output change in imperfectly competitive markets and tax revenues from labour markets.
Land value uplift	Land value uplift is capitalisation of the impacts of a transport investment into land values. As a general principle, it is preferable to estimate the direct user benefits rather than estimate the proportion of those benefits that are transferred to land or property owners. Caution should be applied to avoid double counting with other benefits such as travel time savings when quantifying this benefit.
Infrastructure and service delivery savings	This is the core infrastructure to service residential property, including the connection of water, stormwater, sewerage, gas, electricity, roads, information and communications technology etc. One of the key benefits from urban renewal may be the costs of providing services in more dense developments rather than less dense developments.

Glossary

Amenity: A desirable or useful feature or facility of a building or place.

Annualisation factor: A factor used to estimate the impacts of a transport project for a full year, based on transport modelling undertaken for an average weekday or average day.

Assumption: Something that is outside the responsibility of the project and is therefore a given. It is accepted as a correct position to take in relation to the project development process.

Base case: The base case is the projected costs and benefits without the proposed initiative. It is the point that the project case is compared to. The base case is usually defined as "do nothing" or a more appropriately "do minimum".

Benefit (CBA definition): In CBA, an economic benefit is any positive or negative consequence to the lives of a person in the referent group that will result from the project.

Benefit (Benefit realisation management definition): In BRM, a benefit is the improvement resulting from an outcome perceived as an advantage by one or more stakeholders. A dis-benefit can be described as an unavoidable negative consequence of change.

Benefits can be either quantifiable (monetised in economics or measured in performance) or qualitative.

Benefit cost ratio: The BCR is calculated by dividing the present value of benefits by the present value of costs. An initiative is potentially worthwhile if the BCR is greater than one, that is, the present value of benefits is greater than the present value of costs.

Consumer price index: The standard measure of inflation is the Consumer Price Index (CPI). CPI is a measure of changes, over time, in retail prices of a constant basket of goods and services representative of consumption expenditure by resident households in Australian metropolitan areas.

Consumer surplus: Consumer surplus is the benefit derived when the actual price the consumer pays is lower than the highest price a consumer is prepared or willing to pay.

Contingency: Contingency provisions are funds allocated within a cost estimate to cover the cost of unplanned activities or risks that are necessary to deliver project outcomes and require additional funds.

Discount rate: People prefer to consume goods and services now, rather than in the future. In general, even after adjusting for inflation, people would prefer to have $1 now, rather than $1 in 30 years' time. As the impacts included in CBA are presented in monetary terms, all monetised costs and benefits arising in the future need to be adjusted to take account for this preference, known as 'social time preference'. Discounting is the technique used to perform this adjustment.

Distributional impacts: The impact of costs and benefits as they vary in their effect across different parts of the community.

Escalation: Escalation takes into account the changes in costs from the base date of the estimate to some future period, generally the completion of construction.

Evaluation period: The evaluation period is the initial period of capital investment and the asset life. The asset life is the expected period of time an asset remains useful.

Expansion factor: A factor used to estimate the impacts of a transport project for a full day or weekday, based on transport modelling undertaken for peak hour periods.

Externalities: An externality is the impact of an economic activity on third parties. For example, building cycle paths could lead to people switching from driving cars to cycling. Reduced use of private vehicles leads to reduced carbon emissions, and decrease in air, water, and noise pollution which benefits members of the community who do not use the cycle path.

Financial appraisal: Financial appraisal is a method of assessing the extent to which the project will generate revenues to meet its financial obligations and achieve financial sustainability with cost recovery measures. Financial appraisals are also useful for projects that do not generate significant revenue streams to understand the direct financial impacts on the entity due to cash outflows from the costs of a project.

Inflation: A general increase in prices and fall in the purchasing value of money.

Market prices: In economics, market price is the price for which a good or service is offered in the marketplace.

Market based valuation: Benefits and costs should be valued at market prices when possible. For example, the cost of acquiring an asset can be valued based on the cost of replacing the asset at current market prices.

Net present value: NPV is the difference between the present value of benefits and the present value of costs. A positive net present value indicates that the project has economic merit.

Non-Market based valuation: Market-based valuations usually provide much of the information required for CBA. Other methods are required if a competitive market price is not available. In these cases, non-market based valuations, such as revealed or stated methods of valuation may be required.

Recurrent costs: Recurrent costs are incurred when the project is operational. There are several operating and maintenance costs to consider. For example, routine maintenance such as surface patching and vegetation management, labour costs, utility services and coordination costs with the overall transport network.

Opportunity cost: Opportunity cost is the value forgone by society from using a resource in its next best alternative use. It reflects market prices where there is an absence of market failure. Where market failure exists, appropriate adjustments are required to estimate the true resource cost.

Parameters: A parameter is a constant in a function that determines the specific form of the function but not its general nature. In CBA, parameters are used to set consistent valuations of benefits. For example, in 2019 the parameter value of private travel time is $17.72 per hour. This means that time saved on private travel should be multiplied by $17.72 per hour to calculate travel time savings.

Placemaking: Refers to the development and management of the built environment to influence the character or experience of places. Successful placemaking either preserves or enhances the character of our public spaces, making them more accessible, attractive, comfortable and safe.

Producer surplus*:* Producer surplus is the benefit derived when the market price is higher than the price the producer is willing to accept.

Real prices*:* The real price is one which has been adjusted for inflation. For example, say the price of a good is $1 in 2000, in 2002 the price of the good is $1.10 (an increase of 10%). If during this period inflation had risen by 20%, then the real price of the product would have fallen.

Referent group*:* The referent group is a group of individuals deemed by the decision-maker to be relevant for the purpose of CBA.

Residual value*:* Residual value refers to the components of the project that have significant life remaining at the end of the appraisal period.

Resource cost*:* Resource cost is the opportunity cost of resources used, measured from the point of view of society as a whole. It excludes indirect taxes and subsidy.

Revealed preference methods*:* Revealed preference methods derive consumers' WTP through examining their behaviour. For example, the price a person is willing to pay to travel to the beach could reveal how much they value it.

Stated preference*:* Stated preference methods ask individuals to self-report their preferences or valuations using surveys.

Subsidy*:* A sum of money granted by the state or a public body to help keep the price of a good or service low.

Willingness-to-pay*:* WTP is the maximum amount an individual would be willing to pay for a good or service or to avoid an undesirable outcome.

Acronyms

Acronyms	Full wording
AAI	Advanced Analytics and Insights
ATAP	Australian Transport Assessment and Planning Guidelines
BCR	Benefit Cost Ratio
BRM	Benefit Realisation Management
CBA	Cost Benefit Analysis
CPI	Consumer price index
DCS	Department of Customer Services
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
ETCM	Enhanced Train Crowding Model
IA	Infrastructure Australia
IAAF	Infrastructure Australia Assessment Framework
ICT	Information and communication technology
IIAF	Infrastructure Investor Assurance Framework
INSW	Infrastructure New South Wales
NAI	Network and Asset Intelligence
NPV	Net Present Value
NSW	New South Wales
PTPM	Public Transport Project Model
PV	Present value
SMPM	Sydney Strategic Motorway Planning Model
STM	Sydney Strategic Travel Model
TfNSW	Transport for New South Wales
VOC	Vehicle operating cost
WTP	Willingness to pay
WEBs	Wider Economic Benefits

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