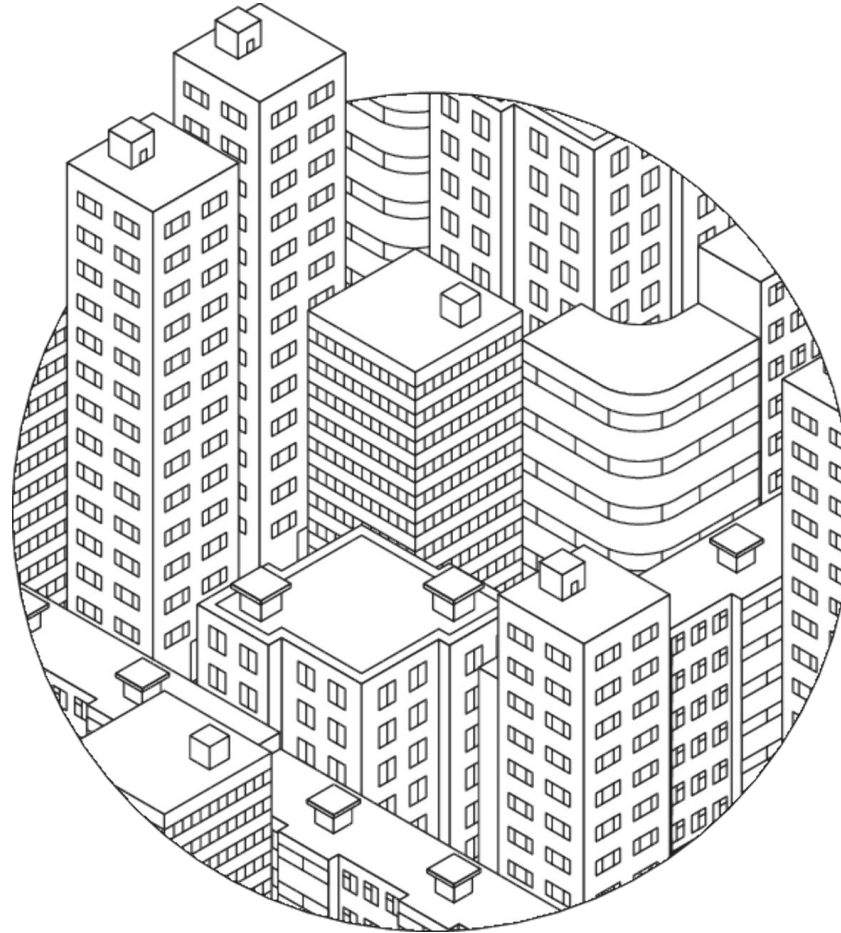




Auckland Council Cost Estimation Review

Final Report – 20 May 2022

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Glossary

Acronym	Term
AT	Auckland Transport
CEM	Cost estimation manual
CFNP	Community Facilities Network Plan
DBC	Detailed business case
DC	Development contributions
DIFF	Drury Infrastructure Funding and Financing
IBE	Indicative business case
LTP	Long-term plan
PT	Public transport
QS	Quantity surveyor
RACI	Responsible, accountable, consulted and informed
RV	Rating valuation
SGA	Supporting Growth Alliance
SRO	Senior Responsible Owner
Sqm	Square metre

Executive summary

We have reviewed capital cost estimation frameworks across three Auckland Council infrastructure groups, with a focus on estimates for projects to be implemented over the long term.



Overview

To calculate development contributions, Auckland Council estimates the capital costs of growth infrastructure projects. Auckland Council has asked Deloitte to review the capital cost estimation frameworks used by three infrastructure groups – transport, open spaces, and community facilities – to identify any opportunities to improve the consistency, transparency and robustness of approach.

The review has focused on the cost estimation approach for projects anticipated to occur over the longer term, particularly in the Drury growth area.

Across each infrastructure group, we assessed the documented approaches against an illustrative best practice cost estimation framework. Our understanding of Auckland Council’s approach was further supplemented by workshops with each group.



Our findings

We have identified five key steps in the cost estimation process, which are outlined below. Our findings correspond to each of these steps and have considered the transparency, robustness and consistency of the observed cost estimation process used by Auckland Council.

1 Data and evidence We have identified opportunities to improve confidence that the best available data is being used. There were examples of reference class and expert input into global rates applying to development and land costs. However, confidence in overall data quality could be improved through: • Consistent use of QS input across groups, • Use of reference class information, and • Periodic review of data.	2 Cost Estimating Methodology The high level methodologies used to determine base cost estimates appear appropriate for early stage projects, having regard to the level of information available and different characteristics of infrastructure groups. We observed that: • Different cost estimation methodologies appeared justified for early stage estimates, • Development costs calculations between open space and community infrastructure appeared to differ, and • Guidance on appropriate methodologies across the project development lifecycle was limited.	3 Base cost, uncertainty and risk There is scope for a more unified approach to the treatment of escalation and contingency. We observed that: • Treatment of project contingency differs between groups for early stage cost estimates, • There is an overall lack of escalation for early stage cost estimates, • Some infrastructure groups may not be including property transaction costs, and • There is scope for a more unified approach across escalation, contingency and some base cost inputs.	4 Cost estimate report There is opportunity to improve the level of documentation prepared for cost estimates. We observed that: • Project timeframes are not fully captured, • Key assumptions and supporting information are not fully documented, and • Documentation of the cost estimation process could be improved.	5 Review and assure We observed various levels of documented quality assurance across the asset groups. We observed that: • Cost estimation review and assurance processes could be more transparent, and • There would be benefit in ensuring alignment in the application of quality assurance across infrastructure groups, where practicable.
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Executive summary | Our recommendations

We have identified opportunities to improve the robustness, consistency and transparency of the cost estimation process undertaken by Auckland Council.

Priority 1 – Recommendations that can be implemented in the short term

1

Consider adopting a consistent approach to escalation, contingency, and property acquisition costs across infrastructure groups:

- A consistent approach to escalation, contingency and property acquisition costs, with appropriate adjustments to each infrastructure group and project specific requirements, will assist with improving the robustness, consistency and transparency of Auckland Council's capital cost estimates.

2

Ensure that best available data is being used:

- Ensure a regular cycle of updates and review is applied to cost inputs used across infrastructure types.
- Consider greater use of benchmarking.

3

Ensure there is transparency in terms of use of expert input, team accountabilities and quality assurance process:

- Consider adopting a common set of principles for when expert input is required into the development and review of project cost estimates.
- Document the quality assurance measures applied to cost estimates.

4

Enhance transparency of key assumptions:

- Document key assumptions, such as chosen levels of contingency, the approach to escalation, or the source of generic global rates.
- Detail assumed project start and end dates.

Priority 2 – Recommendations that we anticipate will form part of an ongoing programme of change over the short, medium and long term

5

Consider adopting a common Auckland Council capital project cost estimation framework:

- Document an overarching cost estimation framework, outlining expectations and requirements for cost estimation mapped against the project development lifecycle.

6

Capture and expand use of reference class data:

- Consider the development of a reference class database of project estimates and costs across the infrastructure groups, both to inform the preparation of cost estimates and to provide a feedback loop on the accuracy of Auckland Council's cost estimates through time.

Introduction

Introduction

The objective of this report is to present the findings and recommendations of our review of Auckland Council’s cost estimation framework - to ensure the development contributions policy is supported by transparent, consistent and robust approaches for capital cost estimation.

Background and context

Auckland Council is conducting a review of the way it calculates development contributions (DCs), which are used to recover the costs of infrastructure needed to meet growth.

Deloitte has been engaged by Auckland Council to conduct a review of the consistency and robustness of the approach used for forecasting the cost of future investments. The capital costs for these investments form a key input into the calculation of development contributions. Auckland Council has agreed in principle to recover a portion of the capital costs of growth projects beyond the 10 year long term plan period through DCs (see next page).

Approach

Our review approach has been based on the following activities:

- Desktop review: we completed a desktop review of documentation provided by Auckland Council.
- Stakeholder interviews / workshops: we conducted several interviews and held two workshops with key stakeholders and process owners to better understand current processes, any constraints, and how stakeholders view the performance of the cost estimation function.
- Comparator analysis: we reviewed cost estimation frameworks adopted by other organisations to provide comparison points against Auckland Council’s current practices and identified common drivers of best practice.

Limitations

- This review was conducted in a short timeframe and on limited data, which has shaped the extent of our analysis and findings. We have aimed to keep our report and its finding and recommendations succinct.
- This engagement did not include a review of the stormwater infrastructure category.
- Our scope did not include analysis of DC beneficiary identification, equity, cost allocation, and growth forecasts.
- The procedures that we performed did not constitute an assurance engagement in accordance with New Zealand Standards for Assurance engagements, nor did it represent any form of audit under New Zealand Standards on Auditing, and consequently, no assurance conclusion or audit opinion is provided.

Review focus areas

- 1 Review of the current approach to forecasting capital costs
- 2 Review application of cost estimation methodologies to relevant projects in Drury
- 3 Recommendations for improvement to the robustness and consistency of Auckland Council’s current methodology for cost forecasting for each infrastructure type
- 4 Recommendations for improvement to the documentation and transparency of Auckland Council’s current methodology

Development contributions context

Auckland Council can recover the capital costs associated with four infrastructure areas. In addition to projects in their long term plan, it has agreed in principle to recover the capital costs of infrastructure to be delivered beyond the next 10 years.

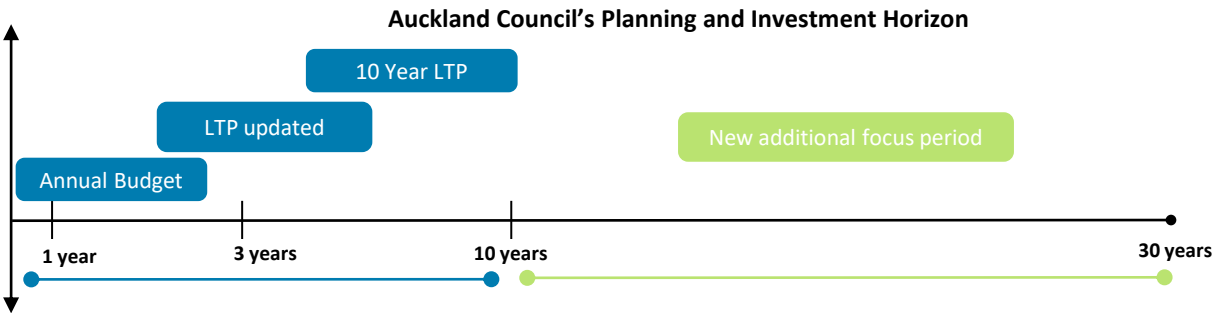
DCs and capital costs

Auckland Council can recover the capital costs associated with investment in transport, reserves (both land acquisition and development), community and stormwater infrastructure through DCs, where the need for this infrastructure is triggered by growth. The capital costs associated with renewing existing infrastructure and increased levels of service cannot generally be recovered.

For each project inputting into the DC model, the capital costs are estimated by relevant business units and Auckland Transport applying their own estimation process. Historically, these costs have been extracted from the Council’s 10 year long-term plan (LTP).

Long term infrastructure provision

Growth can trigger a requirement to invest beyond the 10 year LTP window. Auckland Council has now agreed in principle to recover a portion of the costs associated with growth beyond the LTP period, where sufficient detail is available on relevant infrastructure requirements. In line with this approach, the capital cost of projects in the Drury area, where there is significant greenfield development, have been identified for inclusion in the DC calculation. A key consideration associated with this is that projects to be delivered over the medium to long term typically have less definition with which to estimate capital costs, particularly when compared with projects to be implemented in the near term, which are typically supported by a project business case. This further emphasises the need for adoption of consistent and transparent processes, based on best available information, to produce cost estimates.



Four DC infrastructure areas



Structure of this report

Our report first provides an outline of the role of cost estimation and cost estimation methods across the project development lifecycle. We then provide an overview of each infrastructure group's cost estimation framework, before outlining our findings and recommendations.

01

Cost estimation

An overview of best practice cost estimation approaches across the project development lifecycle

04

Community Facilities

Overview of cost estimation framework, methodology, and Drury case study

02

Transport

Overview of cost estimation framework, methodology, and Drury case study

05

Findings

A summary of our key findings from the review

03

Open Spaces

Overview of cost estimation framework and methodology, and Drury case study

06

Recommendations

Our proposed recommendations based on the key findings

The appendix contains a summary of the cost estimation frameworks adopted by other organisations to provide comparison points against Auckland Council's current practices and identified common drivers of best practice

Cost estimation

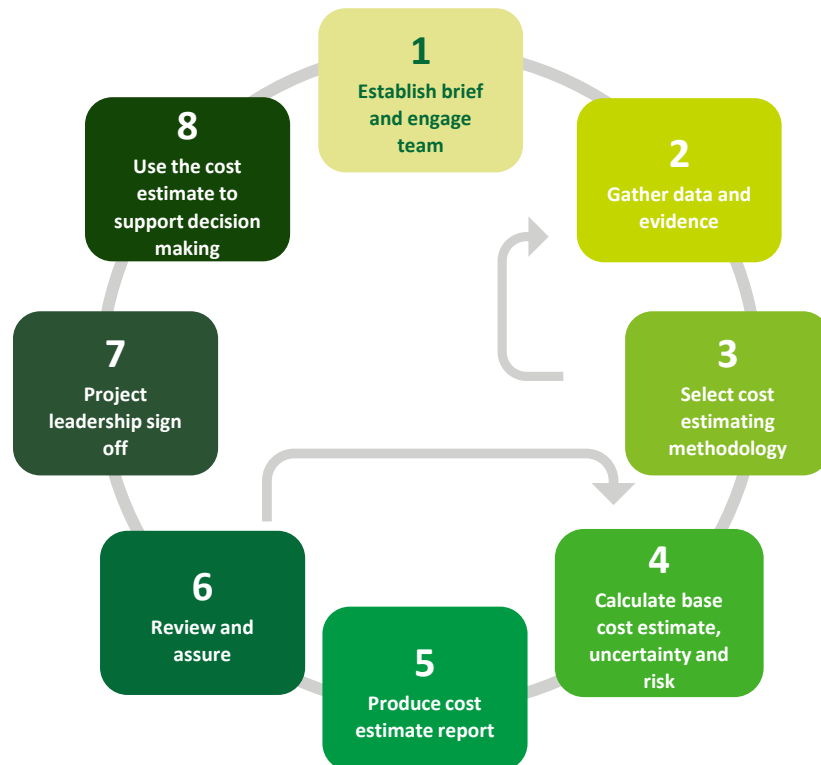
Best practice approaches

Cost Estimation I Process framework

We have identified five best-practice steps that are key to preparing capital cost estimates. The following slides provide further information relevant to these steps.

Approach

We have considered Auckland Council's processes against illustrative best practice cost estimating framework guidance, with particular focus on steps 2 through 6 (see diagram).



Key steps for preparing a robust cost estimate

- 2 Gather data and evidence**
Build an evidence base and document key assumptions
- 3 Select cost estimating methodology**
Give clear justification for the chosen cost estimating methodology
- 4 Calculate base cost estimate, uncertainty and risk**
Prepare costing reflecting the level of risk and uncertainty associated with the project
- 5 Produce cost estimate report**
Document the methodology, assumptions and evidence base
- 6 Review and assure**
Consider type of review and level of assurance required

Diagram: Sourced from Cost Estimating Guidance, Infrastructure and Projects Authority UK

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Auckland Council Cost Estimation | CONFIDENTIAL

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Cost Estimation | Role and Key Components

Cost estimation is the process of forecasting the financial and other resources needed to complete a project within a defined scope and schedule.

Role of a cost estimate

Cost estimates are used to support decisions through the project development lifecycle. Initially, the purpose of a cost estimate is to support budgeting and project feasibility decisions and, as a project moves to implementation, support a final investment decision. All cost estimates are uncertain, but there are several techniques used to overcome uncertainty to the extent practicable at each stage of the project development process, which are outlined over the following slides. Cost estimates typically become more certain over time.

Components of a cost estimate

While there are different terms used across projects and guidance materials, at its core an infrastructure cost estimate will consist of the following three components:

- **Base cost**, which will typically set out the expected cost of the project, including design, construction, property acquisition and project management costs.
- **Contingency**, which will reflect the value of expected project risks.
- **Escalation**, which will adjust the cost estimate so that it reflects the expected level of prices during project delivery.

The diagram to the right identifies the basic inputs needed to calculate each component. Each component is discussed in further detail over the following slides.

Documentation

Large procurers of capital projects often adopt cost estimation policies or manuals to ensure transparency of requirements and consistency of approach across organisations, including templates for how cost estimates are to be presented. The project specific cost estimate itself is often produced in a format called a work breakdown structure, noting this may not be possible for projects in the early stage of the project development lifecycle where there is limitation information on scope.

Cost estimation building blocks

Key components

Supporting data and evidence

Base cost	• Project scope • Quantity • Rates
Contingency	• Risk and uncertainty
Escalation	• Timing • Growth in prices

Cost Estimation I Project Development Lifecycle

Cost estimation approaches evolve through the project development lifecycle as understanding of the project matures.

Cost estimation across the lifecycle

Cost estimation approaches and the accuracy of the estimate evolve as a project moves from conception through to implementation. At the first stages in the project development lifecycle, we would anticipate use of top down approaches to develop base costs and simplified approaches to developing contingency and escalation. The accuracy of early stage cost estimates are inherently limited by lack of project detail and the level of resource available to understand project costs and risks.

As certainty over project scope and timeframes increases, we would expect more detailed base cost estimates and more sophisticated approaches to contingency and escalation. As the UK’s Infrastructure and Projects Authority notes: ‘no single cost estimating method is appropriate for the duration of a project’s development. The cost estimating method used must reflect the maturity of available data and the level of project definition.’

Documentation

We would expect an organisation's cost estimation framework to define the purpose of the cost estimate and the broad estimation approaches expected at each stage. The table to the right identifies, at a high level, how we would expect cost approaches to evolve as a project moves through a typical project development lifecycle.

The Waka Kotahi and UK case studies in the appendix contain examples of organisation specific overviews of how cost estimation approaches evolve over time.

Indicative lifecycle approach to capital cost estimation

Cost estimate component	Project scoping	Programme/Indicative Business Case stage	Detailed Business Case	Implementation
Base cost	High level costs, inputs, and assumptions. Application of top down approaches based on historic projects/professional advice.	Costs based on approximate resources, quantities, rates. Values based on historical projects. Potential blend of bottom up and top down.	Comprehensive breakdown of costs, based on firm resources, quantities, rates. Rates can be specific to the project type.	Cost estimate based on final tendered costs.
Contingency	Deterministic approach can be used.	More refined deterministic approach.	Probabilistic approach if a complex, high value project, but deterministic may be acceptable for some projects.	Drawdown on contingency if risks eventuate.
Escalation	Consumer price inflation / inflation indices specific to asset type.	Inflation indices specific to asset type.	Inflation indices specific to asset type.	Inflation indices specific to asset type.

Cost Estimation | Base Cost

A base cost estimate relies on information and assumptions regarding scope, quantities and rates. The two main approaches to developing the base cost estimate are ‘bottom up’ and ‘top down’.

Base cost breakdown

The base cost incorporates the expected cost of the project and will include:

- **Construction costs:** The cost of materials, labour, equipment and contractor margins.
- **Client costs:** The design costs and project management costs, including for the procuring entity.
- **Property acquisition costs:** The cost of property acquisition, including ancillary transaction costs.

Top down and bottom up methods

Top down approaches are often used early in the project development cycle, with the approach transitioning to a detailed bottom up approach. A combination of bottom up and top down approaches can be used simultaneously depending on the level of information available, and to sense check results.

Data and evidence

Entities may use data from completed projects to form a reference class database, which can be used for development global rates and benchmarks. This can improve accuracy, but can be challenging where there is a limited sample size or projects are bespoke.

An experienced quantity surveyor and, where relevant, property valuer will also typically be involved in estimating quantities and values of inputs based on professional judgement.

Base cost estimation techniques

↓ Top down	Examples	
• Starts with a total cost for the project • Cost is broken down into smaller pieces • Better suited to strategic decision making • This approach can be used to “fill gaps” when detail is not available	Global estimating Global (or order of magnitude) estimating is a method of estimating involving the use of ‘all in’ or ‘global’ composite rates such as road cost per kilometre.	Composite estimating Composite estimating is a more refined method than using global rates as it involves the use of rates that include the combination of a number of work items i.e. drainage, environmental, or traffic management cost per km.
↑ Bottom up	Examples	
• Individual cost items are determined, then aggregated and grouped • Labour intensive • Best suited where design maturity is medium / high • Relies on a complete understanding of the project and full data set	Frist principles estimating Is the preferred method for the DBC stage. As it relies on complete data, this method is best suited to phases where design maturity is medium/high.	Unit rates Unit rate estimating calculates the cost of each item of the project by multiplying the quantity of work by historical unit rates with appropriate adjustments.

Cost Estimation | Contingency

Standard practice is for project cost estimates to include a level of contingency to account for project risks and uncertainty. The level of contingency tends to reduce as the project is developed.

Risk and uncertainty

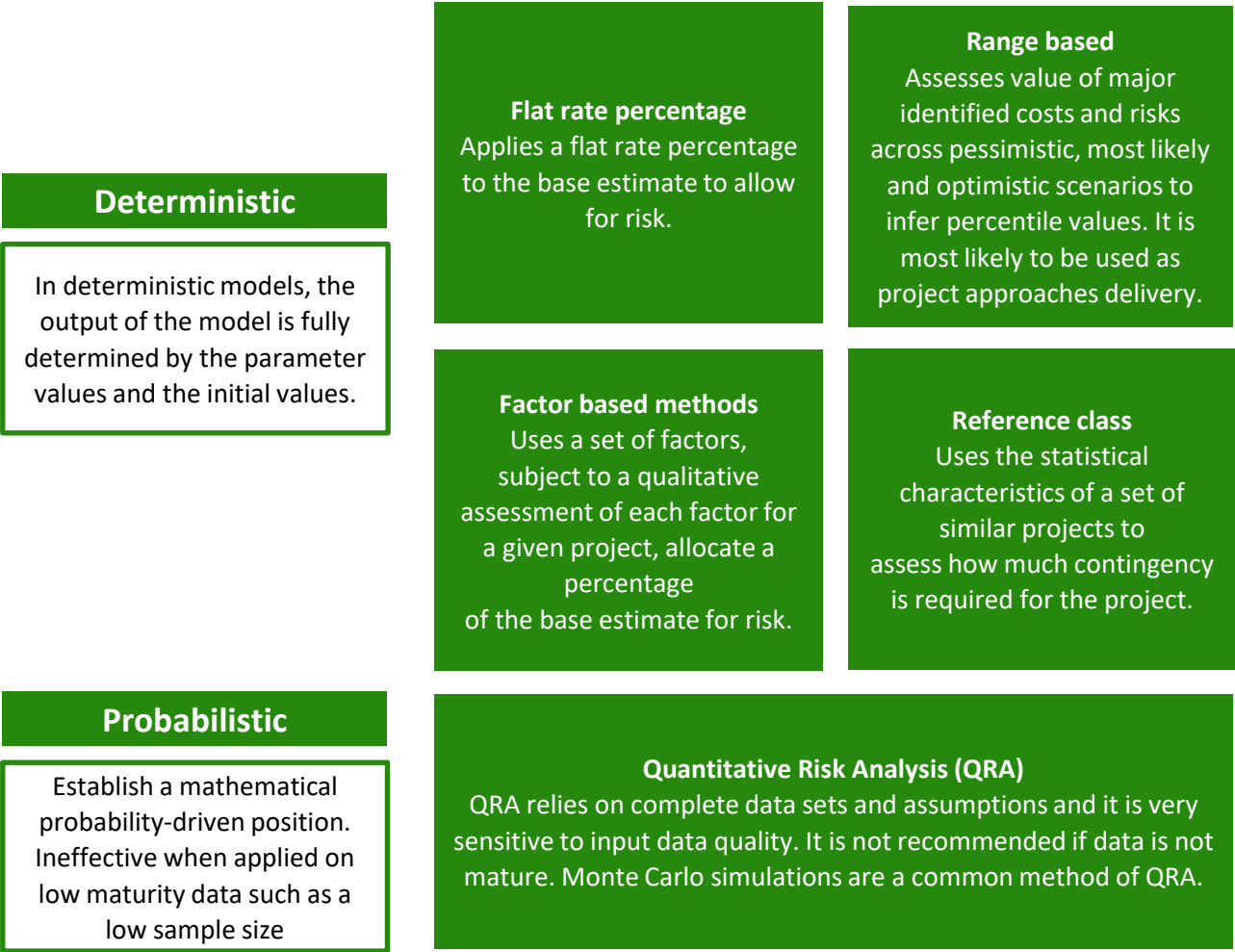
Projects face a range of risks and uncertainties. These range from uncertainty over project scope, quantities and rates, to risks such as unknown ground conditions, contractor failure, and higher than expected inflation. Project contingency accounts for the potential for these risks and uncertainties to adversely affect project costs, given cost estimates are inherently uncertain. As the UK Treasury’s Green Book notes, there is a tendency for project teams to produce optimistic cost forecasts – contingency should account for this. As certainty over project scope is generally low when a project is first conceived, and understanding of risk limited, contingency tends to be higher at first. It then reduces as the scope is developed and risks better understood and mitigated. Illustrative of this, Queensland’s Department of Transport and Main Roads typical contingency ranges are 40-70% for early stage estimates reducing to 10-20% at implementation.

Methods

The two main methods of assessing contingency are deterministic and probabilistic. In the early phases of the project deterministic approaches are typically applied. As the project matures, a probabilistic approach would potentially be more appropriate depending the cost and complexity of the project, noting probabilistic approaches introduce an additional layer of complexity and require quality data. The Department of Infrastructure, Transport, Regional Development and Communications uses an AUD \$25 million threshold for determining whether a probabilistic approach is required.

Level of contingency

In New Zealand, the level of contingency is often set at a P50 or P95 level (i.e. at a level where there is either a 50 or 95 percent chance that project costs will not exceed the available budget). Levels of contingency can also be expressed as ‘pessimistic’, ‘optimistic’ or ‘most likely’ scenarios.



Cost Estimation | Escalation

Escalation adjusts the cost estimate for anticipated changes in the level of prices during the project development lifecycle.

Role

Most cost estimates are developed at a given point in time (the base date). To ensure the estimate is as accurate as possible, the base date estimate should be adjusted as relevant in the circumstances. For example, the estimate may have been prepared several years ago, or an accurate idea of the future cost is needed for budgeting purposes. The table to the right outlines how different levels of cost escalation can impact on the nominal cost of a \$30 million project over a 30 year horizon.

Cost escalation is used to:

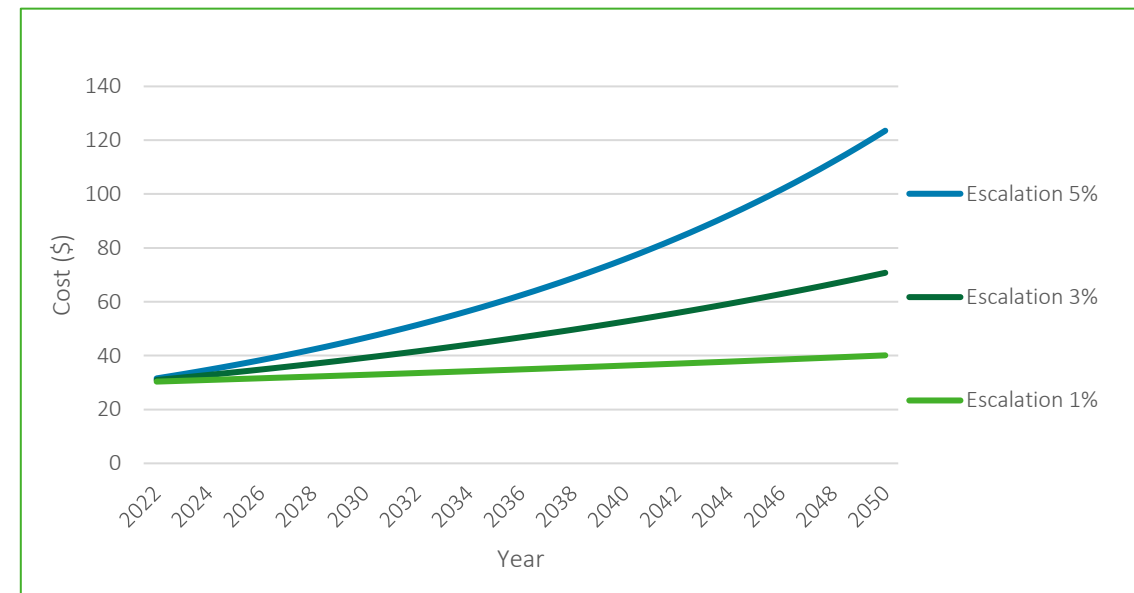
- Adjust an existing cost estimate for any changes in prices since it was prepared, and
- Forecast the nominal cost of the project because on an assumed rate of growth in the level of prices.

Methods

Escalation can be accounted for through a variety of techniques:

- A one off percentage adjustment where there is limited information,
- Consumer price inflation or another equivalent index, and
- An asset specific index relevant to the project.

Escalation scenarios



Cost Estimation | Specific Focus – Property Acquisition

Property acquisition costs are a specific focus for Auckland Council. We have referenced property specific cost estimation considerations below, noting the Waka Kotahi CEM has specific requirements.

Key components for cost estimations of property acquisition



Base costs

An estimate at the start of the project based on a **calculated estimate of property values**, plus **additional allowances as required** (e.g. for the various other claims that can legitimately be made under an compulsory acquisition scenario).



Contingency

Projects face a range of risks and uncertainties, which is accounted for by contingency.

Once the project gets closer or commences, the base cost estimate generally increase but the contingency reduces as there is more certainty around the base cost and less risk of material market change.



Escalation

Land is often **escalated using historical long term averages** and there are a number of construction cost index data sets produced by various groups that provide guidance on historical average cost escalations that are generally applied for long term forecasting.

Cost Estimation | Review and Assurance

Review and assurance of the cost estimate is a critical step to ensuring the robustness of an estimate.

Role

The UK Infrastructure and Project Authority notes that 'reviewing and assuring cost estimates is a leading practice to improve the accuracy of and confidence in the cost estimate.' Review and assurance both assists with error detection and with sense checking the reasonableness of assumptions and final estimates.

Where an organisation uses key cost estimation inputs across projects (e.g. global rates, benchmarks and reference class information), these inputs should be regularly updated to ensure they are current, with this requirement documented.

The accuracy of a cost estimate is also heavily reliant on the professional judgement and experience of the project team and estimators and valuers. A cost estimation process should provide guidance on key accountabilities for cost estimation at each stage of project development lifecycle, with requirements for peer review proportionate to each stage of the process.

Methods

- Accountability matrices: A clear statement of responsibilities and performance expectations for project teams and professional advisors at each stage of the project development lifecycle. For example, a RACI type matrix.
- Internal peer review: Line by line review by an appropriately qualified person from within the relevant agency.
- External peer review: Line by line review by an appropriately qualified person from outside the relevant agency.

Another element of review and assurance of estimates can involve benchmarking metrics against other similar projects.

Key participants in the cost estimation process



Diagram: Sourced from Cost Estimating Guidance, Infrastructure and Projects Authority UK

Transport Infrastructure

Transport Infrastructure | Introduction

Transport is a key enabler of development.



Introduction

Background

Population growth triggers investment in transport infrastructure, which is needed to address traffic congestion, expand public transport (PT) services, provide active transport choices (i.e. walking and cycling), and address safety. Auckland Transport (AT) delivers transport infrastructure for Auckland Council.

In key growth areas, such as Drury, the Supporting Growth Alliance (SGA) (Te Tupu Ngātahi) has been established to identify the transport requirements to support the predicted level of growth forecast to occur in the next 30 years.

Unique features

In a greenfields context, transport is considered “leading infrastructure” as it is an enabler of growth and forms part of a directly connected infrastructure network.

Documents reviewed as part of the engagement

- Drury Developer Contributions Policy: Transport Assessment
- Drury Infrastructure Funding and Financing Cost Allowances Report (and associated appendices)
- Draft AT DC Methodology (the draft methodology)
- AT DC Growth percentage methodology
- Waka Kotahi Cost Estimation Manual (CEM)

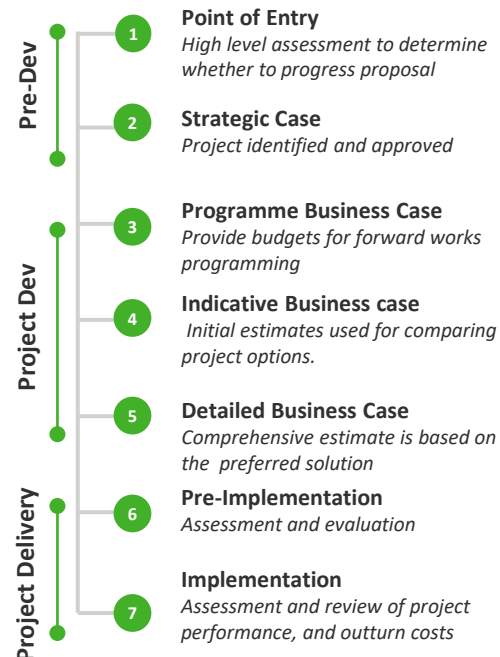


Project development lifecycle

Project development lifecycle and cost estimation

AT leverages Waka Kotahi’s CEM, which outlines cost estimate expectations across each stage of the project development lifecycle. Waka Kotahi’s project development lifecycle is outlined in the diagram below. We have not been supplied with information on AT’s equivalent lifecycle.

Waka Kotahi project development lifecycle



Cost estimation

Cost estimation

AT’s documents do not specify cost estimation methodologies to be applied at each stage of the project development lifecycle. Our understanding is that the cost estimation approach is specific to each project, and actual cost estimations are typically done by a contracted QS.

Our understanding is that project estimates are typically developed in line with the Waka Kotahi CEM, which uses a refined top down approach for early stage estimates, with bottom up estimates prepared at later stages.

Review and assurance

We have not been supplied with a documented overview of key AT accountabilities for cost estimation preparation and expectations for review and assurance.

The draft methodology notes that projects should provide evidence of appropriate assurance reviews and AT endorsements of cost estimates.

The Waka Kotahi CEM does address roles and responsibilities at a high level. It also includes a process for peer review of cost estimates.

Transport Infrastructure | Methodology

Auckland Transport leverages the Waka Kotahi CEM to estimate capital costs across the project development lifecycle.



Base costs

Scope: Project scope is typically defined through a relevant business case.

Quantity and rates: AT's draft methodology requires physical works cost estimates to be based on the Waka Kotahi CEM, with professional standards and assumptions required to generate cost estimates at the appropriate level for the current business case stage.

AT's draft methodology also requires that costs should be broken down by:

- Planning and design (including consenting),
- Property/land,
- Physical works, and
- Project contingency.

AT's draft methodology notes that standard rates and accepted industry assumptions are to be used when estimating costs. However, we understand that AT does not maintain a reference class database on project costs from its portfolio.

Waka Kotahi maintains an elemental cost database that records project outturn costs.

The Waka Kotahi CEM notes elemental cost data is to be used for early stage inputs. It notes 'as more detail becomes available during project development, the estimates based on elemental information will be updated and superseded by more detailed estimates that reflect the improved definition of the project'.



Property acquisition

AT's draft methodology requires property acquisition costs to be based on property specific valuations where possible. When these valuations are not available, cost estimates can be based on Council default rates by funding area.

The Waka Kotahi CEM includes guidance on property and associated transaction costs estimation. Property costs are estimated by taking the current Rating Valuation (RV) and adding market appreciation from the date of the RV to the date that the cost estimate is completed. Further market appreciation is added to the date of purchase.



Contingency and escalation

Contingency: AT's draft methodology has not adopted a final position on contingency. The Waka Kotahi CEM requires contingency to be calculated to both the P50 and P95 levels as part of estimate preparation. Advanced approaches to contingency preparation are required for higher value projects from the detailed business case stage.

Development cost escalation: AT's draft methodology requires escalation rates to be applied across client costs and construction 'based on current AT assumptions.' We understand Auckland Council will receive updated inflation estimates, supplied by the Council's Chief Economist Unit, which will inform AT assumptions.

Property acquisition cost escalation: Waka Kotahi's CEM requires provision for property market appreciation (escalation) from the date the estimate was prepared through to the mid-point of the active acquisition phase for the project. AT anticipates Auckland Council will supply relevant escalation rates.

Phasing of the development: AT's draft methodology notes that a project completion year is required. However, it does not specify a requirement for other project milestones.

Transport Infrastructure Case Study | Drury

Auckland Transport has identified a programme of transport improvements required for Drury. Infrastructure requirements have primarily been defined through a business case.

Base costs

The documentation states that the cost estimates for the Drury programme have been prepared to a programme business case estimate level in line with the Waka Kotahi CEM. A mixture of bottom up and top down approaches were applied to develop costs for the Drury programme. The programme utilised recent cost estimates where information was available, which had been developed for the purposes of an earlier detailed business case (DBC). Several work breakdown structures were supplied for these projects.

For projects that were not part of the DBC, generic linear (global) rates were developed and applied across the length of the projects. Key generic rates and percentages are noted in documents, which state they are based on the experienced judgement of their QS.

The DIFF Cost Allowances Report notes the limitations of the cost estimates, noting that estimates have not been based on any investigations or design detail' and 'further design would be required to provide greater cost certainty'.

Property acquisition

The property costs for the Drury Arterial Network DBC were prepared in July 2020 by the Auckland Transport property team and included transaction costs. Property requirements were based on indicative assessment of each project.

Where property costs were not available from the DBC, a generic rate of \$1,000 per square metre was applied. The justification for this generic rate was not noted.

Future Drury Transport Network



Transport Infrastructure Case Study | Drury

Auckland Transport has identified a network of transport improvements required for Drury. Infrastructure requirements have been defined through a business case.



Contingency and escalation

The cost allowances for the DIFF programme include a 30% contingency and a separate Funding Risk Contingency of 25%, consistent with the Waka Kotahi CEM. These are intended to provide contingency to the P50 and P95 level respectively. We assume these were applied deterministically to the base cost estimate. The table to the right highlights the share of contingency forming the cost estimate for the Drury Programme (for the subset of projects in the DBC).

Project timeframes were not clear from the supplied documentation. We have been advised that project timeframes have not yet been specified.

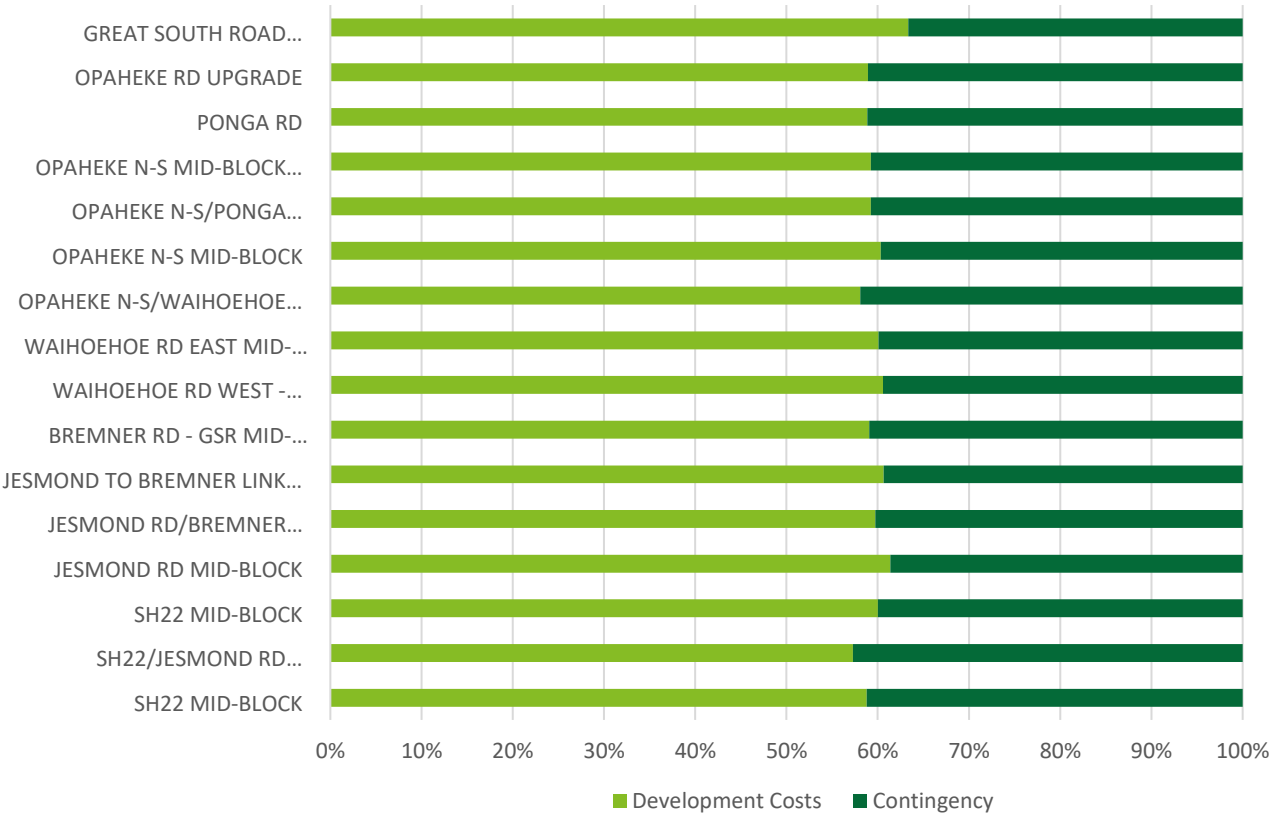
Escalation has not been applied to either development or property acquisition costs. Property costs were from 2020 and not escalated for changes in prices. It also was not clear whether property costs were adjusted for assumed structural changes in zoning through time (see open spaces).



Review and assurance

The original DBC estimates were peer reviewed through cross verification by a person separate to the original estimate. The DIFF Cost Report notes a review had also been undertaken by qualified QS', with a consultant facilitating a review workshop to test and challenge assumptions. The DIFF Cost Report detailed the key steps taken to verify the estimate during both these reviews.

Project Cost Summary - Drury (extracted from DBC)



Open Spaces

Open Spaces | Introduction

Open spaces, such as parks and sports grounds, are included in future greenfield developments to support the wellbeing of Aucklanders.

Introduction

Background

Growth generates a requirement to invest in common parks, specialty parks (such as destination parks or regional parks), linkways and access paths, and riparian and green infrastructure.

Auckland Council's investment in open space infrastructure is composed of two separate programmes:

- Reserve acquisition, and
 - Reserve development
- (collectively referred to as **open spaces** in this report).

Unique features

- Open spaces / parks are part of a wider “network” but can exist in isolation, and are not reliant on other developments, which means there is flexibility in terms of timing acquisition.

Documents reviewed as part of the engagement

- Parks and open space acquisition policy 2013
- Open space policy provision, 2016
- Memo: Open space acquisition cost modelling method, April 2022
- Memo: Modelled costings for developing open space, April 2022
- Professional valuation report

Project development lifecycle

The development lifecycle of reserve acquisition and development differs from that of transport and community facilities, with land acquisition forming a separate and ongoing programme of activity.

While an overview of the relevant project development lifecycle was not captured in the documents, we understand that open space works to an approved three year work plan. Business cases are used for larger or more complex projects.

Review and assurance

The documentation supplied did not outline review and assurance expectations over the project development lifecycle. However, we were supplied with a high level overview of the roles and responsibilities involved in establishing the land acquisition and development costs. We were advised that QS input is sought into development costs when projects are uncertain or significant changes are required. Expert land valuation advice has been used to develop global estimates for land costs. We were also informed that costs are checked for ‘reasonableness’ by assessing alignment of the global rates to recent acquisitions and developments.

The document supplied indicates a level of quality assurance is undertaken in relation to the Open Space Cost Acquisition Model outputs.

Cost estimation

Cost estimation

The Open Space Acquisition Cost Model estimates the cost, number of open spaces needed and the associated square meterage. Advanced estimates are based on more granular information, with longer dated acquisitions and projects based on top-down estimation approaches.

Advanced costing (Projects planned for within 1 – 3 years)

Reserve acquisition: When acquiring land in the short term, Auckland Council reviews recent land acquisitions, any impending land acquisitions where negotiations are underway, and a registered valuer's land report.

Reserve development: The method for estimating development costs was not stated for short term projects in the document. We understand that costs are developed based on bespoke specification.

Early-stage costing (Projects planned 3+ years in advance)

Reserve acquisition: For long-term planning, the costs used per square metre consider the land acquisition comparators, with a cross check of value of land against professional valuation estimates for impending transactions, and stage (i.e. price varies by development stage).

Reserve development: Auckland Council models the cost of developing new parks at the macro level based on a standard provision of amenities required for each park typology, with the cost per square metre based on “recent experience and real-world costs.”

Open Spaces | Reserve Acquisition

We understand the provisioning of reserve acquisition is based on the cost acquisition model and recent land valuation reports.

Reserve acquisition | Property acquisition

Due to the nature of land acquisition, it is challenging to predict when land acquisition occurs. Where land is available to purchase on the open market, Auckland Council may be able to secure it relatively quickly. However, there is also potential for protracted negotiations with multiple owners, which can take several years. Depending on the land type, Auckland Council estimates the average as:

- 3 years** To acquire future urban zone land or subdivided urban lots
- 4 years** To acquire urban zoned land
- 5 years** To acquire infrastructure installed land

The reserve acquisition cost estimation is fundamentally based on a top down approach, using ‘price per square metre x area’ to determine a cost estimate. The different land typologies are described below.

Greenfields: The land acquisition costs are determined using relevant comparators and the most recent external valuation report. The valuation report classes land into four categories, being:

- Future urban zone: greenfield land is rezoned to an intermediary zone
- Urban zoned: Land is rezoned to some form of urban zone
- Infrastructure installed: Infrastructure including network utilities and roading is constructed to the boundary of land to allow for its development
- Completed subdivision to urban lots: The land is developed and subdivided into urban lots ready for sale to third parties.

Due to the special character of some sites acquired (location, rationale, and means for acquiring), Auckland Council has limited relevant comparators to inform costs of other potential acquisitions. We were advised the greenfields acquisition programme is in its infancy, so there is limited actual data available on acquisitions (or development timing) at this stage.

Reserve acquisition | Property acquisition (cont.)

Open Space Acquisition Cost Model

The Open Space Acquisition Cost Model estimates the number of parks by typology (i.e. suburb park) and the corresponding land requirements. As an example, 44 parks are estimated to be required for Drury.

Brownfields: Analysis by Auckland Council of their Open Space Provision Policy and Open Space Network Plans indicated there was generally sufficient provision of brownfield sites. However, there are opportunities to acquire brownfield sites, most often as part of a large-scale development. Brownfield cost inputs are developed through analysis of prior acquisitions between 2015 and 2022.

Contingency and escalation

Phasing: The land acquisition costs are phased over the estimated number of years, depending on the park typology.

Escalation: The cost acquisition model has a parameter for price inflation for greenfields land that can be applied. Auckland Council expects to apply updated inflation estimates when these are supplied by the Council’s Chief Economist Unit.

Over the property acquisition period, the model accounts for changes in land categories as the suburb develops, thereby escalating costs depending on the land typology.

Contingency: We understand there is no contingency applied to reserve acquisition costs.

Transaction costs: There did not appear to be provision for any transaction costs associated with property acquisition. We were advised that, based on historical analysis, between 1-1.5% of reserve acquisition costs are costs other than the land purchase price.

Open Spaces | Reserve Development

Auckland Council uses a combination of policy documents, the cost acquisition model and experience to determine reserve development costs.



Reserve Development | Base costs

Scope: The scope of the open spaces are outlined in the Open Spaces Provision Policy, which contains indicative amenities and provision target for each of the park typologies.

Quantity: The size for each park typology, and its associated development, is based on the guidance provided in the Open Spaces Provision Policy (2016) and adjusted to reflect recent park acquisition sizes.

Development Costs: Auckland Council uses the application of global rates by assumed typologies. We were supplied with a build up of these global rates, which we assume were prepared by a QS informed by “recent experience and real-world costs”. We do not know how often these rates are updated. This resulted in global rates of:

- Suburb parks \$150 per square metre,
- Neighbourhood parks \$600 per square metre, and
- Sports parks \$320 per square metre.

Case study: Drury

From the documents supplied, the number of parks for Drury is estimated to be 44, being:

- 6 suburb parks: 50,000 square metres each
- 35 neighbourhood parks: 3,000 squares metre each
- 3 sports parks: 50,000 square metres each, all of which are existing.

While the configuration of space, location and delivery mechanism of services are not determined at this point given the long-term nature of the programme, the cost estimates are based on the suggested amenities outlined in the Open Space Policy Provision (2016) and by applying the global rates identified above.



Reserve Development | Contingency and escalation

Phasing of the development: The phasing of costs is based on Auckland Council’s experience. A general assumption applied is that development commences two years post acquisition of the land and takes approximately three to four years for the completion of a park, depending on the type. The development costs are then staged over the design and construction period, specific to the park typology. The assumed project duration for each typology is captured in the methodology document.

Development costs contingency: A 10% contingency was added to the Drury development costs for parks. While not documented in the material supplied, we were advised by Auckland Council that the contingency amount was an industry standard amount applied to the cost estimate.

Development costs escalation: The costs are left uninflated in the model, noting the development costs build up does have a 10% adjustment for escalation. While not documented in the material supplied, we were advised this is a proxy for price increases over the lifecycle of a park development project. Auckland Council expects to apply updated inflation estimates when these are supplied by the Council’s Chief Economist Unit.

Community Facilities

Community Facilities | Introduction

Community facilities includes provisioning for community centres, libraries, pool and leisure facilities across Auckland, particularly in Greenfield land developments.

Introduction

Background: Community facilities are an important part of providing local amenities, and include spaces such as community centres, libraries, pool and leisure facilities. Auckland Council aims to ensure the facilities are fit for purpose and meet the future demand arising from population growth.

Unique features: Community facilities are generally developed once the population has surpassed a certain threshold. As such, it is considered a “lagging” development.

The forecast of provisioning is based on the projected population growth using the Auckland Forecasting Centre i11 model.

Documents reviewed as part of the engagement:

- Determining Years 11 to 30+ greenfield provision requirements
- Memo: supporting advice for calculation of Drury / Opāheke community facilities provision
- Site location assessment criteria for Community Facilities in Auckland
- Professional valuation report
- Community Facilities Network Plan

Project development Lifecycle

The project development lifecycle for community facilities spans several years, from the initial high level assessment and establishment of needs, to the business case and finally to execution and evaluation. There are seven stages involved in the relevant project development lifecycle, which are detailed below.



The documentation supplied does not outline clear expectations for cost estimation at each stage of the lifecycle.

Cost estimation

The cost estimation approach for community facility projects varies depending on the investment horizon. The costing estimates for community facilities vary across the phases, with initial needs / high level assessment using top down costing approaches. Once the project reaches stage four and five, cost estimates are refined in greater detail, using bottom up approaches with QS input.

Advanced costing (projects planned for within 1 – 3 years)

The base costs for community infrastructure projects are determined at the business case stage (stage 4) with assistance from an internal QS. An elemental breakdown is used for estimating costs across a range of development options, such as replacement of the existing facility, or construction of a new facility (in a variety of configurations / service offerings).

Early stage costing (projects planned 3+ years in advance)

At the feasibility stage, development cost estimates are based on global rates (cost x square metre), informed by the outturn costs of previous Auckland Council community facility projects. There are limited comparisons available, due to the small number of facilities constructed in recent years.

Review and assurance

There is limited quality assurance documented for the provisioning of community facilities costs. We understand that an internal QS is used in the ‘Business Case’ stage. There may also be involvement of external QS on a case-by-case basis.

Community Facilities | Methodology

Many of the long term inputs for the provisioning of community facilities are derived from the Community Facilities Network Plan.

Base costs

Scope: The scope of the community infrastructure facilities are outlined in the Community Facilities Network Plan (CFNP), which contains a standard ‘ideal schedule of space’ for infrastructure such as libraries and leisure centres for a given level of population.

Quantity: The gross floor areas for each of the community spaces is not specified for all spaces in the CFNP (for example, leisure and aquatic gross floor areas are not specified, but ratio of square metre of library space per unit of population is noted). Where floor areas are not stated in the CFNP, Auckland Council determines an estimated size based on recent community space projects.

Rate: Cost estimates are based on the CFNP guidelines and recent projects. The square metre rate applied are as at March 2022, and range from:

- Community space: \$8,000 - \$12,000 per sqm
- Library space: \$10,000 - \$14,000 per sqm
- Leisure: \$8,000 - \$12,000 per sqm
- Aquatic: \$10,000 – \$14,000 per sqm

The rate by typology includes a build up for building, carpark, landscaping, fitout, design development and project contingency. We understand the cost per square metre has been established by review of comparative community facility projects in the Auckland Council portfolio.

While were supplied with a spreadsheet containing high-level outturn costs information for relevant Auckland Council projects, we have not been supplied with the supporting attachment to the community facilities methodology ‘calculation of square metre rates’. We are, therefore, unsure over how the rates were derived, key assumptions used (e.g. levels of contingency), if QS input has been used to review and develop these rates, and of the wider review and assurance process for ensuring the data is correct and current.

Land acquisition

The land acquisition is based on the methodology outlined in the ‘open spaces’ section.

Quantity: The methodology documents note land requirements generally ranges from 40-60% of gross floor areas for large multipurpose facilities across its portfolio.

Escalation: Land costs are not currently escalated for forecast inflation, noting inflation can be allowed for in the model. Auckland Council expects to apply updated inflation estimates when these are supplied by the Council’s Chief Economist Unit.

Land value (per square metre): The square metre rate is based on the most recent valuation report, which informs the greenfield land by development stage (e.g. future urban zoned, urban zoned, infrastructure installed or subdivided into lots). The methodology document notes that it assumes land is purchased post-subdivision.

Contingency and escalation

Long term: The methodology does not address escalation or contingency, but does note the global rates include project contingency. The level of contingency and supporting reasons are not captured in the methodology document. The costs are left un-inflated.

The methodology does not address specific timeframes, but does note provision is based on 10-year increments with an assumed seven-year timeframe from initiation to delivery (justification for this timeframe, or an assumed spend profile, is not stated).

Short term: As part of the business case, Auckland Council allows for project contingency and escalation in the cost estimate. An in-house QS is involved in the development of business case cost estimates.

Community Facilities Case Study | Drury

The capital costs of future community facilities for Drury has been developed by applying the Community Facilities Network Plan and assumed global rates.

Base costs

Scope: Auckland Council used the Community Facilities Network Plan and “Determining Years 11 – 30+ greenfield provision requirements” to ascertain the future community facility requirements for Drury. In light of the expected population growth in Drury, Auckland Council anticipate that there will be new community space provisioning of up to 8,500 square metres consisting of:

- Community space 600 square metres,
- Library space 1,700 square metres,
- Leisure space 2,700 square metres, and
- Pool/Aquatic space 3,500 square metres.

These provision estimations were cross-referenced to the Drury/Opāheke Structure Plan August 2019, which confirmed the requirement of 8,500 square metres of new facility spaces.

While the configuration of space, location and delivery mechanism of services are yet to be determined, at this stage it is assumed that a large multi-purpose facility incorporating all four space types is the likely service delivery model.

Development costs: The development cost estimate was developed using mid-points of the square metre global rates (see previous page). This resulted in an assumed development cost of \$95.4 million.

We were informed that there are limitations on applying the Community Facilities global rates to the Drury development, due to the different characteristics and nature of the development, which is assumed to be a large multi-purpose community facility for Drury. We do not have information on wider review and assurance of this estimate, but it does not appear the estimate has been cross checked by a QS or against a wider reference class at this stage.

Property acquisition

Property acquisition and provisioning: The land area required for the 8,500 square metres of facilities space was estimated by doubling the gross floor area. This resulted in 17,000 square metres of land required to support the development of the facilities.

The land costs were estimated at \$1,450 per square metre, based on the purchase of land post-subdivision. The value is derived from a professional valuation report, which indicated the development area of Drury was \$1,450 per square metre as a superlot (assumed post subdivision).

Contingency and escalation

Contingency and escalation: The costs are currently not escalated. Precise project timeframes do not appear to have been assigned to this project, with the supplied documentation noting it is expected to occur between 2031 to 2041 to meet anticipated population growth out to 2051.

No information on contingency allowances for this project were detailed in the supplied documentation, noting the relevant methodology document references that project contingency is included in the calculation of global rates.

Findings

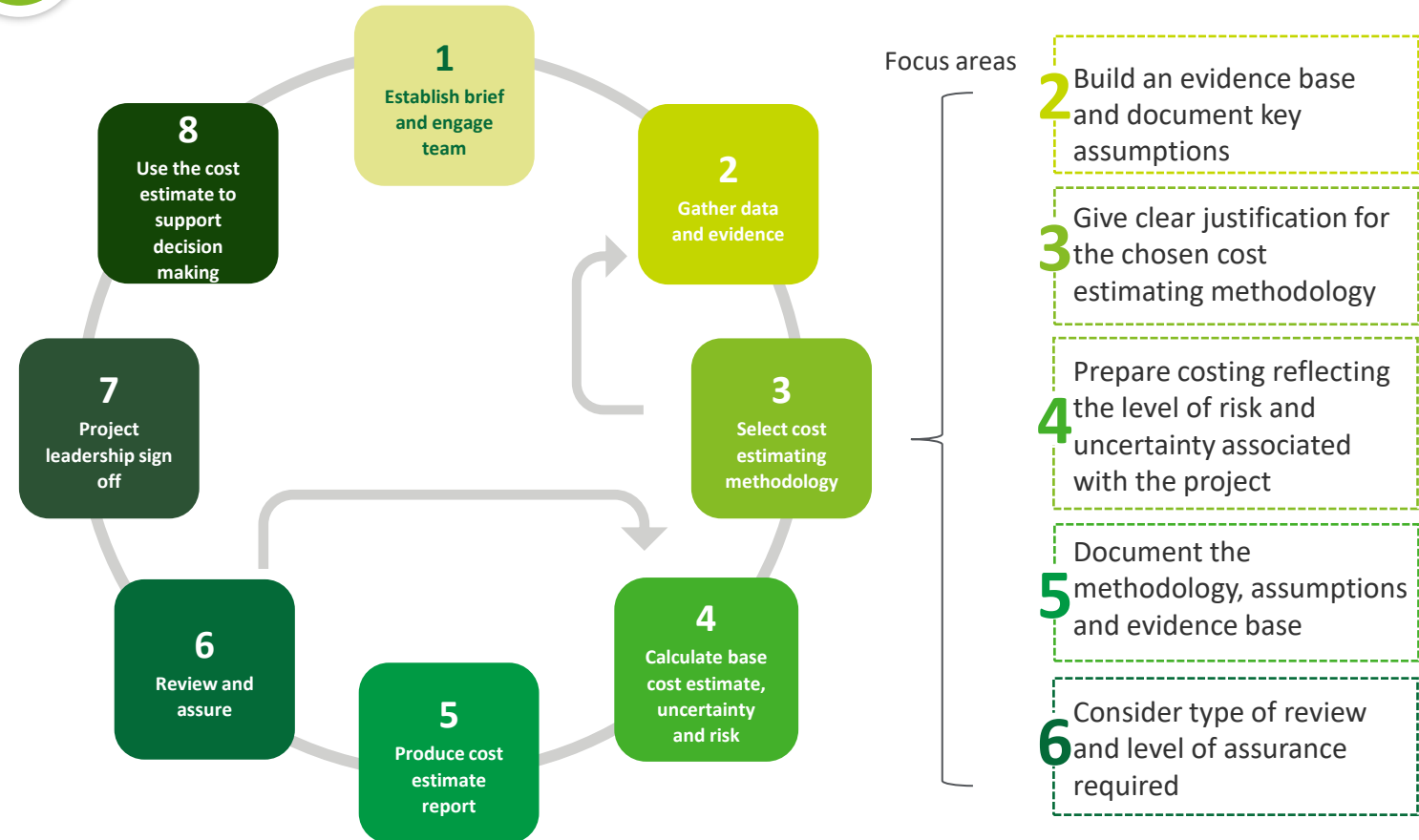
Findings | Approach

We have leveraged five focus areas from the illustrative cost estimating framework to structure our findings, having regard to transparency, consistency and robustness of approach at each step.

Considerations

- **Robustness:** Does the methodology set clear expectations for the approach to be applied across the project development lifecycle? Is the approach proportionate to the level of project definition, reflective of the maturity of available information, risk adjusted, escalated, evidence based, and appropriately reviewed and assured?
- **Transparency:** Is the methodology documented, easily understood and applied? Are key estimation assumptions, approaches and the supporting rationale captured? Are quality assurance processes captured?
- **Consistency:** Are cost estimation approaches consistently applied within each group operating to a consistent overarching estimation framework, with any departures justified by the characteristics of each respective infrastructure type?

Illustrative cost estimating framework process



Findings | Context

We have observed that Auckland Council uses a variety of cost estimating methods when preparing early stage project cost estimates.

High level observations

- We have primarily focused on the process for preparing early stage cost estimates, reflecting the nature of the information supplied to us and the interest in Drury.
- Across all three groups, the high level cost estimation methodologies used for early stage cost estimates appeared reasonable having regard to the specific characteristics of each infrastructure group (step 3).
- We have identified opportunities to improve maturity of approach across the five steps of the illustrative cost estimation framework from the perspective of robustness, consistency and transparency of approach.
- We note there is a lack of overarching framework documentation detailing methodologies to be applied at each stage of the project development lifecycle.

Auckland Council’s projects at an advanced stage of planning

All three infrastructure groups appear to apply **bottom up approaches** to estimating the capital costs of projects that are at a relatively advanced stage of understanding. However, requirements for these estimates and mapping against the project development lifecycle was not always clear.

Auckland Council’s early stage project estimates

Applied methodology between transport, open space and community differs, reflecting the different levels of information available for early stage project estimates and different asset characteristics. Treatment of contingency and escalation also differs across groups.

Transport: Has used a mixture of **bottom up** and **top down estimating**, reflecting that understanding of project scope is more advanced as a result of SGA. The cost estimating framework is not documented to a detailed level, but is supported by the Waka Kotahi CEM.

Community and Open Space: Both asset classes use **top down estimating approaches**, reflecting that there is limited information on project scope for their long term projects. The cost estimating method is documented to a more detailed level than for transport, noting there is no supporting cost estimation manual for these groups.

Findings I Summary

Our key findings are summarised below, with supporting detailed findings outlined over this section. We have aligned our findings with the five focus areas identified on page 34.

Key findings

1

Data and evidence

We have identified opportunities to improve confidence that the best available data is being used. There were examples of reference class and expert input into global rates applying to development and land costs. However, confidence in overall data quality could be improved through:

- Consistent use of QS input across groups,
- Use of reference class information, and
- Periodic review of data.

2

Methodology

The high level methodologies used to determine base cost estimates appear appropriate for early stage projects, having regard to the level of information available and different characteristics of infrastructure groups. We observed that:

- Different cost estimation methodologies appeared justified for early stage estimates,
- Development costs calculations between open space and community infrastructure appeared to differ, and
- Guidance on appropriate methodologies across the project development lifecycle was limited.

3

Base cost, uncertainty and risk

There is scope for a more unified approach to the treatment of escalation and contingency. We observed that:

- Treatment of project contingency differs between groups for early stage cost estimates,
- There is an overall lack of escalation for early stage cost estimates,
- Some infrastructure groups may not be including property transaction costs, and
- There is scope for a more unified approach across escalation, contingency and some base cost inputs.

4

Cost estimate report

There is opportunity to improve the level of documentation prepared for cost estimates. We observed that:

- Project timeframes are not fully captured,
- Key assumptions and supporting information are not fully documented, and
- Documentation of the cost estimation process could be improved.

5

Review and assure

We observed various levels of documented quality assurance across the asset groups. We observed that:

- Cost estimation review and assurance processes could be more transparent, and
- There would be benefit in ensuring alignment in the application of quality assurance across infrastructure groups, where practicable.

Findings | Step 2 – Gather Data and Evidence

We have identified opportunities to improve confidence that the best available data is being used.

Impacts on:			
Finding	Robustness	Transparency	Consistency
Confidence in data quality could be improved There were examples of reference class and expert input into global rates applying to development and property acquisition costs. However, confidence in overall data quality could be improved through: (1) ensuring consistent use of QS input into the development and review of global rates (we were unclear of the level of QS review and input into the global rates used in relation to open spaces and community facilities). (2) development of reference class databases (AT does not have a reference class database, and there are opportunities to expand the use of such databases for the other groups (for example, greenfield property costs in the open spaces context)). (3) periodic review and updates to data used to prepare estimations (there was limited information on the frequency with which key data is reviewed and updated).			
The green dots indicate that the finding noted may affect the robustness, transparency or consistency of Auckland Council's approach to cost estimation.			

Findings | Step 3 – Select Cost Estimating Methodology

The high level methodologies used to determine base cost estimates appear appropriate for early stage projects, having regard to the level of information available and different characteristics of infrastructure groups.

Impacts on:

Finding	Robustness	Transparency	Consistency
Different cost estimation methodologies appeared justified for early stage estimates While the approach to base cost estimation was different between groups (top down estimating or a combination of bottom up and top down estimating) for early stage estimates, this appeared to be driven by the characteristics of each asset group (and levels of available information). For early stage cost estimates, top down approaches appeared appropriate given limited scope information noting the accuracy of such base cost estimates can be low. As projects advance in the project development lifecycle, they should build on project detail using first principles or statistical modelling.			
Development costs calculations between open space and community infrastructure appeared to differ The basis of global rate calculations appeared to differ between community facilities and open spaces, noting this may reflect infrastructure specific factors. Park development global rates appeared to be developed based on QS advice on an assumed scope per typology (based on recent experience and real-world costs) whereas the community facility square metre (global) rates appeared to be based on outturn costs from recent relevant Auckland Council projects. Given the relatively bespoke nature of community facilities, this may mean that global rates cannot be easily developed off an assumed scope by typology, as has been done for open spaces.			
Guidance on appropriate methodologies across the project development lifecycle was limited Based on the documentation supplied, there was limited overarching guidance on what methodologies should be considered at each stage of the project development lifecycle.			

Findings | Step 4 – Calculate Base Cost Estimate, Uncertainty and Risk

There is scope for a more unified approach to the treatment of escalation and contingency.

Finding	Impacts on:		
	Robustness	Transparency	Consistency
Treatment of project contingency differs between groups for early stage cost estimates For contingency, AT has used P50 and P95 estimates in line with the Waka Kotahi CEM. Levels of contingency form approx. 40% of the individual transport cost estimates for Drury (see page 24). However, the use of contingency for open spaces and community infrastructure projects was varied, with no targeted P values assigned. For these two groups, contingency appeared to be significantly lower as a share of the cost estimate compared to transport infrastructure.			
There is an overall lack of escalation for early stage cost estimates There was a lack of escalation across early stage estimates for development costs, and different approaches to property acquisition cost escalation. Property acquisition cost inputs appeared to date from 2020 and may, therefore, be out of date. We were unclear if the transport property acquisition cost estimates for Drury included adjustment for anticipated changes in zoning over the investment horizon.			
Some infrastructure groups may not be including property transaction costs We understand Auckland Council is moving to a common set of property cost inputs. However, the property cost inputs used for open spaces and community infrastructure projects may not be inclusive of relevant transaction costs (e.g consultancy fees).			
There is scope for a more unified approach across escalation, contingency and some base cost inputs There is scope for a more unified approach to contingency and escalation, as well as the treatment of property acquisition costs, with appropriate project specific adjustments made as required. A lack of consistency could expose Auckland Council to criticism, unless justified by infrastructure specific characteristics. ¹ We understand Auckland Council is already progressing the development of common cost escalation inputs across property and development costs.			

¹See for example: https://www.canada.ca/content/dam/dnd-mdn/migration/assets/FORCES_Internet/docs/en/about-reports-pubs-audit-eval/p0972-eng.pdf

Findings | Step 5 – Produce Cost Estimate Report

There is opportunity to improve the level of documentation prepared for cost estimates.

Finding	Impacts on:		
	Robustness	Transparency	Consistency
Project timeframes are not fully captured There could be greater specificity on assumed project timeframes. Cost escalation calculations need supporting timeframes, which were not fully apparent in the AT and community facilities estimates for Drury.			
Key assumptions and supporting information are not fully documented There was an overall lack of clarity for some key supporting assumptions used and supporting rationale behind some assumptions. For example: • Detailed breakdown of development costs for open spaces was supplied in the relevant methodology document, but not for community facilities (noting this may be detailed in an attachment). • Justification for the 10% contingency and escalation for reserve development costs. • Justification for the \$1,000 per square metre used as a generic property acquisition rate by AT.			
Documentation of the cost estimation process could be improved There is scope to improve transparency and consistency of cost estimation processes across each stage of the project development lifecycle relevant to each infrastructure group. While some aspects are captured in detail (e.g. the open spaces cost modelling methodology and the Drury cost estimation reports prepared by SGA), it was challenging to develop a complete understanding of the expectations, requirements and assumptions used at each stage, from project inception through to implementation, across the infrastructure groups. There does not appear to be a standardised format for outlining project or programme cost estimates across infrastructure groups.			

Findings | Step 6 – Review and Assure

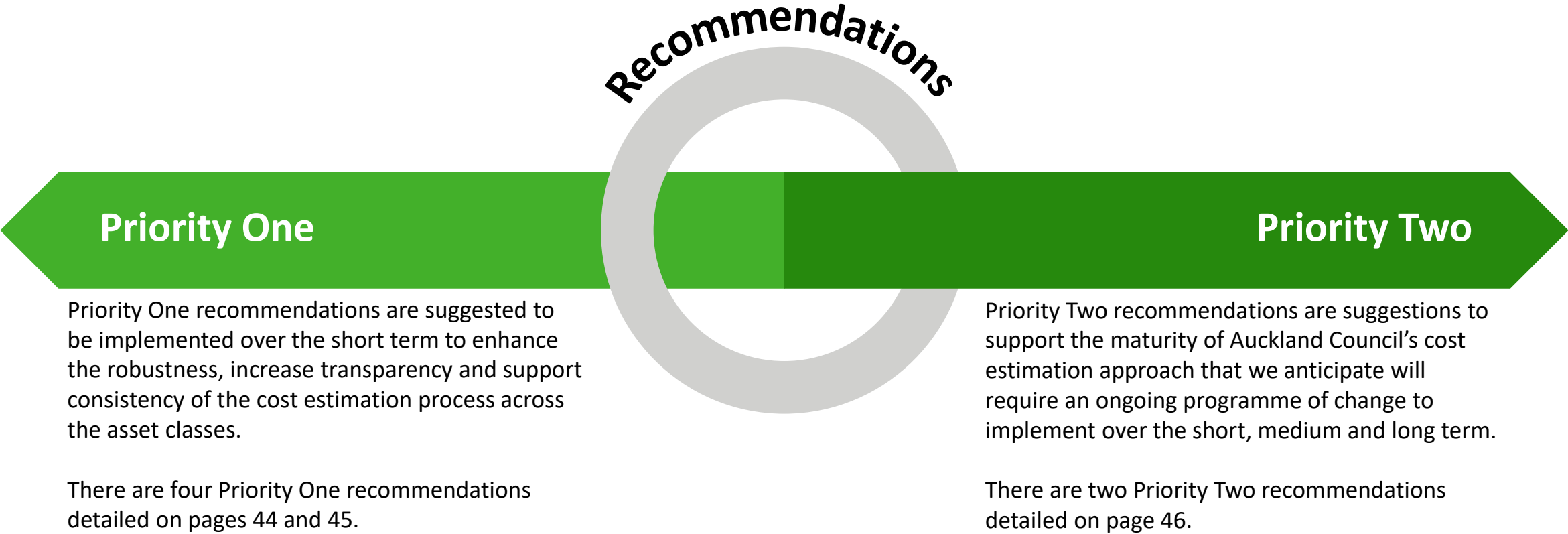
We observed various levels of documented quality assurance across the asset groups, in which the approach to review and assurance could be more robust.

Finding	Impacts on:		
	Robustness	Transparency	Consistency
Cost estimation review and assurance processes could be more transparent Documentation of review and assurance expectations for each stage of the cost estimation process could be further improved. In addition, accountabilities for estimate preparation were not fully apparent from the material reviewed. While the different groups do make use of peer review and expert input, this could be better documented. Further, documented processes for the periodic review and assurance of global rates and project specific cost estimates, to ensure they remain current and relevant, would improve confidence that estimates are as robust as possible.			
There would be benefit in ensuring alignment in the application of quality assurance across infrastructure groups There would be benefit in ensuring, where practicable, alignment on the use of expert input and peer review across infrastructure groups. This would help ensure estimates across groups are based on an equivalent level of professional judgement and quality assurance, noting the appropriate level of quality assurance may differ reflecting infrastructure group and project characteristics. For example, AT has used QS input for early stage estimates, but our current understanding is that there is limited QS involvement in the development and review of community infrastructure early stage estimates.			

Recommendations

Recommendations | Approach

Our recommendations support the robustness, consistency and transparency of the cost estimation process undertaken by Auckland Council to determine future capital project costs.



Recommendations | Priority One

Prioritise achieving a consistent approach to the treatment of escalation, contingency and property acquisition as well as ensuring best available data is used.

Recommendation	Detail
1. Consider adopting a consistent approach across escalation, contingency and property acquisition costs	• Consider adopting a consistent approach to the treatment across escalation, contingency and property acquisition costs, with appropriate adjustments to each infrastructure group and project specific requirements. • We understand Auckland Council is developing long term forecasts for construction cost escalation and land appreciation. Use of these inputs, as well as common land valuation numbers (including across anticipated zoning) will assist with making cost estimates more consistent, transparent and robust across infrastructure groups. For property acquisition costs, there may be group-specific adjustments required if transaction costs differ. • Consider alignment between contingency approaches across asset groups (e.g. ensuring the various groups are producing a P50 and P95 equivalent at each stage of the project development lifecycle). The exact level of contingency should reflect the relative degree of risk for each asset class and the level of confidence in the base cost estimate.
2. Ensure that best available data is being utilised	• Ensure a regular cycle of updates and review is applied to cost inputs used across infrastructure types to ensure the currency and relevance of information, and that relevant expert input is sought where appropriate. • Consider greater use of benchmarking where there are limitations on data. For example, the reference class data used by community facilities to develop its global rates has apparent limitations in the Drury context. Benchmarking against a wider data set of equivalent projects or square metre rates from outside Auckland Council may add confidence that estimates are as robust as practicable.

Recommendations | Priority One

Auckland Council should also prioritise increasing transparency of both quality assurance processes and key assumptions.

Recommendation	Detail
3. Ensure there is transparency in terms of use of expert input, team accountabilities and quality assurance process	• Project specific estimates should document any quality assurance applied. • Consider adopting a common set of principles applying across infrastructure groups on when expert input is required into the development and review of a project cost estimate at each stage of the project development lifecycle. • Across all infrastructure groups, ensure accountabilities and expectations on project teams and estimators are documented.
4. Enhance transparency over key assumptions	• Across the key components of each cost estimate, ensure that key assumptions are documented and consider appropriate logging of changes to assumptions throughout the lifecycle. For example, capturing where levels of contingency, escalation, or generic global rates have been used on the advice of relevant experts. • For each project, ensure there is clarity of both assumed project duration and the project start and end dates.

Recommendations | Priority Two

Consider evolving the maturity of cost estimation approach through adoption of a common framework and consider expanded use of reference class data based for Auckland Council’s capital project portfolio.

Recommendation	Detail
5. Consider adopting a common Auckland Council capital project cost estimation framework	• A central Auckland Council cost estimation framework identifying expectations and requirements for capital cost estimation mapped against the project development lifecycle would improve transparency and consistency of approach across the Council. This could be structured around the best practice process steps outlined in this report, or an equivalent process tailored to Auckland Council’s requirements. • Infrastructure group specific methodologies could be developed in response to this common framework. • Consider introducing a standardised approach (including the development of relevant templates) to the presentation of individual project and programme cost estimates. This would also assist with transparency and consistency.
6. Capture and expand use of reference class data	• Consider the development of a reference class database of project estimates and costs across all infrastructure groups to inform the development and benchmarking of early stage cost estimates (supplemented by QS advice on wider market rates). The level of accuracy of cost estimates for longer dated projects will invariably be lower than those based on detailed design and first principles estimates. However, reference class data can help ensure estimates are as a reasonable as possible. • Reference class databases can also be used to evaluate the accuracy of Auckland Council’s cost estimates through time, providing a feedback loop to support continuous improvement in Auckland Council’s cost estimation processes.

Appendix

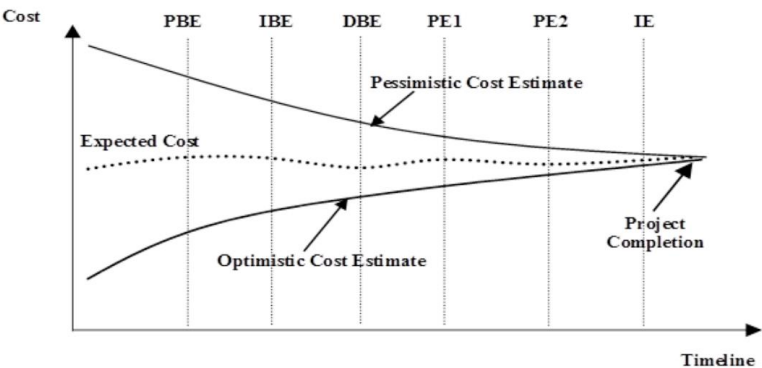
Waka Kotahi

The Waka Kotahi Cost Estimation Manual sets out its procedures and guidelines for preparing, reviewing and submitting estimates for its capital projects.

Key features

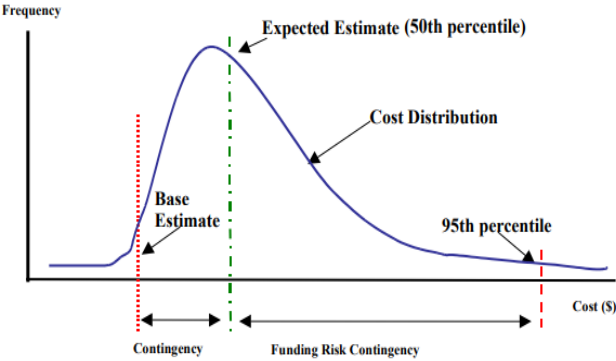
- Waka Kotahi notes there will normally be six types of cost estimate prepared over lifecycle, noting that from the indicative business case stage it is essential that project scope, assumptions, exclusions and functionality is known.
- The main use of this elemental cost data will be in the preparation of estimates early in the project life cycle, i.e. for programme and indicative business case estimates. As more detail becomes available during project development, the estimates based on elemental information will be updated and superseded by more detailed estimates that reflect the improved definition of the project.
- A process for estimating property acquisition costs, with a core formula of: ‘Current RV x market appreciation factor = market value at estimation date x future market appreciation.’
- The Waka Kotahi estimation procedures focus on developing a Base Estimate with Contingency then determined based on risk analysis. Funding Risk Contingency is then applied to determine the P95 estimate.

- A Schedule of Elemental Prices is provided along with definitions of each elemental cost item to drive consistency in data collected and therefore improvement in the accuracy of project estimates.
- The P95 estimate is calculated by considering the ‘worst case’ residual ‘target’ exposure, minus the ‘most likely’ value of residual ‘target’ exposure.
- The Waka Kotahi expected estimate (P50) is based on the Base Estimate plus Risk Contingency. Further Funding Contingency is calculated to the P95 level.
- Waka Kotahi acknowledges that with ongoing design development and improved understanding of the site conditions the Contingency and Funding Risk Contingency will reduce over time.
- Waka Kotahi adopts an ‘Advanced’ risk analysis approach for projects in excess of \$20m. This advanced method involves Monte Carlo simulation.



ESTIMATED IMPLEMENTATION PHASE COST			
ESTIMATE TYPE	<\$20M	>\$20M - \$50M	>\$50M
PBE	General	General	General
IBE	General	General or Advanced	General or Advanced
DBE	General	General or Advanced	Advanced
PE1 AND PE2	General or Advanced	Advanced	Advanced
IE	General or Advanced	Advanced	Advanced

Risk management approach by project stage and costs



Australian Government

The cost estimation guidance notes prepared by the Australian Government's Department of Infrastructure, Regional Development and Communications include a range of practical estimation techniques.

The Australian Government's Department of Infrastructure, Transport, Regional Development and Communications has prepared a suite of Cost Estimation guidance notes. These are intended to provide a range of theoretically sound techniques for estimators to adopt and that strike a balance between theoretical rigour and practical implementation.

Key features

- The guidance provides an overview of approaches to base cost estimation, including acceptable methodologies. It also highlights the importance of estimate review, and of revalidation when new information becomes available. It notes that while work breakdown structures will vary by agency, it expects each agency would have a standard work breakdown structure.
- There is a dedicated guidance note on escalation, which notes: 'using the CPI or equivalent as the basis of infrastructure project escalation estimates is ineffective because the consumer targeted by the CPI reflects a person whose spending patterns and market have little relevance to infrastructure project spending or markets.'
- The guidance requires probabilistic cost estimation process must be used for all projects, for which Australian Government funding is sought, with a total anticipated outturn cost (including contingency) exceeding \$25 million, with approaches varying by the level of project definition.
- For the purposes of meeting departmental requirements for funding submissions, approximations to 50% and 90% confidence values may be estimated using a deterministic method for those projects with a total anticipated risk adjusted outturn cost of less than \$25 million. The diagram to the right notes the methods expected to be applied through the project development lifecycle, which are described in the guidance.

The full suite of guidance is available here: [Cost Estimation Guidance \(infrastructure.gov.au\)](https://infrastructure.gov.au/cost-estimation)

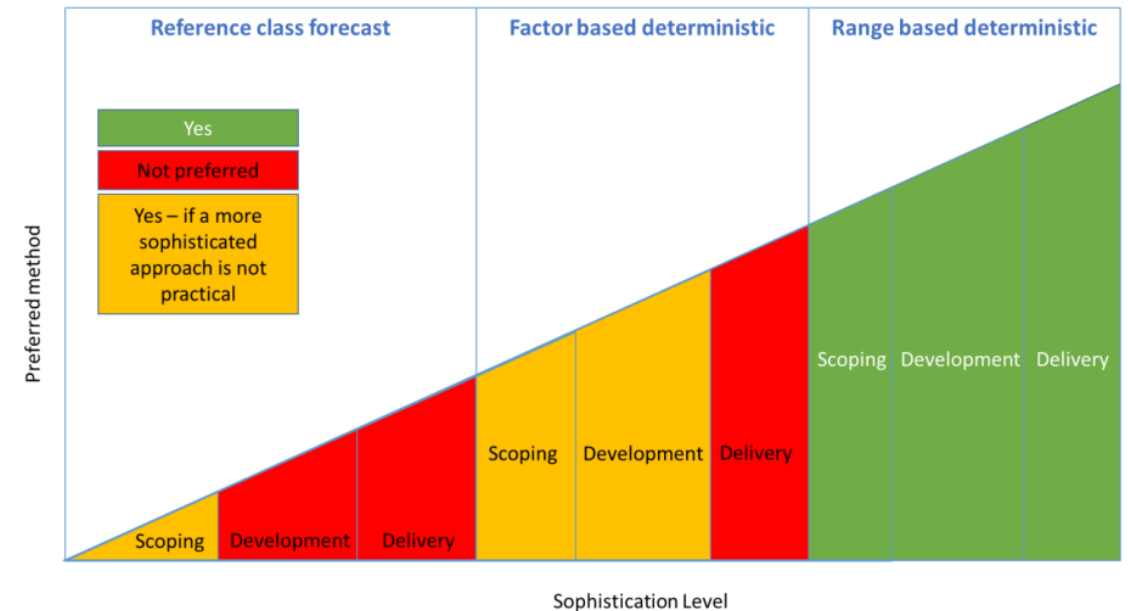


Figure 1: Recommended application of contingency calculation methods when seeking funding for various project phases²

Highways England

A 2019 review for the Office of Rail and Road assessed Highways England’s cost estimation processes favourably.

Key features

Cost estimation approach over the project lifecycle

- A well-established cost estimating methodology and document suite, including a cost estimation manual, cost estimation procedures and detailed cost build up from estimate commissioning through to approval and issue of outputs, all of which use a consistent templated approach.
- As highlighted in the figure (top right), the cost estimation approaches vary over the project development lifecycle, being:
 - First principles, or bottom up estimating, which has detailed estimates for cost components,
 - Parametric estimating, based on known parameters, and
 - Analogy estimating, using historical unit rate data for similar projects.
- Outturn cost information is fed back into a detailed cost database to improve confidence in the accuracy of its estimates.
- Internal assurance of estimates is undertaken at each stage of the estimate lifecycle.

Risks, assumptions and inflation

- A portfolio risk allowance is included for risks that are more appropriately managed at that level. It ensures that risk allowances are separate from project costs but included in the business case appraisal.
- An allowance is made for uncertainty, which reduces through time (see chart bottom right).
- Project risks are detailed through a bottom up risk and opportunity assessment when project definition is mature enough. An optimism bias amount is applied in lieu of the quantified assessment for projects in early stages of the lifecycle.
- A bespoke inflation model calculates and applies inflation costs consistently to all major project costs.

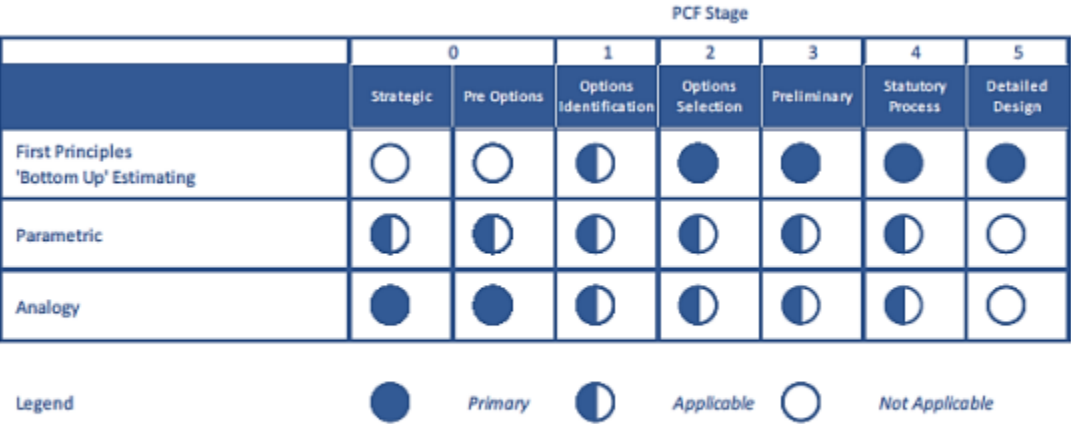


Figure 2: Highways England’s application of estimating methods during lifecycle phases

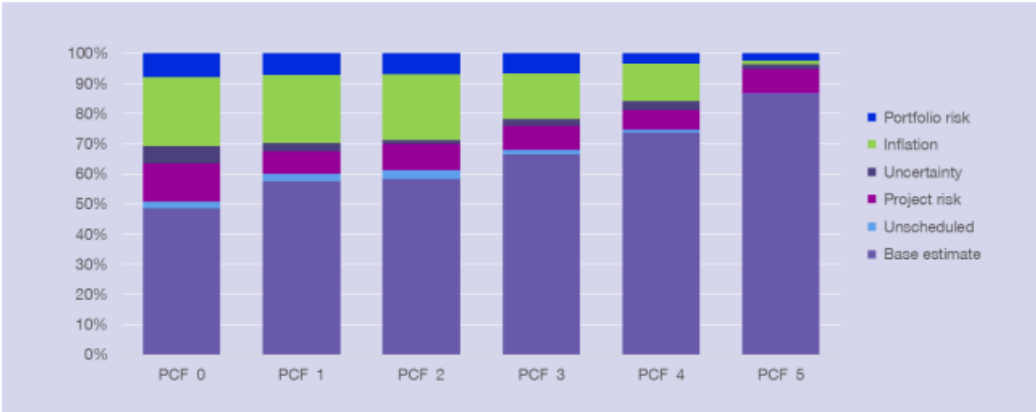


Figure 1: High level cost breakdown per PCF stage (Phase 1 and 2 sample projects)

Source: Highways England [Assessment of Highways England's cost estimation approach for RIS2](#)

Queensland

The Project Cost Estimating Manual from the Department of Transport and Main Roads provides guidance on cost estimating practices, primarily for transport infrastructure.

Key features

Cost estimation approach over the project lifecycle

- The document provides a process overview of requirements and activities expected at each stage of the project development lifecycle.
- For early stage estimations, it notes that typical strategic global rates and the costs of completed projects are used as a guide for such estimates.

Treatment of contingency

- The Manual notes because of the project specific nature of risks, it is difficult to be prescriptive on how contingency should be estimated, noting professional experience and judgement needs to be applied. However, it does provide typical contingency ranges for each stage of the project development lifecycle (see top right), with allowances for uncertainty expected to reduce through time (see bottom right).
- For early stage estimates, the Manual notes these are generally not expressed as a probability not to be exceeded (for example P90) but should be described as an estimate range with a most likely cost.

Quality assurance

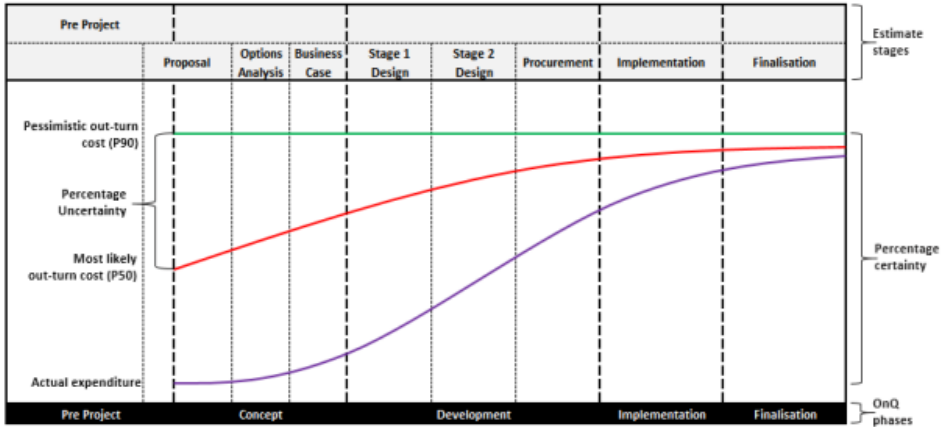
- The Manual notes that review of strategic estimates will not be as intensive as subsequent estimates. However, some form of appraisal must exist to ensure the estimate is realistic.
- The Manual also requires estimators to perform a ‘reality check’ at each stage of estimate preparation.
- Estimate preparation and estimation review responsibilities are detailed in the manual.

Source: <https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Project-delivery-and-maintenance/Project-Cost-Estimating-Manual/PCEM-8.pdf?la=en>

Table 3.4 - Expected contingency range

Base estimate stage	Level of project definition	Typical contingency ranges
Strategic estimate	1% to 15%	40% to 70%
Project proposal estimate	1% to 15%	40% to 70%
Options analysis estimate	N/A	N/A
Business case estimate (P90)	10% to 40%	30% to 40%
Development Phase Stage 1 Design estimate	30% to 65%	20% to 30%
Development Phase Stage 2 Design estimate	40% to 80%	10% to 20%

Figure 4.1(b) - Estimate confidence profiles in the program life cycle for traditional project delivery



Large UK Infrastructure Project

The cost estimation framework developed by a large UK infrastructure delivery organisation sets out the cost estimates at different stages throughout the project lifecycle.

A large UK infrastructure delivery organisation developed a cost estimation framework. The framework sets out clearly how cost estimates will be prepared at different stages in the project lifecycle and the corresponding level of accuracy that is expected.

Key features

- A large UK infrastructure client has implemented a cost estimation process allowing for greater precision of cost estimation at different stages through a project lifecycle.
- The framework:
 - Divides up the core project stages by estimate components (this is based on where more/less certainty is available for each component).
 - Provides a more solid confidence level around cost estimation and sets expectations more clearly.
 - Is used for large spend projects where there is less certainty and experience.
 - Is flexible enough to adapt to different clients' relevant project 'stage gates'.

Estimate Type	Gate 1 – Order of Magnitude	Gate 2 – Budget Estimate	Gate 3 – Initial Feasibility Estimate	Gate 4 – Feasibility Estimate	Gate 5 – Definitive Estimate	Gate 6 – Construction Phase Estimates
Type of Rates	High Level, Cost per m2, Provisional Sums	Budget Rates, cost per m2 for functional areas	Internal / Consultants legacy cost rates	Detailed rates / resourced estimates by suppliers	Firm / fixed rates / lump sum or resourced target costs	Firm / fixed rates / lump sum or resourced target costs
Type of Costs	Costs based on previous historical projects	Costs based on approximate high level rates	Costs based on approximate resources, quantities, rates	Costs based on firm resources, quantities, rates	Fixed cost plan. Tendered prices	Fixed cost plan. Tendered prices
Scope	Options identified	Options evaluated and examined	Best option selected but scope of works variable	Single option refined, scope of works determined	Final option defined, scope of works fixed	Final option defined, scope of works fixed
Design	Percentage allowance	Percentage allowance	Design costs based on outline sketches / drawings	Design costs based on selected detailed drawings	Final design costs based on project drawings	Final design costs based on project drawings
Preliminaries	Percentage allowance	Percentage allowance	Costs based on approximate resources, quantities, rates	Costs based on firm resources, quantities, rates	Costs fixed on tendered quotes / resources, quantities, rates	Costs fixed on tendered quotes / resources, quantities, rates
Land /Property Purchase Not required as part of Point Estimate	Percentage allowance	Percentage allowance	Approximate value from Property Surveyor	Value from Property Surveyor	Value from Property Surveyor	Value from Property Surveyor
Inflation Not required as part of Point Estimate	Percentage allowance	Percentage allowance	Average percentage inflation	Inflation indices for each asset	Inflation indices for each asset	Inflation indices for each contract



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