Infrastructure and Projects Authority

Cost Estimating Requirements

A technical guide for cost estimating teams and professionals

Reporting to Cabinet Office and HM Treasury

Contents

Cover image courtesy of Highways England

Infrastructure and Projects Authority

Introduction

About this document

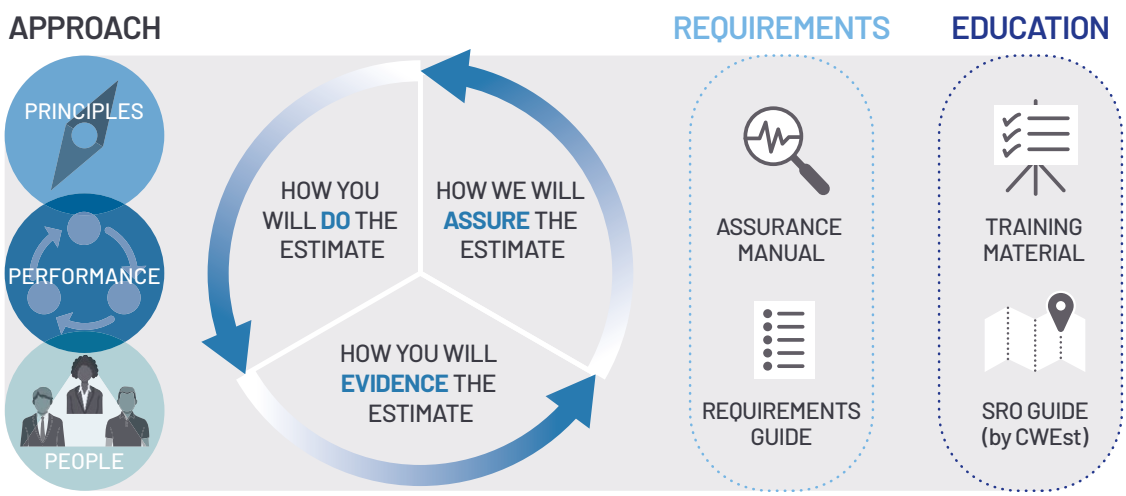
As the Government's centre of expertise for infrastructure and major projects, the Infrastructure and Projects Authority (IPA) is committed to improving the quality of cost estimates to underpin key decisions. The IPA will work with departments to support and assure cost estimates which are robust, realistic and presented using appropriate ranges.

Establishing clear requirements for the development and assurance of capital cost estimates will improve the quality of decision making and delivery discipline.

This cost estimating requirements and assurance document is a guide for cost estimators and experts in the field. It aims to provide guidance on how teams should evidence and how the IPA will assure the cost estimate. It includes a step-by-step process requirements guide, which sets out in detail each step to cost estimating and assurance. This document is part of a suite of guidance, which also includes:

- **Cost estimating guidance** - setting out a best practice approach to cost estimation for all team members
- **Training material** – to support the development of professionals and promote the adoption of consistent methods

Figure 1 – IPA's Approach to improve cost estimating for government



Introduction

There are two aspects to this cost estimating requirements document:

1 Cost estimate requirements by stage gate

As projects mature and pass through the stage gate, the cost estimate should also reflect this evolution. The cost estimate serves distinct purposes in informing each stage gate decision point and project teams must be able to evidence how they have applied the cost estimating requirements set out in this document at each stage gate.

This section outlines the requirements, the expected evidence and assurance which should be applied at Strategic Business Case (SOC), Outline Business Case (OBC) and Final Business Case (FBC) when reviewing the cost estimate.

2 Cost estimating process requirements

The development of high-quality cost estimates will benefit from a consistent and structured process.

This section provides detailed requirements to support practitioners in producing robust cost estimates. The requirements focus on common problem areas and are structured around the eight standard steps to producing a cost estimate described in the Cost Estimating Guidance for Infrastructure Projects and Programmes document.

Method

The development of this document was informed by cost estimating guides, industry reports, and academic papers. In addition, lessons learned from cost estimating practice and independent assurance of projects were considered.

This material has been developed and tested collaboratively with over 50 industry professionals and representatives, including an IPA-chaired panel comprising of cost estimating experts, senior industry professionals and academics, and the Cross-Whitehall Cost Estimating Group (CWEst).

Scope

This document provides guidance as to how a projects cost estimate should be evidenced and assured. It is targeted at cost estimate practitioners and reviewers in their respective roles and aims to assist in creating, communicating, validating and assuring high quality cost estimates. The document does not replace the sector specific cost estimating processes and procedures within an organisation, but should be used to reflect on these, and develop them to ensure a best-in-class approach to cost estimating is implemented.

This work is focused on the capital cost estimate for government infrastructure projects. Whilst some of the concepts may be applicable more broadly, for example to non-infrastructure and non-construction projects, it has not been designed with those in mind. Additionally, whilst independent assurance will provide a measure of confidence, it is part of a toolkit for success and not a guarantee. It aims to identify, but not prevent poor management, decision making, performance or behaviours and cannot overcome the unknown.

1 Cost estimate requirements by stage gate

In fulfilling its mandate, the IPA is committed to setting and assuring the requirements for high quality project delivery. The IPA manages the Government Major Projects Portfolio (GMPP), encompassing the most complex government projects. As the Government's centre of expertise for major projects, the IPA will assure the most significant and challenging GMPP projects from stage gates 1 to 5 in support of a HM Treasury Approval Event. The projects cost estimate will be a fundamental input into that assurance and approval.

The cost estimate has many different uses, and evolves as a project progresses through each stage gate, including:

- **Strategic Outline Case (SOC)** – At SOC a broad range is provided as a cost estimate to provide some indication of the cost of the project.
- **Outline Business Case (OBC)** – as the project becomes slightly more defined and options distilled, a cost estimate with a smaller range is provided. At this point it enables value for money considerations to be made and supports the decision as to whether or not to progress with the project.
- **Full Business Case (FBC)** – approval of the cost estimate enables major contractual commitments to be undertaken. This enables organisations to conduct procurements and enter into relationships with suppliers to deliver the scope of works.
- **Project execution and close-out** – at this point, the cost estimate is fixed and a baseline established. The cost estimate is used to monitor the financial performance of the project against the plan and enables project leadership to input corrective action where there are overruns. Should the cost estimate need adjustments, the requirements for the FBC should be adopted.

At each stage gate, the project team needs to be able to evidence that they have met the cost estimating requirements set out in this document. The IPA will review this evidence as part of its assurance activities. This section focuses on the stage gate SOC, OBC and FBC outlining the fundamental requirements which need to be met at each stage gate in order to ensure sufficient development of the cost estimate.

1 Cost estimate requirements by stage gate

How project teams should evidence the cost estimate

In preparing for a stage gate, the Senior Responsible Owner (SRO) and the project team must ensure that the cost estimate is sufficiently developed in line with the project definition, and that they can substantiate this through:

- **Project cost estimate** –the models and source calculations
- **Cost estimate report** – the summary of the cost estimate which includes results, key data points, assumptions and exclusions to inform the project team
- **Cost estimating procedures** – typically defined at organisational level or across a major project or programme. These procedures may require tailoring early in a project if it differs from typical projects undertaken by the organisation. They will set common guidance such as data sources or communication standards, methodologies and control measures.

Additionally, the cost estimate is underpinned by project definition documents, owned and developed by the wider project team and delivery organisation that are key inputs to the cost estimate. These documents include:

- Project Requirements
- Management and Governance Strategy
- Design and Development Strategy
- Project Delivery Strategy
- Procurement and Contracting Strategy
- Property Acquisition Strategy
- Description of the Works (Scope)
- Project Controls Procedures
- Risk Management Procedures
- Schedule Management Procedures
- Commitments Register
- Dependencies Register
- Third Party Interface Register
- Change Control Register
- Work Breakdown Structure (WBS)
- Project Design Reports
- Project Risk Register
- Project Opportunities Register
- Project Schedule
- Project Progress Report
- Project Land and Property Register

1 Cost estimate requirements by stage gate

Whilst the maturity of the cost estimate progressively increases as the project develops, the expected steps to produce a high-quality cost estimate remain constant, and therefore the guidance on what and how to set the cost estimate is broadly consistent across stage gates.

Large and complex projects are likely to require more evidence, whilst small or repeatable projects may reuse or reference previous examples to substantiate their assumptions. In the interest of producing a flexible and robust guide to practitioners, section 2 of this document presents an extended list of requirements for the cost estimating process; it is recognised these may not be applicable to all projects.

Strategic Outline Case

At SOC, the project team articulates the strategic context for the project, makes the case for change and determines a preferred option from a shortlist which will deliver the required outcomes.

The cost estimate should be used to confirm the viability of the project and support the selection of an initial, preferred option alongside other project information (e.g. benefits delivered).

There are a number of typical characteristics of the cost estimate at this stage gate:

- Low project maturity (typically <5%).
- Developed using deterministic techniques (e.g. expert opinion, analogy) rather than probabilistic techniques.
- Cost estimate aggregated and presented in few categories, consistent with the IPA Level 0 cost breakdown.
- A cost estimate report listing and describing the major sources of information, assumptions made and methods employed.
- Categories of assumptions and exclusions identified.
- Aligned to a schedule with key milestone dates and saddled durations major work elements.
- A broad range to reflect the low project maturity and therefore uncertainty.

1 Cost estimate requirements by stage gate

Strategic Outline Case – Requirement, evidence and assurance

Area/Theme	SOC Requirement	Expected evidence	Assurance questions
Owned	The cost estimate must be owned by the SRO.	The Management and Governance strategy outlines the owner and role of the Project Executive in regards to the cost estimate, in line with the cost estimating procedures.	Has the SRO approved the cost estimate? Are the principles of ownership at SRO and Project Executive level established and documented in the Management and Governance strategy?
Consistent (Alignment)	The cost estimate must show a clear link to the project outcomes.	The cost estimate report should articulate how the project cost estimate meets the project outcomes.	Does the cost estimate align with the project objectives and key outcomes?
Robust	Techniques such as comparison to similar projects, expert opinion, benchmarking and scenario-based modelling must be used to support the cost estimate.	The cost estimate report should outline what techniques have been used and for what particular elements of the project cost estimate.	Which recognised industry standards have been adopted in the production of the initial cost estimates to compare options and inform early decisions?
Complete	The cost estimate must be complete, presented at Level 0-2 granularity, consistent with the IPA Level 0 breakdown.	The cost estimate is built on the right level of work breakdown structure and aligns to the project requirement. The cost estimate report aggregates the values to the Level 0.	Does the high-level elemental and component structure of the cost estimate reflect the entire scope of the works?
Accurate	The cost estimate must be presented as a range around the Anticipated Final Cost (AFC), within the following confidence ranges: Target: -20% to +50% By exception: -30% to +100% (subject to IPA's approval)	The cost estimate report clearly presents the confidence range around AFC.	Is the cost estimate shown as a range within the target confidence interval?
Controlled	Procedures must be put in place to record spend to date and forecasted future spend. Spend to date should be comparable to 1% of the AFC.	The cost estimate report articulates the spend to date and forecast to the next stage gate.	Does the project have an agreed start date for expenditure and accounting principles agreed for recording, funding, allocating and communicating expenditure to date? Is the spend to date comparable to the expected target?
Managed	The capability required to deliver a robust cost estimate must be understood.	The management and governance strategy outlines the accountabilities, hierarchies and responsibilities evidencing alignment to IPA approach, documented in the cost estimating procedures.	Are the principles of how the project will be governed, managed and supported by competent organisations and individuals established and documented?

1 Cost estimate requirements by stage gate

Strategic Outline Case – Sign off

This is to confirm that the following members of the team are satisfied that the core requirements have been completed at SOC and sufficient evidence has been provided to support this.

Area/Theme	Assurance questions	Check
Owned	Has the SRO approved the cost estimate? Are the principles of ownership at SRO and Project Executive level established and documented in the Management and Governance strategy?	
Consistent (Alignment)	Does the cost estimate align with the project objectives and key outcomes?	
Robust	Which recognised industry standards have been adopted in the production of the initial cost estimates to compare options and inform early decisions?	
Complete	Does the high-level elemental and component structure of the cost estimate reflect the entire scope of the works?	
Accurate	Is the cost estimate shown as a range within the target confidence interval?	
Controlled	Does the project have an agreed start date for expenditure and accounting principles agreed for recording, funding, allocating and communicating expenditure to date? Is the spend to date comparable to the expected target?	
Managed	Are the principles of how the project will be governed, managed and supported by competent organisations and individuals established and documented?	

SRO	[NAME]	**Accounting Officer**	[NAME]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]
Project Director	[NAME]	**Project Design/Delivery**	[NAME]
			[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]
Cost estimate	[NAME]	**Review/Assurer**	[NAME]
	[POSITION]		[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]

1 Cost estimate requirements by stage gate

Outline Business Case

At OBC, the project team revisits the options identified and finalises the preferred option for a more detailed appraisal. Affordability is confirmed and management arrangements are put in place for the successful delivery of the project. At the conclusion of the OBC, the project team may initiate the procurement phase of the project.

The cost estimate should be used to support affordability calculations and inform decisions made regarding the preferred option.

There are a number of typical characteristics of the cost estimate at this stage gate:

- Improving project maturity (typically around 30%).
- The cost estimate is aggregated at the appropriate level based on project maturity (typically at a more granular level than SOC).
- Depending on the data available, the risk and cost estimating methodology could complement deterministic, scenario-based or benchmark calculations with probability-driven and first-principles evaluations in certain elements of the project.
- The cost estimate is informed by a detailed schedule with the basic logic and critical path identified.
- Exclusions are defined at summary level and agreed with sponsors.
- Assumptions are established at summary level and owned.
- The cost estimate report contains more detail around the input data and design information, such as sensitivity analysis and boundary conditions for assumptions.
- Benchmarking is used to validate project-wide assumptions or category-specific cost estimates, providing a level of control over the proposed cost envelope.
- A smaller range to reflect the improving project maturity.

1 Cost estimate requirements by stage gate

Outline Business Case – Requirement, evidence and assurance

Area/Theme	OBC Requirement	Expected evidence	Assurance questions
Owned	The cost estimate must be owned by the SRO, and there must be an owner for each component of the cost estimate.	The Management and Governance strategy articulates clear accountability and responsibility for the cost estimate (and its components therein), aligned to the cost estimating procedures.	Has the SRO approved the cost estimate? Is the responsibility for and ownership of each major element of the project that supports the cost estimate clearly documented and agreed?
Consistent (Alignment)	The cost estimate must show a clear link to the project outcomes. It must clearly align with the description of works, design and key assumptions.	The cost estimate report details how the different components of the project have been factored into the project cost estimate.	Does the cost estimate align with the project objectives and key outcomes? Does it align with the scope of preferred option and design reports? Is it consistent with the project key assumptions?
Robust	The appropriate methodologies must be used to calculate the cost estimate, given the project complexity and maturity.	The cost estimate report articulates the methodology/ methodologies used to calculate the cost estimate and provides justification for these.	Which cost estimating methodology and comparison techniques have been applied to inform the cost estimate at this early stage of design maturity? How were they approved?
Complete	The cost estimate must be complete. It must have a clear work breakdown structure built from the wider project information, consistent with the IPA Level 0 breakdown.	The cost estimate is built on the right level of work breakdown structure and aligns to the project requirement. The cost estimate report aggregates the values to the Level 0.	Does the cost estimate reflect the entire scope of the works? Does it reflect it in a level of detail commensurate with the description of works, design reports and risk identification?
Accurate	The cost estimate must be presented as a range around the Anticipated Final Cost (AFC), within the following confidence ranges: Target: -15% to +30% By exception: -30% to +50% (subject to the IPA's approval)	The cost estimate report clearly presents the confidence range around AFC, and validation substantiating its calculation.	Is the cost estimate shown as a range within the appropriate confidence interval? Is it sufficiently substantiated?
Controlled	Expenditure to date must be clearly captured in the work breakdown structure. Spend to date should be comparable to 3% of the AFC.	The cost estimate report articulates the spend to date and forecast to the next stage gate. Any changes from the previous version is clearly presented and explained.	Does the project have established cost breakdown structures with sufficient granularity and alignment between departmental budgets and cost elements to reliably inform the cost estimate with the progress of expenditure? Is the spend to date comparable to the expected target?
Managed	There must be a clear plan to meet any capability gaps within the project team.	The management and governance strategy outlines the accountabilities, hierarchies and responsibilities aligned to the IPA approach and documented in cost estimating procedures. The procurement and contracting strategy articulates how capability will be procured.	Are the requirements met? Has the project established how it will procure, organise, motivate, recruit, retain, train and develop the competent persons and organisations required for successful delivery?

1 Cost estimate requirements by stage gate

Outline Business Case – Sign off

This is to confirm that the following members of the team are satisfied that the core requirements have been completed at OBC and sufficient evidence has been provided to support this.

Area/Theme	Assurance questions	Check
Owned	Has the SRO approved the cost estimate? Is the responsibility for and ownership of each major element of the project that supports the cost estimate clearly documented and agreed?	
Consistent (Alignment)	Does the cost estimate align with the project objectives and key outcomes? Does it align with the scope of preferred option and design reports? Is it consistent with the project key assumptions?	
Robust	Which cost estimating methodology and comparison techniques have been applied to inform the cost estimate at this early stage of design maturity? How were they approved?	
Complete	Does the cost estimate reflect the entire scope of the works? Does it reflect it in a level of detail commensurate with the description of works, design reports and risk identification?	
Accurate	Is the cost estimate shown as a range within the appropriate confidence interval? Is it sufficiently substantiated?	
Controlled	Does the project have established cost breakdown structures with sufficient granularity and alignment between departmental budgets and cost elements to reliably inform the cost estimate with the progress of expenditure? Is the spend to date comparable to the expected target?	
Managed	Are requirements met? Has the project established how it will procure, organise, motivate, recruit, retain, train and develop the competent people and organisations required for successful delivery?	

SRO	[NAME]	**Accounting Officer**	[NAME]
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			[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]
Cost estimate	[NAME]	**Review/Assurer**	[NAME]
	[POSITION]		[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]

1 Cost estimate requirements by stage gate

Final Business Case

At FBC, the contractual arrangements are recorded, affordability confirmed and the agreed management arrangements for the delivery, monitoring and post-evaluation of the project are put in place.

The cost estimate at OBC is integral in enabling the major contractual commitments to be undertaken and to proceed with the procurement. It enables a final go/no-go decision on the project and for the baseline to be set.

There are a number of typical characteristics of the cost estimate at this stage gate:

- Good project maturity (typically around 60%).
- Established through a first principles bottom up cost estimate.
- Exclusions fully detailed and agreed with owners and relevant 3rd parties.
- Detailed assumptions owned, codified and cross referenced to risk.
- A cost estimate report with a comprehensive record of design information relied upon, data sources included, comparison techniques employed and checking processes undertaken.
- Cost estimate still presented as a range but at a smaller range than at OBC.

Beyond the OBC, the cost estimate is considered baselined and supports discipline in the project execution. Further iterations of the cost estimate (such as cost estimate to Complete and Earned Value Management calculations) should follow the requirements of the FBC stage gate.

At the end of the project the team should produce a reconciliation of the actual costs incurred against the cost estimate at initial gates to promote a body of knowledge that will improve future cost estimates as a reference class.

1 Cost estimate requirements by stage gate

Final Business Case – Requirement, evidence and assurance

Area/Theme	FBC Requirement	Expected evidence	Assurance questions
Owned	The cost estimate must be owned by the SRO, and there must be clear ownership of all components and inputs into the cost estimate.	Each input will have an owner clearly stipulated in the document in line with the cost estimating procedures.	Has the SRO approved the cost estimate? Are all components of and key inputs to the cost estimate under clear, documented ownership through production, assurance and presentation?
Consistent (Alignment)	The cost estimate must show a clear link to the project outcomes. It must align with detailed scope, design, assumptions, exclusions, schedule and risks.	The cost estimate report details how the different components of the project have been factored into the project cost estimate.	Does the cost estimate align with the project objectives and key outcomes? Does it align with detailed scope, design, assumptions, exclusions, schedule and risks?
Robust	The cost estimate must use cost estimating and comparison techniques appropriate to the project definition. First principles and probabilistic cost estimates must be clearly substantiated by assumption and risk registers.	The cost estimate report should outline what techniques have been used and for what elements of the project cost estimate.	Have the project team used appropriate cost estimating and comparison techniques, commensurate with the design stage to take full advantage of the detailed supporting information available at this stage gate?
Complete	The cost estimate must be complete. It must have a clear work breakdown structure built from the wider project information, consistent with the IPA Level 0 breakdown, and must reflect the detailed scope of works.	The cost estimate is built on the right level of work breakdown structure and aligns to the project requirement. The cost estimate report aggregates the values to the Level 0.	Does the cost estimate reflect the entire and detailed scope of works funded by the project, including works to be carried out by third parties, external dependencies and risk mitigating actions?
Accurate	The cost estimate must be presented as a range around the Anticipated Final Cost (AFC), within the following confidence ranges: Target: -10% to +10% By exception: -10% to +20% (subject to IPA approval)	The cost estimate report clearly presents the confidence range around AFC, and validation substantiating its calculation.	Is the cost estimate shown as a range within the appropriate confidence interval? Is it sufficiently substantiated?
Controlled	There must be controls and reporting (baseline management, change control processes, contingency drawdown and progress reporting) in place to effectively manage the project. The spend to date should be comparable to 5% of the AFC.	The cost estimate report articulates the spend to date and forecast to the next stage gate. Any changes from the previous version are clearly presented and explained. The management and governance strategy outlines the approach to baseline management, change control processes, contingency drawdown and progress reporting.	Does the project have detailed baseline management, change control processes, contingency drawdown and progress reporting that informs and reconciles with the project cost estimate? Is the spend to date comparable to the expected target?
Managed	The project must have a clear organisation structure and information flows to effectively prepare, review, assure, communicate and manage the project cost estimate	The management and governance strategy details the organisation structure key responsibilities of the team aligned to the cost estimating procedures.	Are the requirements met? Does the project have appropriately designed organisation, communication and delegation protocols to effectively prepare, review, assure, communicate and manage the project cost estimate?

1 Cost estimate requirements by stage gate

Final Business Case – Sign off

This is to confirm that the following members of the team are satisfied that the core requirements have been completed at FBC and have sufficient supporting evidence.

Area/Theme	Assurance questions	Check
Owned	Has the SRO approved the cost estimate? Are all components of and key inputs to the cost estimate under clear, documented ownership through production, assurance and presentation?	
Consistent (Alignment)	Does the cost estimate align with the project objectives and key outcomes? Does it align with detailed scope, design, assumptions, exclusions, schedule and risks?	
Robust	Have the project team used appropriate cost estimating and comparison techniques, commensurate with the design stage to take full advantage of the detailed supporting information available at this stage gate?	
Complete	Does the cost estimate reflect the entire and detailed scope of works funded by the project, including works to be carried out by third parties, external dependencies and risk mitigating actions?	
Accurate	Is the cost estimate shown as a range within the appropriate confidence interval? Is it sufficiently substantiated?	
Controlled	Does the project have detailed baseline management, change control processes, contingency drawdown and progress reporting that informs and reconciles with the project cost estimate? Is the spend to date comparable to the expected target?	
Managed	Are the requirements met? Does the project have appropriately designed organisation, communication and delegation protocols to effectively prepare, review, assure, communicate and manage the project cost estimate?	

SRO	[NAME]	**Accounting Officer**	[NAME]
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			[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]
Cost estimate	[NAME]	**Review/Assurer**	[NAME]
	[POSITION]		[POSITION]
[SIGNATURE]	[DD/MM/YY]	[SIGNATURE]	[DD/MM/YY]

1 Cost estimate requirements by stage gate

How project documentation should progress through each stage gate

Ref	Project documentation	Author	Description	Expectation of documentation at each stage gate		
				SOC – Initiated	OBC – Developing	FBC – Mature
ED-01	Project Requirements	SRO	Sponsors requirements, interpreted into project and functional requirements	Fundamentals and objectives established, detail under discussion	Detail and certainty increasing, but subject to change and refinement	Requirements fully detailed, communicated and stable
ED-02	Management and Governance Strategy	Project Director	Objectives, values, organisation, accountabilities and authorities	Key headings and fundamentals established	All sections with at least basic content and key issues settled	Full org. charts, delegated authorities, RACI charts, all disciplines embedded
ED-03	Design and Development Strategy	Project Director	All aspects of how the design will be procured, developed and delivered	Broad principles established and options under consideration	Delivery option selected for each element of design work	All elements of design under management and coordinated
ED-04	Project Delivery Strategy	Project Director	Implementation, mobilisation, contract management, performance, handover	Principles established for how the works will be managed and delivered	Key assumptions formed for team size, location, structure and duration	All parameters, functions and characteristics established
ED-05	Procurement and Contracting Strategy	Project Director	Market engagement, supply chain, packaging, risk transfer and incentives	Concept and principles with initial view of packaging and engagement method	Packaging firming up, contract forms shortlisted, risk appetite in discussion	Packaging, contracting method, market engagement, risk transfer agreed
ED-06	Property Acquisition Strategy	Project Director	Approach, method, powers, timing, compensation schemes, agents	Main land parcels, boundaries and requirements established	Tenants and landowners identified and compensation types established	Book of reference, powers, agents appointed
ED-07	Risk Management Procedures	Design & Delivery	Rules, processes protocols, structures, conventions for risk management	Fundamentals, principles, approach and basic structures established	Major risks identified, owned and risk treatment agreed	Fully developed, owned and quantified registers, detailed QRA, comprehensive action plans established

1 Cost estimate requirements by stage gate

Ref	Project documentation	Author	Description	Expectation of documentation at each stage gate		
				SOC – Initiated	OBC – Developing	FBC – Mature
ED-08	Schedule Management Procedures	Design & Delivery	Rules, processes protocols, structures, conventions for schedule	Fundamentals, principles, approach and basic structures established	Top level WBS established, calendars, key assumptions, presentation defined	Fully developed WBS, processes, assumptions and exclusions
ED-09	Project Controls Procedures	Design & Delivery	Rules, processes protocols, structures, conventions for change, doc, reporting etc.	Fundamentals, principles, approach and basic structures established	Progress and performance reporting established, basic system interfaces designed	Fully developed, detailed progress and performance reports, all system interfaces and controls tools in place
ED-10	Work Breakdown Structure (WBS)	Design & Delivery	The tiered, breakdown the activities required to complete the project	Top tiers established for major elements	WBS adding definition and tiers, links to scope, schedule, cost, risk, contract packages etc. established	Fully detailed tiered structure for all elements, aligned with and coded to contract packaging
ED-11	Description of the Works	Design & Delivery	Scope book with schedules of work, interfaces, dependencies etc.	Preferred option emerging, high level components/ element described	Details of permanent works, sub elements and key constraints	Settled descriptions of all works with detailed supporting schedules
ED-12	Project Design Reports	Design & Delivery	Drawings, specifications, designs, methods and assumptions	Concept reports for major elements	Outline reports for most elements and early methodology assumptions	Developed reports for all elements with method, temporary works, constraints etc.
ED-13	Project Schedule	Design & Delivery	Milestones, durations, logic, sequencing, critical paths, constraints and float	Key milestone dates and saddled durations, major work elements	Detailed schedule with basic logic and critical path identified	Comprehensive schedule for all activities with full logic
ED-14	Project Land and Property Register	Design & Delivery	All property parcels, rights of way, blight, hardship, affection and compensation	Major land parcels and categories of compensation identified	Increasing granularity with emerging understanding of ownership and use	Book of reference detailing all property ownership and rights affected and the cost impact of the project's intervention

1 Cost estimate requirements by stage gate

How project documentation should progress through each stage gate continued

Ref	Project documentation	Author	Description	Expectation of documentation at each stage gate		
				SOC – Initiated	OBC – Developing	FBC – Mature
ED-15	Project Risk Register	Design & Delivery	Schedule of all risks with owners, actions, assessments and status	Key risks identified and structure of register established	Further risks identified, qualitatively scored, owned and under review cycle	Detailed register with all risks owned, quantified, correlated and action plans agreed
ED-16	Project Opportunities Register	Design & Delivery	Schedule of all opportunities with owners, actions, assessments and status	Key opportunities identified and structure of register established	Maturing register of opportunities, recording basic status, likelihood and range of impact if successful	All opportunities identified, quantified and with implementation plans agreed and owned
ED-17	Commitments Register	Design & Delivery	All promises, undertakings, assurances, planning conditions given or imposed	Record of formal commitments given to 3rd parties to date	Growing number of commitments as development proceeds with increased definition and impact analysis	Full detailed list of all commitments given including how they will be fulfilled and their impact on cost and time
ED-18	Dependencies Register	Design & Delivery	Projects and works out of scope that are required to be completed by others	Key dependencies identified and early assumptions formed	All major dependencies identified and assumptions on treatment established	All dependencies identified, described in detail and treatment agreed with relevant 3rd party
ED-19	Third Party Interface Register	Design & Delivery	All the touch points with 3rd parties' assets and the nature of the interface	Key interfaces with 3rd party assets identified and early assumptions formed	All major interfaces identified and assumptions on treatment established	All interfaces identified, described in detail and treatment agreed with relevant 3rd party
ED-20	Change Control Register	Design & Delivery	Approved, anticipated and early warning changes and their forecast impact	Sequential, chronological register established, recording major changes	Description and impact of major proposed and approved changes since previous agreed baseline	All early warnings, proposed and approved changes with detailed time, cost and risk impact recorded

1 Cost estimate requirements by stage gate

Ref	Project documentation	Author	Description	Expectation of documentation at each stage gate		
				SOC – Initiated	OBC – Developing	FBC – Mature
ED-21	Project Progress Report	Design & Delivery	Regular report showing physical and financial progress, trends and actions	Basic physical and financial progress reporting in the early design stages	Maturing progress and performance reports providing progress, cost, time and change control updates	Detailed, regular reports covering numerous progress, performance and financial measures, and informing decisions
ED-22	Cost estimating Procedures	Cost Estimating Team	Rules, processes protocols, structures, conventions for cost estimating	Fundamentals, principles, approach and basic structures established	Key assumptions, top level CBS complete, all areas covered in principle	Fully developed CBS, processes, assumptions and exclusions
ED-23	Key Exclusions Register	Cost Estimating Team	Scope, costs, risks etc. specifically excluded and transferred to other parties	Main categories, owners and management principles established	Exclusions established at summary level and agreed with sponsors	Exclusions fully detailed and agreed with owners and relevant 3rd parties
ED-24	Key Assumptions Register	Cost Estimating Team	Issues material to scope, cost, risk, schedule, objectives, benefits, etc.	Main categories, owners and management principles established	Assumptions established at summary level and owned	Detailed assumptions owned, codified and cross referenced to risk
ED-25	Cost Estimate Report	Cost Estimating Team	The basis of cost estimate recording information referenced, assumptions and sources	Listing and describing the major sources of information, assumptions made and methods employed	More detailed information about benchmarking, input data and design information relied upon	Comprehensive record of design information relied upon, data sources, comparison techniques employed and checking processes undertaken
ED-26	Project Cost Estimate	Cost Estimating Team	Rates, allowances, contingency, inflation, phasing, accrued liability	Approximate cost estimates, parametric, provisional sums, benchmarks, OB, RPI/CPI	Some measured works, fewer provisional sums, reduced reliance on benchmarks, basic QRA, some indices	High degree of measured works, few provisional sums, detailed QRA and tailored indices

2 Cost estimating process requirements

This section supports the cost estimating team to produce a robust and consistent cost estimate.

It should be noted this is not a cost estimating manual. The guide assumes proficiency in the cost estimating team and does not articulate how each process step is fulfilled. Delivery bodies and organisations should reflect these requirements into their existing cost estimating procedures as appropriate.

Cost estimating process

The figure below sets out the cost estimating process covering the production, review and subsequent decisions made based on the cost estimate. The eight-step process should be repeated to ensure a robust cost estimate is produced.

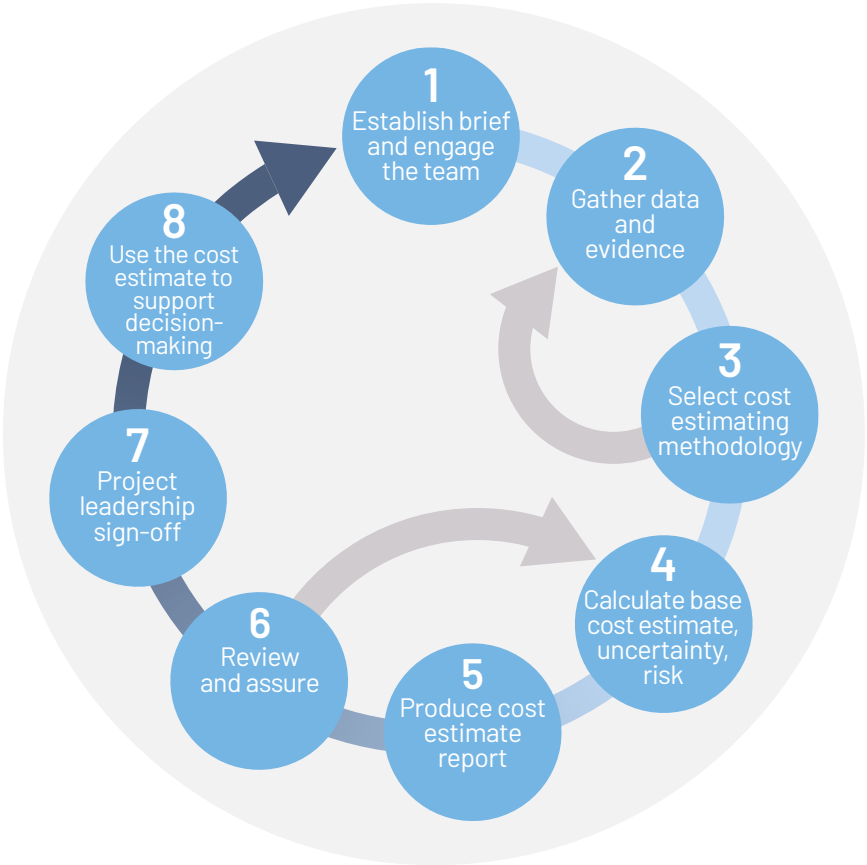
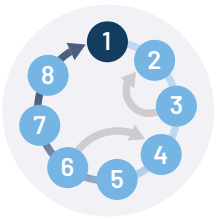


Figure 2 – Cost estimating performance framework

The requirements for developing a robust cost estimate are broken down into steps.

2 Cost estimating process requirements



Step 1: Establish brief and engage the team

The cost estimating team must be established and engaged with the wider project to understand the project scope and therefore the cost estimate requirements. This project information should be used to select suitably qualified and experienced team members with the appropriate disciplines to undertake the cost estimate and those who will be involved in the review and assurance.

Project progression

At SOC, the team will identify and agree the project outcomes, understand the strategic options short-listed and how to cost them and evaluate their suitability. As a first principle in the cost estimating practice the team should set a programme with stakeholders, independent of the project, and establish sign off protocols.

The dynamic experience and skills of the team should evolve with the project as it progresses through stage gates. At each stage gate the required skills and experience to undertake the cost estimate should be reviewed.

At OBC and FBC, the outcomes and objectives of the project are reviewed and refined based on the additional information available (if necessary). The stakeholder engagement should build on previous cycles and will include information gathered and lessons learned at SOC and OBC if relevant.

Continuity of the review and assurance team is important to support continuous improvement and prevent the loss of information during handover.

Size and complexity considerations

The following points should be considered based on the size and complexity of the specific project:

- What level of specialist capability is required – this will be greater for more complex projects.
- What volume of resource is required – larger projects will naturally require a larger team.
- What capability can be delivered in house and what needs to be outsourced – if the project is a one-off unique project it may be that capability should be sought outside the organisation.
- What level of review and assurance is appropriate – this could be a peer team within the organisation, a similar ALB or department, or an independent body, depending on the required areas of expertise.

2 Cost estimating process requirements

Process requirements

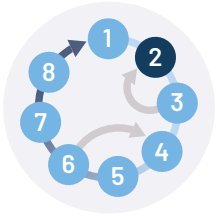
Step 1: Establish brief and engage the team

Area	ID	Requirement	Evidence	Owner
Understand project outcomes	**1.1**	Engage with key project stakeholders at stage gate initiation meeting	Project Requirements	Project Director
	1.2	Provide cost estimate documentation to inform the basis of the cost estimate	Description of the Works	Senior Responsible Owner
	1.3	Agree overall cost estimate timeline, sign off protocols and stakeholder touchpoints	Project Delivery Strategy / Management and Governance Strategy	Cost Estimating Team
	1.4	Establish system for managing change control during cost estimate	Change Control Register	Cost Estimating Team
	1.5	Map the accountabilities for deliverables of the cost estimate	Management and Governance Strategy	Cost Estimating Team
	1.6	Define assurance strategy	Management and Governance Strategy	Project Director
	CHECK	**Project outcomes have been understood and confirmed**		
Get the right team	**1.7**	Engage with the market to understand capacity and market conditions	Procurement and Contracting Strategy	Project Director
	1.8	Identify the suitably qualified people (SQEP) aligned to the different attributes of the cost estimate	Project Delivery Strategy, Cost Estimating Procedures	Project Director
	1.9	Engage with specialist suppliers/delivery entities within the supply-chain where their input is required to validate engineering or constructability concerns and firming up pricing aspects. E.g. if a piece of specialist kit is specified, what ancillary equipment is required, what enabling activities are necessary and what lead-in times need to be allowed for.	Procurement and Contracting Strategy	Project Director

2 Cost estimating process requirements

Area	ID	Requirement	Evidence	Owner
Get the right team	**1.10**	Perform resource gap analysis to identify internal capabilities and where additional external resource may be required	Project Delivery Strategy	Senior Responsible Owner
	1.11	Formalise the team and ensure roles are assigned	Project Delivery Strategy, Cost Estimating Procedures	Project Director
	1.12	Define an appropriate communication plan to effectively disseminate key information	Management and Governance Strategy	Project Director
	1.13	Implement training programme to meet internal skills shortages (as required)	Procurement and Contracting Strategy/ Project Delivery Strategy	Senior Responsible Owner
	CHECK	**Consideration has been made for the requirements of the project with regards to market capacity and individuals to support the delivery**		
Set up an independent assurance team	**1.14**	Identify and establish an independent review panel to engage with the wider project, ensuring alignment of the cost estimate outputs to project outcomes	Management and Governance Strategy, Cost Estimating Procedures	Senior Responsible Owner
	1.15	Establish cadence for independent assurance panel meetings regular touch points	Management and Governance Strategy	Cost Estimating Team
	1.16	Define the Terms of Reference (ToR) for the assurance panel	Management and Governance Strategy, Cost Estimating Procedures	Cost Estimating Team
	1.17	Establish feedback loop to SRO to ensure full appraisal of cost estimate implications	Management and Governance Strategy	Project Director
	CHECK	**Independent review panel members have been identified and terms of reference established**		

2 Cost estimating process requirements



Step 2: Gather data and evidence

Once the team is established, the body of evidence that will support and underpin the calculation of the cost estimate needs to be developed.

The cost estimate is required to have a Level 0 structure. This remains consistent and in place throughout the project stage gates. The structure must either replicate the IPA common structure or include a clear explanation of how an alternative structure maps to the IPA Level 0, ensuring that all IPA cost categories are accounted for and a category for "other costs" is avoided. This will provide consistency and greater comparability across projects, whilst minimising the risk of transposition errors where cost estimating practitioners change through the deliverable.

Project progression

The data used to build the cost estimate is expected to increase in maturity as the project evolves and any issues of data quality should be documented with clear target improvement actions identified. Assumptions around the cost estimate should be clearly documented and easily understood by all stakeholders. This will enable informed decision making and support change control, and lessons learned from changing assumptions.

Benchmarking could be used to support early stages of the project to either validate early cost estimate assumptions or as the basis of high-level cost estimates for key project components. This approach should not be limited to benchmarking of project cost elements, but should incorporate lessons learned from similar previous projects, or projects with similar attributes, considering aspects including Project Brief, Engineering Documentation, Specifications, Outcomes and Benefits, Schedule and Assumptions.

Size and complexity considerations

The following points should be considered based on the size and complexity of the specific project:

- **How readily available is the data –** more complex projects are less likely to have the required data applicable to components of the project.
- **How suitable is the data for the project –** more complex projects require more research and engagement to ensure suitability of data against the scope.
- **Should benchmarking be used –** for more complex projects, benchmarking should be considered to fill data gaps and provide assurance on any bottom up elements. Novel or unique projects may use benchmarking on sub-components but may not be able to establish like-for-like comparisons at project level (risk of out-of-range extrapolation).
- **What level of assumption should be made –** larger and more complex projects usually make bigger assumptions to fill gaps in data

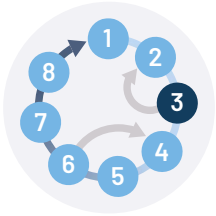
2 Cost estimating process requirements

Process requirements

Step 2: Gather data and evidence

Area	ID	Requirement	Evidence	Owner
Establishing and adhering to a standard structure	**2.1**	Adopt a consistent cost breakdown structure that is compatible with the IPA's "level 0"	Work Breakdown Structure (WBS)	Design and Delivery team
	2.2	Evaluation of risk events (threats and opportunities)	Risk Register	Cost Estimating Team
	CHECK	**A clear and common cost breakdown structure has been established**		
Data Integrity	**2.3**	Undertake gap analysis between scope and data to ensure receipt of all project information	Cost Estimating Procedures	Cost Estimating Team
	2.4	Demonstrate the data is robust, relevant and reflects the maturity proportional to the stage of the project	Cost Estimating Procedures	Project Director
	2.5	Understand the quality of the data acquired and have measures in place to support the improvement (e.g. develop improved collection and interpretation methodology)	Cost Estimating Procedures	Senior Responsible Owner
	2.6	Use benchmarking to fill gaps in data and to assure bottom up cost estimates	Cost Estimating Procedures	Cost Estimating Team
	CHECK	**The integrity of the data used to underpin the cost estimate has been validated**		
Documenting assumptions	**2.7**	Where separate options are being considered, they should be documented and treated separately	Project Requirements/ Key Assumptions Register	Design Team
	2.8	Provide key schedule and scope assumptions of the project to inform the basis of the cost estimate	Key Assumptions Register	Senior Responsible Owner
	2.9	Record all design assumptions made when planning out the cost estimate and articulate to the SRO at progress meetings	Key Assumptions Register	Design Team
	2.10	Record all cost estimating/valuation assumptions made when planning out the cost estimate and articulate to the SRO at progress meetings	Key Assumptions Register	Cost Estimating Team
	2.11	Define a strategy for capture of learnings to benefit future stage gates/iterations	Project Delivery Strategy	Senior Responsible Owner
	2.12	Ensure plain language is used and avoid technical/acronym laden narratives	Cost Estimating Procedures	Project Director
	2.13	Commence capture of anticipated risks in a register that contains, as a minimum: likelihood, impact, mitigation action, dependency, assumptions and justification of cost and schedule associated	Project (cost estimate) Risk Register	Project Director
	CHECK	**Assumptions that inform the basis of the cost estimate have been clearly documented and confirmed as appropriate for the project stage gate**		

2 Cost estimating process requirements



Step 3: Select cost estimating methodology

Once evidence has been collected and key assumptions have been documented, the project team selects the appropriate cost and risk cost estimating methodology. This should be based on the project definition, design maturity and purpose of the cost estimate in recognition that some methodologies provide more efficient and reliable results. Multiple methods may be used for sub-components of the cost estimate or to 'test' the cost estimate.

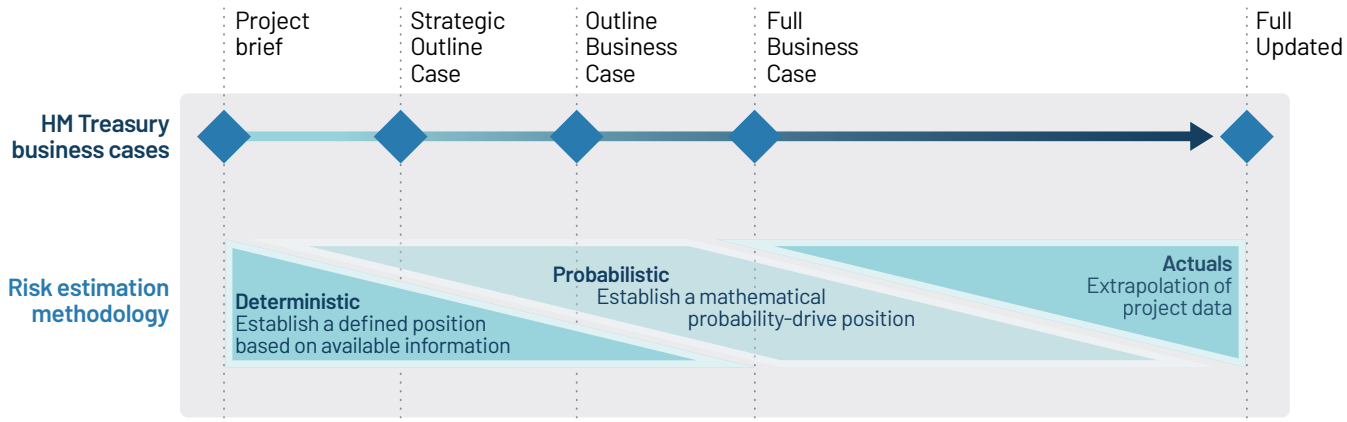
The basis of the decision for the methodology should be clearly documented.

Project progression

The cost estimating methodology will likely change through the project development. While the selection is not driven by specific stage gate requirements the dependency on data maturity to progress through stage gates drives a progressive shift in methodology. Where data maturity is low, typically at earlier stages, deterministic methods should be used to estimate costs and risks. As data maturity increases the cost estimating team can rely on probability-driven methods, which provide more granular information but are sensitive to data completeness.

At SOC the project may rely on project-wide or large category cost estimates (comparison to other projects, benchmarking based on few parameters) and articulate a top-down allocation of the cost estimate envelope across few breakdown categories. By FBC, bottom up first principles cost estimating should be in place given the expected project definition. The transition from top-down to bottom-up methods is a point of special attention, where variance in findings should be clearly documented. The use of multiple methods to cross-reference the findings and articulate the source potential changes is encouraged.

Figure 3 – Cost estimating methodology evolution



2 Cost estimating process requirements

Size and complexity considerations

The following points should be considered based on the size and complexity of the specific project:

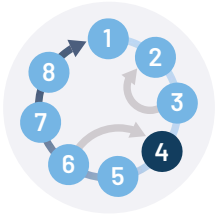
- Does the methodology reflect the level of data maturity – larger, more complex projects are more likely to have lower data maturity at earlier project stages; while less novel projects may use probabilistic methods when comparable experience data is available.
- Should more than one methodology be used to develop the cost estimate – different methodologies may be suitable for different elements of the cost estimate based on level of definition.

Process requirements

Step 3: Select cost estimating methodology

Area	ID	Requirement	Evidence	Owner
Selecting an cost estimate methodology	**3.1**	Evaluate the maturity of available data across all aspects of the project in the context of understanding available methodologies for each	Cost Estimating Procedure	Cost Estimating Team
	3.2	Select appropriate methodologies the elements of the cost estimate (multiple methods can be applicable for different components of the cost estimate)	Cost Estimating Procedure	Cost Estimating Team
	3.3	Select an appropriate platform for producing, recording and communicating cost estimates	Management and Governance Strategy	Cost Estimating Team
	3.4	Document justification for selection of estimation methodology/methodologies	Cost Estimating Procedure	Cost Estimating Team
	CHECK	**The maturity of the project has been assessed to inform the most appropriate cost estimating methodology and justification recorded and clearly documented**		

2 Cost estimating process requirements



Step 4: Calculate base cost estimate, uncertainty, risk

Once the methodology has been selected, the base cost estimate, uncertainty and risk should be calculated following the agreed methodology.

The base cost estimate should be undertaken in an agreed work breakdown structure (WBS) supported by an industry standard method of measurement. Costs are then calculated to produce an initial base cost estimate. The uncertainty of the cost estimate is assessed to determine the likely upper and lower ranges of each cost or section. The base cost estimate can then be adjusted to reflect this.

Risk is managed through an active risk register with likelihoods, impact, owners and actions clearly set out and managed on an ongoing basis by the project team.

Project progression

At early project stage gates the data and design definition will be more immature than is required for the later stage gates of a project and the base cost estimate calculation, three-point cost estimate and risks will reflect this.

The cost estimate outputs will become more detailed as the underpinning data develops in maturity. Where possible, risks should be continually and actively managed out, or mitigation measures identified to minimise probability and impact. Opportunities should be realised as early in the programme as possible and where the likelihood of these occurring is high, they should be built into the base cost estimate. This will serve to enhance the confidence in the overall Anticipated Final Cost (AFC) as the project progresses.

Size and complexity considerations

The following points should be considered based on the size and complexity of the specific project:

- How the components of the cost estimate are brought together – for more complex projects it is likely that differing methodologies will be used for different components of the cost estimate. It is important to have clarity on how these are aggregated and structured, avoiding gaps or overlaps.
- How to effectively calculate risk – more complex or novel projects are likely to have more unknown risks and projects should use deterministic methods for quantifying these. For routine projects with known risks and documented experience, appropriate likelihood and mitigation activity can be determined allowing the use of probabilistic methods.

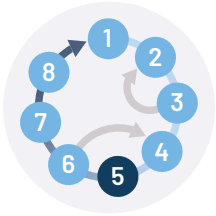
2 Cost estimating process requirements

Process requirements

Step 4: Calculate base cost estimate, uncertainty, risk

Area	ID	Requirement	Evidence	Owner
Developing the base cost estimate	**4.1**	Review and understand documentation that will underpin the cost estimate and record all queries	Description of the Works	Cost Estimating Team
	4.2	Apply selected methodology to undertake quantification and build the base cost estimate	Cost Estimating Procedures	Cost Estimating Team
	4.3	Establish appropriate classification of cost estimate based upon the maturity of project information, articulating dependencies	Cost Estimating Procedures	Cost Estimating Team
	4.4	Demonstrate a level 0 cost structure that can be clearly and consistently aligned to the IPA level 0.	Work Breakdown Structure (WBS)	Cost Estimating Team
	4.5	Undertake preparation of the cost estimate utilising the appropriate methodology	Cost Estimating Procedures	Cost Estimating Team
	4.6	Consider whole life cost (WLC) and carbon in the build-up of the cost estimate	Project Requirements	Cost Estimating Team
	CHECK	**The point cost estimate has been developed following selected methodologies (from step 3)**		
Calculating cost estimate uncertainty	**4.7**	Calculate a three-point cost estimate of the minimum, most likely, and max cost positions of each component of the cost estimate	Project cost estimate	Cost Estimating Team
	4.8	Aggregate the uncertainty ranges to obtain a single three-point cost estimate	Project cost estimate	Cost Estimating Team
	4.9	Utilise the aggregated uncertainty ranges to adjust the base cost estimate, producing a single figure accounting for calculated uncertainty	Project cost estimate	Cost Estimating Team
	CHECK	**Cost estimate uncertainty has been calculated using a three-point cost estimate for each element and aggregated to a single probability-adjusted figure (at median or P-50 equivalent)**		
Calculating risk	**4.10**	Identify risks (threats and opportunities) utilising appropriate risk methodology aligned with project maturity to reflect risks which may/may not occur, their likelihood and their 'pre-mitigated cost'	Risk Register	Cost Estimating Team
	4.11	SQEP to evaluate risk response	Risk Register	Cost Estimating Team
	4.12	Calculate the costs of mitigation and the 'post-mitigation' position in terms of changed likelihood and impact as the sum of project risk	Risk Register	Cost Estimating Team
	4.13	Actively manage, implement and document mitigations in order to achieve the post mitigated position, building the mitigation activities into the cost estimate schedule	Risk Management Procedures	Cost Estimating Team
	4.14	Manage material/critical risks, upon which the continuation of the project depends, separately to generic project risks	Risk Management Procedures	Cost Estimating Team
	CHECK	**Risks have been purposefully considered with a view to mitigating risks where possible, identifying a probability-adjusted cost**		

2 Cost estimating process requirements



Step 5: Produce cost estimate report

Once the base cost estimate, uncertainty and risk have been calculated, the cost estimate should be presented as a range around an Anticipated Final Cost (AFC). The cost estimate and supplementary information must be structured for presentation within a cost estimate report clearly articulating the project cost estimate and key input drivers (e.g. design, scope, assumptions, exclusions and schedule).

This step is fundamental to ensure clear and consistent communication of the cost estimate which can be commonly understood by project leadership and review and assurance teams.

Note that if the scope or assumptions change significantly, the cost estimate must be re-baselined rather than relying on the confidence range envelope to capture every eventuality.

Project progression

As the project progresses through the stage gates the granularity and detailing of the requirements must adapt to reflect the purpose of the cost estimate. At all stage gates the requirements must work to ensure the Project Leadership has sufficient detail and confidence to make robust, evidence-based project decisions. Additionally, the changes between cost estimate iterations will be evidenced with the underlying cause for change. An assessment of the impact of those changes regarding cost and risk will be detailed.

The cost estimate may be produced at the higher levels of the Cost Structure at SOC, but lower, more granular levels at FBC. Producing the FBC cost estimate will require more detailed information and a differing cost estimating approach than that available and taken at SOC, but ultimately the output must enable decision makers to interpret the findings to justify progression approval or rejection.

As the project definition (e.g. design and data maturity) increases the cost estimate is expected to progress through the stage gates achieving a decreasing range of variability around the AFC. This reducing range when compared over the stage gates creates a funnel-like picture of the uncertainty through the project.

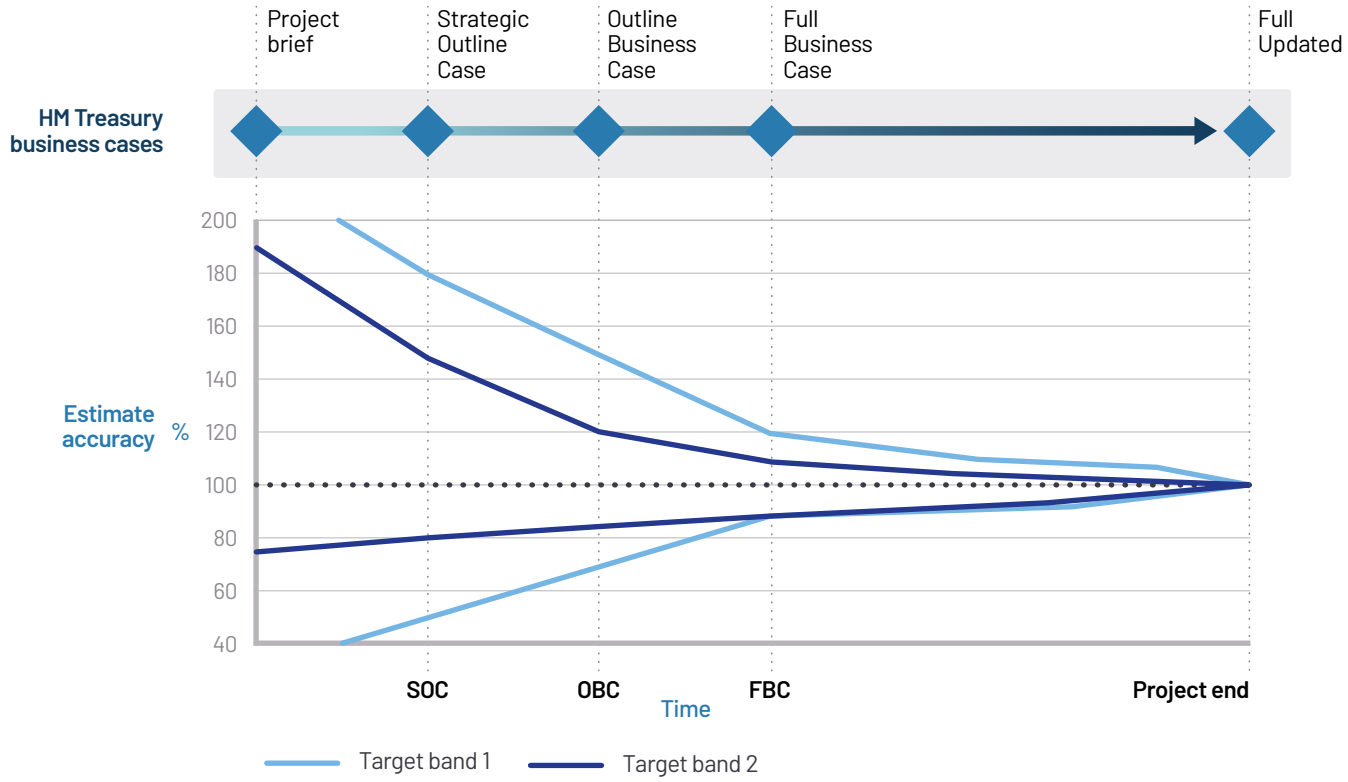
Size and complexity considerations

The following points should be considered based on the size and complexity of the specific project:

- Does the accuracy of the project sit within the acceptable ranges – most projects will be required to fall within the acceptable ranges; however by exception projects may be able to demonstrate that whilst it's at the expected maturity and complies with all the requirements, the cost estimate retains a higher degree of uncertainty. The IPA will evaluate these projects on an individual, exceptions-only basis.
- What should be included in the cost estimate report – projects with more components and higher complexity may include a higher volume of supporting information within the cost estimate report.

2 Cost estimating process requirements

Figure 4 – Cost estimate range through the project stages



Process requirements

Step 5: Produce cost estimate report

Area	ID	Requirement	Evidence	Owner
Defining the Anticipated Final Cost (AFC)	**5.1**	Calculate the AFC by combining the adjusted base cost estimate (accounting for calculated uncertainty) and value attributed to the risk within the cost estimate elements	Project cost estimate	Cost Estimating Team
	5.2	Record all underpinning assumptions and data sources used in producing the AFC in a clear and easily identifiable format	Project cost estimate	Cost Estimating Team
	5.3	Undertake a review of the AFC cost estimate taking into account scope, available project information, data quality and engineering and cost estimating assumptions	Project cost estimate	Cost Estimating Team
	CHECK	**The anticipated final cost has been captured with recorded justification for any assumptions**		

2 Cost estimating process requirements

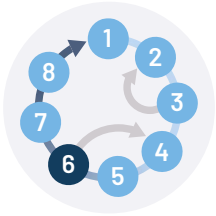
Step 5: Consolidating cost estimate findings continued

Area	ID	Requirement	Evidence	Owner
Define confidence + / - delta on the range of overall cost estimate as AFC	**5.4**	Apply the expected accuracy range to the AFC based on the classification of the cost estimate selected earlier in the project and update by learnings obtained during the pricing of the cost estimate.	Project Cost Estimate	Cost Estimating Team
	5.5	Record the accuracy range and compare it against the target project gateway, considering corresponding limitations and dependencies for the proposed confidence envelope.	Project Cost Estimate	Cost Estimating Team
	CHECK	**An overall gauge of cost estimate confidence is has been recorded as a + / - delta on the AFC**		
Consolidating the cost estimate	**5.6**	Securely store the cost estimate and all corresponding information, minutes and assumption registers, archiving redundant and superseded versions.	Management and Governance Strategy	Cost Estimating Team
	5.7	Appropriately store the cost estimate within the location defined by the project director and invoke suitable controls to manage commercial sensitivity.	Management and Governance Strategy	Cost Estimating Team
	5.8	Compile the cost estimate under the agreed WBS with commentary appended to provide context to all key cost areas, aligned to further explanation contained within the report if required	Project Cost Estimate	Cost Estimating Team
	CHECK	**The cost estimate is only available for viewing by the required people and commercially sensitive elements protected**		
Provide a report along with appropriate appendices	**5.9**	Produce a 'Project Overview' outlining: ■ The purpose/objective of the cost estimate ■ Identification of Critical Stakeholders ■ The Outcome Solution upon which the cost estimate is based ■ Principal Quantities	Cost Estimate Report	Cost Estimating Team
	5.10	Articulate the 'Basis of cost estimate' covering: ■ Cost Estimate Base Date, and Inflationary Indices used ■ Cost Estimate Base Location, and any adjustment indices used ■ Cost Estimate Currency, and any Currency Adjustments used ■ Risks (Threats and Opportunities) which impact the project ■ Schedule Duration including Key Milestones	Cost Estimate Report	Cost Estimating Team
	5.11	Detail 'Information Sources' including: ■ Procurement Strategy ■ Principal Sources (and receipt dates) for Critical Design Information ■ Supply Chain Engagement and Quotations received ■ Sources of Relevant Cost Data (Schedules of Rates/ Parametric Models/Pricing Books, etc) ■ Risk (Threats and Opportunity) Register ■ Schedule which underpins cost estimate	Cost Estimate Report	Cost Estimating Team

2 Cost estimating process requirements

Area	ID	Requirement	Evidence	Owner
Provide a report along with appropriate appendices	**5.12**	Articulate the 'Cost Estimating methodology' illustrating: ■ Applied Work Breakdown Structure (and corresponding Level achieved) ■ Methodology used including Method of Measurement (MoM) ■ Cost estimating platform(s) used ■ Classification Applied and basis for selection ■ Cost estimating Accuracy assessment and approach taken ■ Critical Dependencies and Information Gaps ■ Limitations	Cost Estimate Report	Cost Estimating Team
	5.13	Evidence of robust 'Change Control' where the solution, constructability approach or key underlying assumptions have changed between the cost estimate iteration design handover and the completion of the cost estimate	Change Control Register	Cost Estimating Team
	5.14	Clearly and concisely present the 'Conclusions, Recommendations and Proposed Next Steps' of the cost estimate, articulating the cost limitations and dependencies around options where they exist	Cost Estimate Report	Cost Estimating Team
	5.15	Evidence the 'Assurance' approach undertaken in the development of the cost estimate, demonstrating: ■ Strategy for Curating underpinning data ■ Actions to improve the cost estimate ■ Benchmarking Activities ■ Critical Assumptions and underpinning justification ■ Evidence of Assurance undertaken of Key Quantities ■ Dates and Attendees from Peer Review Assurance Meeting ■ Minutes and agreed changes from Peer Review Assurance Meeting ■ Evidencing Sign Off	Cost Estimate Report	Cost Estimating Team
	5.16	Present the cost estimate at an appropriate level of the Cost Structure (Typically 0 or 1) with the Final Anticipated Cost shown as: ■ Point cost estimate categorised across the levels of the Cost Stack ■ Cost Estimating Uncertainty ■ Risk and Opportunity ■ Expected Accuracy Range	Cost Estimate Report	Cost Estimating Team
	CHECK	**A report detailing the cost estimate findings has been produced and includes the information as agreed with the Project Leadership covering the elements articulated in the process requirements table**		

2 Cost estimating process requirements



Step 6: Review and assure

Once the cost estimate report has been produced summarising the contents of the cost estimate, independent review and assurance is then carried out. The purpose of this step is to increase confidence above and beyond that of an internal review processes. A strong understanding of the purpose and benefits of independent assurance will help major project teams maximise the value of the activity and ultimately lead to meaningful improvements in the overall results.

The review/assurance team should be independent from the cost estimating team, project design and delivery team and leadership. The team should behave ethically, impartially and be free from any real or perceived conflicts of interest.

Following the outputs of the review/assurance, the cost estimating team may need to update the cost estimate (step 4) before seeking project leadership sign off (step 7).

Project progression

Whilst confidence in the cost estimate should increase through the project stage gates, the purpose, value and overarching approach to assurance remains constant. Consideration should be given to indicators of project definition (e.g. design and data maturity) and whether this is at the expected level for the stage gate. Independent assurance is highly recommended prior to FBC approval.

Size and complexity considerations

Each project is likely to have its own unique complexities and challenges. Therefore, it is important to fully appraise the information available for the project in question when considering the actions in the review and assurance requirements at each stage gate.

It is recommended that projects within the Government's Major Project Portfolio (GMPP) complete independent assurance given the level of scrutiny, size and complexity of the projects. For smaller projects, review and assurance may be performed by peer teams, internal review panels, cross-delivery body or department.

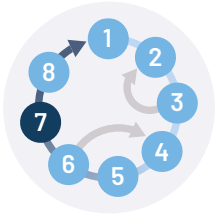
2 Cost estimating process requirements

Process requirements

Step 6: Review and assure

Area	ID	Requirement	Evidence	Owner
Preparing for Assurance	**6.1**	Obtain and review key relevant project documentation configured for the baseline under review including key changes since previous	Pack of key baseline documentation	Reviewers & Assurers
	6.2	Establish interviews, query and response processes, communications protocols and output requirements	Management and Governance Strategy	Reviewers & Assurers
	CHECK	**A clear body of evidence to underpin the cost estimate has been prepared for assurance purposes**		
Completing the assurance	**6.3**	Review statistical validity and arithmetic integrity of the cost estimate and the range parameters proposed	Cost Estimate	Reviewers & Assurers
	6.4	Review sources, provenance, checking, benchmarking, comparison, market testing and verification work	Cost Estimate Report and supporting evidence	Reviewers & Assurers
	6.5	Review coverage, extent of challenge work, assumptions, exclusions and boundaries between components such as works and property	Cost Estimate Report	Reviewers & Assurers
	6.6	Review structure, consistency, compliance with procedures and compatibility with other cost estimate components	Cost Estimate	Reviewers & Assurers
	6.7	Review link to scope, specification, requirements, objectives, strategies, design, plans, schedule and change control	Cost Estimate and Cost Estimate Report	Reviewers & Assurers
	6.8	Review treatment of provisional allowances, risks, uncertainty, opportunities, efficiencies and escalation	Cost Estimate and Cost Estimate Report	Reviewers & Assurers
	6.9	Review the treatment of 3rd party works, stakeholder interfaces, dependencies, planning constraints and undertakings	Cost Estimate and Cost Estimate Report	Reviewers & Assurers
	6.10	Review the project team's management and governance of the cost estimating process including treatment of previous recommendations	Cost Estimate Report	Reviewers & Assurers
	CHECK	**The assurance steps have been followed and recorded. Confirmation of findings at each assurance step have been recorded**		
Actions resulting from assurance	**6.11**	Discuss, agree and document findings, recommendations, implications and immediate actions with the project team	Assurance output, recorded in the Cost Estimate Report	Reviewers & Assurers & Project Team
	6.12	Incorporate recommendations into the cost estimate improvement plan, cost estimating processes and plans for future iterations	Project cost estimate improvement plan contained in the Cost Estimate Report	Reviewers & Assurers
	CHECK	**Actions resulting from assurance have been clearly documented and communicated**		

2 Cost estimating process requirements



Step 7: Project leadership sign off

The cost estimate is now complete and has been reviewed and assured. The SRO along with the rest of the project leadership approves and takes ownership of the cost estimate prior to making any onward project decisions.

Project progression

Sign off is fundamental at each stage gate to provide the decision makers with the confidence that project leadership (Accounting Officer, SRO and Project Director) have formally accepted the cost estimate and are suitably satisfied with the accuracy of the cost estimate given the stage gate.

To confirm progression through each stage gate, project leadership is required to complete the sign off document in Section 1 for the appropriate stage gate. In addition to project leadership, a representative from each of the project functions (Cost Estimating team, Design & Delivery team and Review & Assurance team) will sign the document to confirm they are happy with the accuracy of the cost estimate.

Whilst the sign off process remains consistent, there will be more information to assimilate as the project progresses and therefore more time should be allowed to complete the stage gate approval process, in line with Section 1 specification.

Size and complexity considerations

The project leadership sign off step does not differ dependent on the size and complexity of the project. All projects should go through the same sign off process.

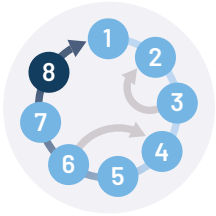
2 Cost estimating process requirements

Process requirements

Step 7: Project leadership sign off

Area	ID	Requirement	Evidence	Owner
Revisiting Purpose	**7.1**	Complete a statement on the 'Purpose of cost estimate' to reinforce the cost estimating objective.	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.2	Restate the principal solution attributes and quantities	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.3	Articulate the project stage gate	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	CHECK	**A clear statement provided to confirm the purpose of cost estimate with alignment to the project stage gate**		
Contextualising the cost estimate	**7.4**	Record the Cost Estimate Classification and Accuracy Parameters supporting the decision for confidence ranges	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.5	Record Critical Assumptions, Limitations and/or dependencies	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.6	Document risk calculations plus 'Material/ Critical' risks and Opportunities	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.7	Articulate the Affordability Threshold	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	7.8	State the AFC, and Upper and Lower envelope thresholds	Cost Estimate Report, supplemented by Leadership Sign off Document	Project Director
	CHECK	**All project attributes documented and the cost estimate fulfils the requirements of the gateway**		
Housekeeping	**7.9**	Record sign off date	Leadership Sign off Document	Project Director
	7.10	Record the cost estimate Version, Reference Number, File location and completion date.	Leadership Sign off Document	Project Director
	7.11	Capture the Names and Roles of signatories (using the sign off sheet in Section 1) including confirmation of authority to act in that role	Leadership Sign off Document	Project Director
	CHECK	**All corresponding documenting evidence compliant with the information management process**		
Accounting officer review and sign off	**7.13**	Sign off by the accounting officer is dependent on the steps outlined above being correctly undertaken and that any actions resulting from the assurance steps have been undertaken to the satisfaction of the team leadership. The cost estimate is now ready to inform the project sponsors and advise their further decisions.	Leadership Sign off Document	Senior Responsible Owner
	CHECK	**Accounting officer has reviewed and signed off the cost estimate**		
Sign off meeting	**7.14**	All the above to be organised ahead off and signed off within a dedicated sign off meeting	Leadership Sign off Document	Project Director
	CHECK	**Hold sign off meetings and record minutes for storage in project records in line with the information management process**		

2 Cost estimating process requirements



Step 8: Use the cost estimate to support decision-making

On sign off and acknowledgement of the cost estimate, the project leadership team is able to use the cost estimate to make strategic decisions.

In making these decisions, the team should consider:

- Interpretation of the reasonable expected costs, not only focussing on the most likely, but also the envelope of reasonable best and worst-case scenarios should be considered.
- How the reasonable cost envelope compares to the project affordability threshold.
- Consideration on the scale and probability of material/critical risks occurring, including the necessary mitigation measures.

Once these have been considered, the project leadership can make an informed decision on whether or not to progress with the project. Following this step and any stage gate approvals, the cycle starts again and the project returns to aligning on the outcomes, engaging with key stakeholders and establishing or confirming a suitably qualified and experienced team (Step 1) to refine the cost estimate.

Project progression

Whilst the overarching project decision process is consistently applied through the project stage gates, the decision makers must interrogate the cost estimate confidence as the project progresses through the stage gates. The cost estimate supports different objectives at each stage gate, although the integrity and reliability of the technical support it provides remains consistent.

Size and complexity considerations

The project decision step does not differ depending on project type. All projects should go through the same process.

Process requirements

Step 8: Use the cost estimate to support decision-making

Area	ID	Requirement	Evidence	Owner
Reflecting on the findings	**8.1**	Consider the findings of the report covering: ■ The cost estimate Purpose ■ Material/Critical Risks ■ Critical Assumptions, Limitations and Dependencies ■ Storyboarded Change (where relevant) ■ Recommendations and Next Steps ■ Lessons Learned	Leadership Sign off Document	Senior Responsible Owner
	CHECK	**Reflect on the cost estimate findings, supporting evidence and purpose of the cost estimate to inform the project decision**		
Interpreting the reasonable expected costs	**8.2**	Attributed specific focus to interpreting the reasonable expected costs covering: ■ The Anticipated Final Cost ■ The upper and lower uncertainty range ■ The project characteristics, cost estimate class and methodology used	Leadership Sign off Document	Senior Responsible Owner
	CHECK	**The impact of the uncertainty around the expected project costs has been understood**		
Affordability	**8.3**	Compare the Reasonable Expected Costs against the Affordability Threshold	Leadership Sign off Document	Accounting Officer
	CHECK	**A comparison has been undertaken to test the expected cost against an affordability threshold**		
Approve progression through the stage gate	**8.4**	Decide to approve or reject progression through the stage gate	Leadership Sign off Document	Senior Responsible Owner
	8.5	Record justification for decision to approve/reject progression	Leadership Sign off Document	Accounting Officer
	CHECK	**Formal decision on acceptance/rejection of the project documentation with justification**		
Investment up to the next stage gate	**8.6**	Agree investment for development of project definition up to the next stage gate	Leadership Sign off Document	Senior Responsible Owner
	CHECK	**Funding for the project up to the next stage gate agreed**		

Appendix

Appendix A – Glossary of Terms

Term	Definition
3-Point Cost Estimate	A cost estimate which gives three estimation figures: the reasonably optimistic case, the most likely and the reasonably pessimistic case.
Anticipated Final Cost	A cost estimate or forecast of the final cost which is compiled prior to the completion of the project which considers the risk exposure at the time the cost estimate is made using risk analysis.
Base Cost Estimate	The building blocks of an estimate (see IPA Level 0). Does not include risk or contingency.
Base Date	The date at which costs contained in the cost estimate are deemed current, such as Q1 2021.
Benchmarking	Market testing of outputs and costs to ensure parity and value.
Bottom-up Cost Estimating	Otherwise known as first principles cost estimating, a detailed analytic cost estimate produced by analysing the resources (e.g. labour, materials, equipment etc.) required in significant detail.
Contingency	The part of a budget to deal with uncertainties and risks. It may be allocated at project or programme level, but this does not necessarily imply that expenditure of contingency is delegated to the relevant project or programme manager.
Cost Breakdown Structure	CBS created and developed based on the WBS and can be used to create and allocate costs to each part of the building project.
Cost Estimate vs Anticipated Final Cost	Description of factors which may cause costs to change between the produced cost estimate and the delivered asset.
Expert Opinion	Quantification of risk models using the experience and knowledge of suitable people. Useful when addressing complex projects that require judgement for validation. Main criticism is the subjective nature (judgement of judgement) so cross-referencing independent appraisals is recommended.
FBC	Full Business Case.
First Principles	A cost estimating technique based on making cost estimates of every work package (or activity) in the work breakdown structure and summarising them to provide a total cost estimate of cost or effort required.
Level 0 Cost Structure	The minimum level of definition required to catalogue the components of a cost estimate – (see IPA example).

Appendix

Term	Definition
Material/Critical Risk	Risks that, should they be realised would impact the project in such a way that would compromise its continuity. These risks should be documented and handled separately, regularly reported to the project leadership and accounted for separately. Other terminology to address these risks are "blowout risks", "show-stopper risks", "tombstone risks" or "black swan events".
OBC	Outline Business Case.
Opportunity	A risk event that could have a positive effect on objectives.
Parametric Cost Estimating	A cost estimating technique that uses a statistical relationship between historic data and other variables (for example square meterage in construction, lines of code in software development) to calculate a cost estimate.
Project Information	All information filed relating to the project.
Provisional Sum	Assumed sum applied where no detail is known of cost usually rounded to say £50,000.00.
Risk	An event that may affect the schedule or delivery of the project, which may or may not occur.
Risk escalation	The transfer of ownership of a risk.
Risk Management	A systematic application of principles, approach and process to identifying, assessing and controlling risks to provide a disciplined environment for proactive decision-making.
Risk Register	A comprehensive, up to date, structured database of identified risks including detail such as the impact, likelihood, mitigation.
SOC	Strategic Outline Business Case.
Schedule	Normally referring to a Gantt style project or programme.
Third party or Outside party	Parties other than the client which may have an impact on the project such as landowners.
Threat	A risk event that could have a negative effect on objectives.
Uncertainty	The variability in the cost based on the variance in assumptions, or the lack of confidence in the data that informs the Point cost estimate calculation.
Range Cost Estimate	Probability distribution assigned to elements of Base cost estimate and risk analysis performed for each project. Monte Carlo based analysis to determine 'most likely' outcome.
Work Breakdown Structure	A WBS deconstructs an end-product into successive levels with smaller specific elements until the work is subdivided to the lowest level WBS components, or work packages, for which the cost can then be cost estimated.

Appendix

Appendix B – Useful documents

Infrastructure and Projects Authority: Cost Estimating Guidance:
A best practice approach for infrastructure projects and programmes
www.gov.uk/government/publications/cost-estimating-guidance

Infrastructure Projects Authority, IPA Mandate (2021):
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/949868/IPA_Mandate_2021.pdf

Infrastructure and Projects Authority: Setting up for success: The Importance of Front-End Loading (2020):
https://ipa.blog.gov.uk/2020/09/09/setting-up-for-success-the-importance-of-front-end-loading/

Infrastructure and Projects Authority: Principles of Project Success (2020):
www.gov.uk/government/publications/principles-for-project-success

HM Treasury: The Green Book: Appraisal and evaluation in central government (2020):
www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

HM Treasury: The Magenta Book: Central government guidance on evaluation (2020):
www.gov.uk/government/publications/the-magenta-book

National Audit Office, Lessons learned from major programmes (2020):
www.nao.org.uk/wp-content/uploads/2020/09/Lessons-learned-from-Major-Programmes.pdf

Infrastructure and Projects Authority: Best practice in benchmarking (2019):
www.gov.uk/government/publications/best-practice-in-benchmarking

Infrastructure and Projects Authority: People, Performance and Principles: The IPA's priorities for 2020 (2019):
https://ipa.blog.gov.uk/2019/09/24/people-performance-and-principles-the-ipas-priorities-for-2020/

Infrastructure and Projects Authority: The role of the Senior Responsible Officer (2019):
www.gov.uk/government/publications/the-role-of-the-senior-responsible-owner

Infrastructure and Projects Authority: The art of brilliance (2019):
www.gov.uk/government/publications/the-art-of-brilliance-a-handbook-for-leaders-of-transformation-programmes

HM Treasury: Accounting officer assessments guidance (2017):
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/645068/Accounting_officer_assessments_guidance.pdf

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Ministry of Defence: Defined pricing structure guidance (2017):
www.gov.uk/government/publications/defined-pricing-structure-guidance

Infrastructure and Projects Authority and HMT: Project Initiation Routemap (2016):
www.gov.uk/government/publications/improving-infrastructure-delivery-project-initiation-routemap

HM Treasury, Treasury Approvals Process for Programmes and Projects (2016):
www.gov.uk/government/publications/treasury-approvals-process-for-programmes-and-projects

Infrastructure and Projects Authority: Assurance review toolkit (2011):
www.gov.uk/government/collections/infrastructure-and-projects-authority-assurance-review-toolkit

Infrastructure and Projects Authority: Delivery Confidence Assessment (2011):
www.gov.uk/government/publications/guide-on-delivery-confidence-assessment

Office of Government Commerce: OGC Gateway process (2007):

Review 1: Business justification:
www.gov.uk/government/publications/ogc-gateway-review-1-business-justification-guidance-and-templates

Review 2: Delivery strategy:
www.gov.uk/government/publications/ogc-gateway-review-2-delivery-strategy-guidance-and-templates

Review 3: Investment decision:
www.gov.uk/government/publications/ogc-gateway-review-3-investment-decision-guidance-and-templates

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