Improving Infrastructure Delivery: Project Initiation Routemap
Risk Management Module
Infrastructure and Projects Authority and Infrastructure Client Group

Infrastructure shapes the way we live and is the foundation on which a successful economy is built. Transport links get us where we need to be, energy systems power our homes and businesses, and digital networks allow us to communicate. It is vital to improving our quality of life and integral to the creation of a vibrant economy.

The government is committed to delivering the high-quality infrastructure that the UK needs to build and sustain a more productive economy. To achieve this the government has committed to spend £100 billion on infrastructure this Parliament. This investment will create jobs and raise productivity.

To help realise the benefits from this investment the government created the Infrastructure and Projects Authority (IPA) as the government’s centre of expertise for project development and delivery. The IPA’s Cost Review and the NAO report on delivering major government projects identified the early stages of projects as a common source of failure on infrastructure projects. The original Project Initiation Routemap (Routemap) helped address these challenges and this update, which expands to include all construction projects and adds new modules, will enhance that work, helping provide the UK with the infrastructure it needs to thrive.

The Infrastructure Client Group demonstrates the value of effective collaboration between government and industry to support the development and exchange of best practice to improve delivery. Initially brought together by government to support the work of the Infrastructure Cost Review, the membership of this group is representative of the major infrastructure clients. It has been instrumental in setting a common agenda for change and supports a programme of activities and applied knowledge transfer across the public and private sectors. The success of this initiative has been made possible by the continued and valuable support from industry and academic partners.

Preface

Since the launch of the Routemap over 20 major projects across the transport, water, flood defence and energy sectors have undergone a Routemap assessment, helping to drive their successful delivery. Yet there is still work to do as projects continue to face challenges.

The recent NAO report on Delivering Major Projects in Government (2016) and the Infrastructure UK Cost Review (2010) both noted that projects continued to encounter problems in their early stages - and, particularly, that projects often publically announced timelines and costs before plans have been properly tested. The report also identified a lack of project capability especially at portfolio level. The Routemap will help address these challenges by offering support on strategic decision making during project initiation based on the latest thinking and knowledge acquired from delivery of Major Projects applied in a series of structured exercises. It enables sponsors and those responsible for project delivery to properly align complexity with the necessary capabilities and other enhancements to ensure a more successful outcome.

The Project Initiation Routemap is a product of government working collaboratively with industry and the University of Leeds, through the Infrastructure Client Group. Building on its success with economic infrastructure, the Routemap is being expanded to cover all construction projects and longer-term transformation projects as well. As part of this expansion two new modules are being added, for Risk Management and Asset Management alongside the existing topics on Requirements, Governance, Procurement, Execution Strategy and Organisational Design & Development. The new Risk Management Module covers the best practice in how to develop the project’s approach to risk management during the initiation phase. The Asset Management Module provides advice on how to structure and manage the interaction between the project team and the corporate asset management function to successfully deliver project outcomes.

Tony Meggs
Chief Executive of the Infrastructure & Projects Authority

Andy Mitchell
Chair of the Infrastructure Client Group

June 2016
**Introduction:** Align for Success - Risk Management

The Project Initiation Routemap (Routemap) is an aid to strategic decision-making. It supports the alignment of the sponsor and client capability to meet the degree of challenge during initiation and delivery of a project*. It provides an objective and structured approach to project initiation founded on a set of assessment tools.

The assessment tools help determine:

- The context and complexity of the delivery environment;
- The current and required sponsor, client, asset manager and market capability;
- Key considerations to enhance capability where complexity-capability gaps are identified.

The Routemap provides further diagnostics on addressing common capability gaps that typically need to be enhanced, such as blurred governance structures, or lack of alignment between benefits and requirements. These areas are explored in more depth in a number of Align for Success modules.

The purpose of each Align for Success module is to help:

- Gain a greater understanding of the complexity-capability results;
- Identify and analyse options to better align complexity-capability;
- Plan for successful achievement of desired outcomes;
- Assure enhancement plans during implementation.

Application of the Risk Module aims to optimise project outcomes through considering risk adequately in decision making and putting in place appropriate governance and processes to retain the value proposed through delivery.

*Throughout this guide the term project is used to mean both project or programme.
Introduction: Whether to use the Risk Management Module

**Typical findings relating to Risk Management**

If findings from your complexity-capability assessment identify any of the following issues (or similar ones) then this Align for Success module on Risk Management may help. Use the Considerations tables that follow to diagnose enhancements that may be required.

Through the life of the project there is little provision for or anticipation of potential scope changes caused by changes to external factors.

The accountability for risk does not match the organisation’s capability or appetite to manage the risk.

Contract incentives appear misaligned to sponsor’s requirements or Client Model, which may mean the supply chain performs contrary to expectations.

Lack of accountability, as people (or organisations) are able to make decisions for which they are not fully accountable.

It is not clear how the deliverables align to or contribute to the expected benefits, therefore whether or not the totality of the benefits will be realised by the project.

There is likely to be conflict or tension between the participating organisations as the project is not fully aligned with all their individual objectives.

There is a disjointed relationship between sponsor, client, asset manage and supply chain.

A client model (e.g. alliancing) is being proposed that the client/supply chain organisations do not have previous experience of applying successfully, therefore may need capabilities they do not currently have.

**Modules that help**

<table>
<thead>
<tr>
<th>Risk Management</th>
<th>Asset Management</th>
<th>Requirements</th>
<th>Governance</th>
<th>Execution Strategy</th>
<th>Organisation</th>
<th>Procurement</th>
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<tbody>
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**Tip:**

This module should not be used in isolation. It is assumed you have already completed the Complexity - Capability Gap in the Project Initiation Routemap handbook and have identified issues with Risk Management.

- Primary module for help
- Related module for help
Why Risk Management Matters
Risk is defined as the uncertainty of outcome, whether positive opportunity or negative threat, of actions and events. The risk has to be assessed in respect of the combination of the likelihood of something happening, and the impact which arises if it does actually happen. Risk management includes identifying and assessing risks (the “inherent risks”) and then responding to them. The Orange Book-Definition of risk

Why is good Risk Management important?
Effective Risk Management is critical to project success. Analysis of common causes of project failure by the NAO highlight this as a recurring theme:
- Uncertainty about the size, timescale, ambition and complexity of projects can put at risk their successful delivery
- More risky and uncertain projects have entered this portfolio since 2012. The group concerned most, is the 35% of projects due to deliver in the next 5 years.

The NAO emphasises the importance of effective risk management in their 2011 Good Practice report ‘Managing Risks in Government’ alongside the guide ‘Initiating Successful Projects’

Characteristics of good Risk Management
Effective Risk Management should ensure that:
- There is clarity of the objectives of the project and the allocation of risk between sponsors, stakeholders and supply chain is well understood.
- The project leadership recognise the importance of risk management and actively promotes its implementation and use at all levels of the project.
- Senior managers challenge the risks to the project and understand the organisation’s risk appetite.
- A formal risk process exists, and is used by the organisation to support design and delivery activities.
- The project has a comprehensive understanding of its assumptions, uncertainties and risks, and can make a reasonable quantitative assessment of their impacts on cost and schedule forecasts.
- A consideration of risk - both quantitative and qualitative - is used to inform decision making.
- Risk management is recognised by internal and external stakeholders as an effective component of the assurance framework.
- Inputs and outputs of quantitative risk assessments are shared with sponsors and funders to provide confidence on delivery commitments.

Tip:
The implications of not incorporating robust risk management into projects at the initiation stage are explored in the NAOs 2013 report *Over-optimism in government projects*. 
Why Risk Management Matters: Risk Module Overview

**Introduction**

Why Risk Management Matters

**Considerations**

Supporting Material

Final Check

Future Guidance

**CONTEXT & UNDERSTANDING**

Sponsor – Client

Market – Client

**ASSESSMENT & QUANTIFICATION**

Reference Class Forecasting

Quantitative Risk Assessment

**MANAGEMENT & MITIGATION**

Initiation

Delivery

1. Risk Identification & Mapping
2. Behaviours & Capability Analysis
3. Assumptions & Risk Based Decisions
4. Risk Measurement & Estimation
5. Risk & Contingency
6. Incentives
7. Control in Delivery

From the Delivery Environment Complexity Analytic, understand Project Complexity as an indicator of key threats and opportunities.

Cross check against risk checklist to ensure all categories of risk are understood.

Carry out analysis to examine maturity of both Client/ Sponsor and Client/ Market relationships. Immature Client/ Sponsor relationship may constrain risk allocation, organisation and governance design. Immature Client/ Market relationship may impact technical development and confidence in delivery.

Understand the maturity of the project and the robustness of early decision making. Recognise that ‘locking down’ the early definition stages has a significant effect on reducing the range of outcomes. Test any assumptions thoroughly.

Use Top-Down and Bottom-up approaches to develop a comprehensive assessment of risk and uncertainty. Recognise that both Top-Down and Bottom-Up approaches are valid, but best applied at different points in the life cycle.

Develop a robust view of Risk Exposure and Contingency.

Recognise the key distinction between Risk (Forecast) and Contingency (Budget). Recognise that different models for contingency management and funding are available.

Consider the objectives of the key stakeholders, the alignment of those objectives to those of the Sponsor and the influence of each party to manage risk. Where necessary consider the introduction of new incentives to improve alignment of the objectives of all parties.

Put in place the controls necessary to manage uncertainty and risk throughout the life of the project. Consider the 4 pillars:
- Defining Boundaries
- Informing Decisions
- Building Confidence
- Protecting Value
Considerations
Considerations

This section lists a series of questions that might be considered when validating an existing risk management strategy or testing the design of a new one. Considering these questions helps the project team to form an effective risk management strategy and target areas for enhancement.

Prior to asking these questions, the output from the Routemap capability and complexity assessments should be reviewed for any factors relating to risk management.

**Pillars of Risk Management**

Risk Management can save time, improve quality and reduce the cost of achieving an agreed outcome. The very process of considering the risks works to bring the Client, Asset Manager, Market and Sponsor closer together in understanding the activity to deliver the programme objectives. The structure of this module will guide sponsors and clients through the 4 pillars of risk management to reflect on and develop their approach to risk management.

To engage in effective risk management the sponsor and client need to understand the following:

- **Pillar 1 - Defining the boundaries**
  - The context within which the project is set

- **Pillar 2 - Informed decision making**
  - How to reflect uncertainty in the decision making process and understanding the impact of those decisions on overall risk exposure

- **Pillar 3 – Building Confidence**
  - How to build the confidence of internal and external stakeholders

- **Pillar 4 – Protecting Value**
  - The control mechanisms to effectively allocate and mitigate risk

Tip:

It may be helpful to review the Delivery Models in the supporting material (Risk and Contingency II) prior to using the following considerations tables.
**Considerations: Defining the Boundaries**

Understanding the context within which the project is set, and will develop, is central to identifying the strategic risks to its success. Clarifying where the project starts and finishes is part of this.

<table>
<thead>
<tr>
<th>Key prompts</th>
<th>Considerations</th>
<th>What may help</th>
</tr>
</thead>
</table>
| **Stakeholders** | - Who are the significant stakeholders in the project?  
- What is the nature of their vested interests in the projects? e.g. is it for the project, against or neutral? | [1] Institution of Civil Engineers 2015 publication 'Global Risk Assessment and Strategic Planning' |
| **Dependencies** | - What dependencies exist that are of significant importance to the project’s success?  
- Are there other projects/operations that this project is dependent upon?  
- Are other projects/operations dependent on this project? | Supporting material Risk Identification & Mapping |
| **Commitments** | - What early public commitments and announcements have been made?  
- Have these been informed by an assessment of risk?  
- At what ‘level’ have these been made? E.g. local, national, public, internal, stock market | Supporting Material ‘Assumptions & Risk based decisions’ |
| **Assumptions** | - What are the projects significant assumptions? (Cost benefit)  
- How significant will the impact be if they are not true?  
- How likely are they to be true?  
- What degree of control does the project have on these? | Supporting material Risk Identification & Mapping |
| **Objectives** | - Have the project’s objectives been articulated by the sponsors and client?  
- Have these been tested?  
- How sensitive are the objectives to changes in the external environment?  
- Do they take account of strategic risks and are they understood? | Requirements module – Three step approach to assessing requirements p.14. |
| **Aligned and linked** | - Are the objectives aligned across sponsors, client and stakeholders?  
- Are the requirements and scope linked to the sponsors objectives?  
- Have the risks to the project objectives been considered in the broadest terms (Political, Environmental, Economic, Technological, Societal, Legislative) | PESTLE techniques |
| **Benefits** | - Have the objectives for the Operating Phase being defined.  
- Is there a clear link through the project inputs, outputs, and operational performance to the delivery of benefits. | Requirements module – Benefits mapping p.16 |

*Note: Further Guidance contains details and links for each document reference - Ref [1]*
Considerations: Informed Decision Making

During project initiation critical decisions will be required at the time when the greatest uncertainty exists and governance processes are immature. Ensuring that uncertainty is reflected in the decision making process, and that the impact of those decisions on the overall risk exposure is understood, is critical to later success.

### Key prompts

#### Decisions
- Is uncertainty considered as part of decision making process? (e.g. Does the Business Case make adequate provision for uncertainty)?
- When options are compared, is relative uncertainty recognised? (e.g. Are less mature options risk adjusted to reflect lower levels of definition)?
- Are the risks to achieving the project’s overall objectives considered when making decisions? (e.g. Are early decisions informed by an assessment of the risk to the operating phase and the delivery of benefits)?

#### Governance
- Has the project governance been designed with consideration of risk exposure?
- Does the project governance establish accountability for the management of risk between sponsor, client and the market?
- Is the delegation of authority clear and sufficient to enable the management of risk by those accountable?
- Do governance processes require that risk exposure is considered when making decisions?
- Does the project governance require the reporting of risk exposure to the governing bodies?
- Is the project management team/executive held to account for the management of risk by the project sponsor?

### What may help

See supporting material Assumptions & Risk Based decisions

ISO 31000 Risk Management

Governance Module

### Tip:

Decisions made without an appreciation of the change in risk will be unreliable

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*Note: Further Guidance contains details and links for each document reference - Ref [2]*
### Considerations: Building Confidence

A key role of risk management is to build the confidence of internal and external stakeholders. During the project initiation stage, risk management enables sponsors to be confident that the parties involved are capable of dealing with uncertainty and have plans to mitigate the impact of risk in place.

<table>
<thead>
<tr>
<th>Key prompts</th>
<th>Considerations</th>
<th>What may help</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capability</strong></td>
<td>Are sponsors risk-aware and comfortable dealing with uncertainty?</td>
<td>Supporting material Behaviours and capability analysis</td>
</tr>
<tr>
<td></td>
<td>Is there a common level of awareness and understanding of risk between sponsors and client?</td>
<td>Organisational Design and Development Module – Client Model Decision Tool p16-17</td>
</tr>
<tr>
<td></td>
<td>Is risk thinking an inherent part of project planning and evaluation?</td>
<td>Procurement module – Risk Allocation p25</td>
</tr>
<tr>
<td></td>
<td>Does the project leadership promote the open and honest discussion of risk and encourage risk management as core business?</td>
<td>[3] Institute of Risk Management 2016 publication ‘Thought Leadership - Risk Culture’</td>
</tr>
<tr>
<td></td>
<td>Does the project board or executive committee routinely discuss risk exposure?</td>
<td>[4] HMT Green Book supplementary guidance</td>
</tr>
<tr>
<td></td>
<td>Do the cultures of the organisations involved support active risk management?</td>
<td>Supporting Material Risk Measurement &amp; Estimation</td>
</tr>
<tr>
<td></td>
<td>Have all the parties with responsibility for management of risk been identified? (e.g. sponsors, clients, developers, contractors, operators, maintainers and funders).</td>
<td>[5] Ciria 747 Engaging with Risk</td>
</tr>
<tr>
<td></td>
<td>Do the organisation involve have in-house expertise in risk management or is this outsourced?</td>
<td>[6] ISO31010:2009 Risk Management – Risk Assessment Techniques</td>
</tr>
<tr>
<td></td>
<td>Have the organisations involved assessed their own risk management and risk valuation capabilities, perhaps using a maturity model?</td>
<td></td>
</tr>
</tbody>
</table>
**Considerations: Protecting Value**

Understanding and controlling uncertainty and risk – and acting to mitigate it – is critical to the successful delivery of projects from the earliest stage. This behaviour begins during the initiation and development stages, and the direction set here can greatly influence the success of delivery. Appropriate risk allocation and effective control mechanisms are significant contributors to protecting project value.

**Key Prompts**

- **Risk allocation and appetite.**
  - Is the level of risk associated with the project understood by all parties involved in delivering it?
  - Does the sponsor understand the ability and desire of the other organisations involved to manage and bear risk?
  - Is there the potential for misalignment between risk appetite and capability, between sponsors, funders, client, and deliverer?
  - Has the allocation of risk been properly considered?
    - Is it understood which risks would be uneconomic to allocate to a particular party. (e.g. risks associated with operational assets might reside best with the asset owner.)
    - Is it understood which risks the sponsor might retain to stabilise the project and improve VFM?
  - Does the procurement and contracting strategy clearly allocate the risk to the parties best placed to manage it?
    - Inappropriate risk transfer may result in a risk premium being paid – there may be more efficient options
    - Does the market have appetite for the risk allocated in the procurement strategy? - there may be less risky returns elsewhere.
  - Do reputational and commercial incentives align with the allocation of risk?

- **Processes**
  - Is there a project board or executive member accountable for the effectiveness of the risk management process?
  - Is a recognised Risk Management methodology being used?
  - Is risk management a part of a comprehensive and robust set of control processes?
  - Does routine reporting include extent, nature and changes in risk profile?
  - Is contingency budget allocated with reference to risk exposure?
  - Is there robust contingency management process linked to the control of change?
  - Is the risk mitigation programme adequately budgeted?
  - Do stage gates challenge the management of risk (threats and opportunities)?
  - Are suitable KPIs in place to measure the risk management process and changes in risk exposure?

**What may help**

- Governance Module.
- Route Map Procurement module.
- See supporting material Incentives
- Supporting material Control in Delivery
- Supporting material Risk & Contingency
- [8] Institute of Civil Engineers ‘Risk Analysis & Management for Projects’ framework published 2014
- [9] Ciria SP125 Control of Risk - A guide to the systematic management of risk from construction

**Tip:** Understanding the risk from each stakeholder’s perspective gives a valuable insight to the project

*Note: Further Guidance contains details and links for each document reference - Ref [7,8,9]*
Supporting Material
During the analytics phase of the Routemap the project team will complete the Delivery Environment Complexity Assessment (DECA) which gives the distribution of project complexity (high, medium, low) across 12 categories. The complexity profile from the DECA can be a useful tool to indicate potential sources of risk and cross check a strategic risk register. As well as mapping the sources of risk it shows whether the dominant risk characteristics sit within the client/sponsor or client/market relationships. Understanding the balance of risk between these relationships is key in understanding, estimating and mitigating risk effectively.

The project team will be issued with a Strategic Risk Map (right) which is colour coded to show the areas of high, medium and low risk for their specific project, similar to the example to the right. This can be used to work through the rest of the supporting material.

**DECA**

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>PROFILE</th>
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<tbody>
<tr>
<td>Stability</td>
<td>M</td>
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<tr>
<td>Stakeholders/Influencers</td>
<td>H</td>
</tr>
<tr>
<td>Interfaces/relationships</td>
<td>H</td>
</tr>
<tr>
<td>Requirements &amp; Benefits Articulation</td>
<td>L</td>
</tr>
<tr>
<td>Dependencies</td>
<td>H</td>
</tr>
<tr>
<td>Financial Impact &amp; Value for money</td>
<td>H</td>
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<tr>
<td>Strategic Importance</td>
<td>H</td>
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<tr>
<td>Interconnectedness</td>
<td>M</td>
</tr>
<tr>
<td>Execution Complexity</td>
<td>M</td>
</tr>
<tr>
<td>Range of disciplines &amp; skills</td>
<td>M</td>
</tr>
<tr>
<td>Extent of change</td>
<td>M</td>
</tr>
<tr>
<td>Organisational capability</td>
<td>M</td>
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</tbody>
</table>

**Chart continued on page 17**

**Tip:**

Insurance can provide a means of mitigating risk exposure. For instance, the use of owner-controlled insurance policies for construction risk.
Supporting Material: Risk Identification & Mapping

From the DECA map on the previous page you can begin to explore the relationship between the project complexity and the strategic risks, the table below provides an extensive list of common sources of strategic risks linked to each DECA category. This context can provide a focus for the enhancement planning actions.

<table>
<thead>
<tr>
<th>Sources of Risk</th>
<th>Client/Sponsor Relationship</th>
<th>Client/Market Relationship</th>
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<tbody>
<tr>
<td></td>
<td>Strategic importance</td>
<td>Stakeholders/Influencers</td>
</tr>
<tr>
<td>Defining the investment need and business case</td>
<td>Obtaining Permissions &amp; powers to construct and operate</td>
<td>Specifying the sponsors requirements</td>
</tr>
<tr>
<td>Responding to government and external environment</td>
<td>Managing corporate affairs and public relations</td>
<td>Realising the benefits</td>
</tr>
<tr>
<td>Developing policies and strategic plans</td>
<td>Complying with legal regulatory and tax frameworks</td>
<td>Defining the functional specification</td>
</tr>
<tr>
<td>Managing results and out turn confidence</td>
<td>Managing insurance warranties and third party compensation</td>
<td>Specifying the engineering requirements and standards</td>
</tr>
<tr>
<td>Providing leadership and motivational alignment</td>
<td>Managing project controls and core processes</td>
<td>Developing policies and strategic plans</td>
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<tr>
<td>Managing resources and collaborative partnerships</td>
<td>Managing risk, governance and assurance</td>
<td>Managing insurance warranties and third party compensation</td>
</tr>
<tr>
<td>Managing results and out turn confidence</td>
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</table>

**Tip:**

Sponsor, Client, Asset Manager and Supply-chain should work to reduce (mitigate) the risk exposure. The “4Ts” (Terminate, Transfer, Treat, Tolerate) provide a useful model for designing risk mitigation plans.
Supporting Material: Assumptions & Risk Based Decisions

A core pillar of effective risk management on major projects is the relationship that risk has with the decision making process. It is useful to visualise the ‘spine’ of a project around which risks, uncertainties and assumptions typically exist.

It is only possible to move down this spine, and therefore progress the project by taking decisions, making assumptions, or accepting ranges of uncertainty. The level of risk at any given time in the lifecycle is defined by how strong or weak the bridges between the various steps are and how significant the impact of any uncertainty is. Any estimate of cost or time will, by necessity, have made assumptions about all the uncertainties and variables throughout the spine. It is the role of the risk analysis to express how exposed the project is to these assumptions failing to hold true.

The higher up the spine an uncertainty is the more significant its potential impact on the estimate will be so it is crucial that projects accurately identify where their requirements and scoping assumptions are exposed to variation.

Examples of some crucial early decisions are:
- Setting budgets.
- Setting benefit expectations.
- Committing to schedule milestones.
- Making commitments to stakeholders.
- Designing project team organisation structure.
- Designing project governance regime.

It is the role of the risk analysis to express how exposed the project is to these assumptions failing to hold true.

Projects exist to deliver a vision and a set of objectives and benefits

The benefiting body or end user defines the outcomes that will achieve this vision in a set of User Requirements

In response to which is developed the project Scope

Which will be designed and delivered according to a particular Methodology

Which will consume resources to pursue: Cost/Time

Key:
- Range
  Range of outcomes which might result from each phase
- Arrow
  The decision making activity crucial at each phase, which typically moves the project from one state to the next
- Locked
  Decisions made, Assumptions locked
- Unlocked
  Decisions made, but Assumptions NOT locked

A typical project progressively locks down uncertainty at each stage. Where early stage uncertainty is not sufficiently locked, e.g. because of poorly defined benefits or user requirements, significant unexpected variation can remain (pink triangle).
Supporting Material: Assumptions & Risk Based Decisions

A project aims to ‘lock down’ levels of uncertainty at each stage in its lifecycle. This is most difficult to achieve on novel or highly complex schemes where a lack of available benchmarking or reference class data makes achieving scope certainty more arduous. It is crucial the estimates for cost and time are prepared with a clear strategy for dealing with all residual uncertainties to avoid the concealed exposure shown on page 18.

A potential project’s journey down the spine through its lifecycle, using the gateways between stages to confirm uncertainties have been ‘locked down’. In this case a QRA would first be conducted at the end of concept design with further certainty being established before setting the final estimates at the end of detailed design.
Supporting Material: Behaviours and Capability Analysis

It is important to begin to draw together assessment of risk (valuing) and the ability to mitigate it (maturity). This will produce a snapshot of the current risk position, or risk profile, at a given time in the project’s development. The supporting material below considers maturity and what to consider. It’s important to repeatedly take this snapshot as the project develops.

Using the information from page 16 on sources of risk and the DECA assessment you should be able to identify the sources of the most significant risks to your project. The tables below give some considerations based on this profile and the information from the gap analysis.

<table>
<thead>
<tr>
<th>Major area for risk mitigation:</th>
<th>Client/Sponsor Relationship</th>
<th>Client/Market Relationship</th>
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</thead>
<tbody>
<tr>
<td>High Capability</td>
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</tr>
<tr>
<td>Unbalanced capability – unwillingness from Sponsor to delegate risk and contingency management will constrain optimum allocation/mitigation of risk. Strengthen project governance and delay making key decisions around KPIs and incentives.</td>
<td>Mature Combined capability – use the complexity of the project to drive the approach to risks management. Avoid complacency in this section as the capabilities of both parties will need to evolve over the project life cycle.</td>
<td>Mature Combined capability – use the complexity of the project to drive the approach to risks management. Avoid complacency in this section as the capabilities of both parties will need to evolve over the project life cycle.</td>
</tr>
<tr>
<td>Immature combined capability – limits the ability to identify, value and allocate risks. Focus on building capability before taking decisions on requirements, governance &amp; contingency management.</td>
<td>Unbalanced capability – the corporate governance of the sponsor potentially constraining the project’s ability to manage risk. Focus on building capability before taking decisions on requirements, governance &amp; contingency management.</td>
<td>Unbalanced capability – Markets limited capability to accurately estimate risk and understand their own risk appetite will be limiting client decision making. Strengthen market capability look at a different commercial approach to draw broader market and test before making key decisions around risk allocation through commercial approach.</td>
</tr>
</tbody>
</table>

**Key**
- High level of Client/Sponsor or Client/Market Capability
- Medium level of Client/Sponsor or Client/Market Capability
- Low level of Client/Sponsor or Client/Market Capability
Supporting Material: Risk Measurement & Estimation

Having understood project complexity, capability and project assumptions, the project team needs to quantify the risk exposure and inform contingency. There are a number of ways developing an understanding of the risk exposure. The reliability of these results will depend on the maturity and depth of knowledge on the programme.

**Reference Class Forecasting (RCF)** is a ‘top down’ approach which uses past project results and relates them to the project in question. Statistical methods are used to analyse large samples of projects in order to provide a reliable reference class which is relevant to the project circumstances. Often, different reference classes are required to relate to different parts of project scope.

**Quantitative Risk Assessment (QRA)** is generated ‘bottom up’ derived from identifying specific risks, costing their impacts by various ranges, should they occur and building them into a model of how we perceive the ‘project’ might work out.

At any point in the project’s development one approach will dominate. However an understanding of the other should be maintained. Additionally, Stress Testing of credible cases to help ‘triangulate’ the view of risk exposure on project can be used.

The point of changing from a top down RCF to a bottom up risk model will be determined by the degree of definition of the project and the organisational maturity (process and capability). The more mature an organisation the earlier the transition point. As a minimum, however, this should not be earlier than optioneering, when there are still significant options open for a meaningful bottom up risk model.

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**Tip:**

Optimism Bias is a specific form of Reference Class Forecasting based on data from past projects which is described in HMT Green Book.
Supporting Material: Risk Measurement & Estimation

The figures below illustrate examples relevant to the concepts on page 21. At the outset of the project, there will be many uncertainties and opportunities for the project to evolve along a number of different routes. At this stage RCF approach is more appropriate. As the project nears completion, the ‘bottom up’ approach will be more applicable, as there will be detailed information available about most aspects and few remaining uncertainties.

Example 1 – High Level of Client/Sponsor or Client/Market Capability

Key points

- The high combined maturity of the organisations involved meant that:
  - The switch from RCF to QRA could happen sooner.
  - The estimated cost range reduced more quickly as a result of improved accuracy from QRA.

Example 2 – Low Level of Client/Sponsor or Client/Market Capability

Key points

- The low combined maturity of the organisations involved meant that:
  - The switch from RCF to QRA was unable to take place.
  - The estimated cost range did not reduce and therefore the business case was not sufficiently robust as more accurate QRA was not undertaken.

Tip:

- The accuracy with which you can estimate and value risk increases over the project lifecycle, denoted by reducing bars on the schematics. It’s important to note that although overall uncertainty in cost estimates reduces project costs themselves may increase as estimated risk items are incorporated into the project baseline cost.
Supporting Material: Risk and Contingency (i)

Once risk exposure has been determined, allocated and mitigated, a specific budget, known as a contingency, should be established to guard against the impact of that risk.

Forecasts include an assessment of Risk Exposure typically assessed through QRA. Budgets should be set to include an element of contingency i.e. the funds available to cover risk events.

Budget and Forecast
It is important to draw a fundamental distinction between Budget and Forecast. While projects typically have limited funds with which to deliver their objectives, a genuine assessment of anticipated final cost will vary over the life of the works. Controls should be set up to maintain fixed Budgets but allow Forecasts to properly reflect changing circumstances: emerging issues, changing delivery performance and risk.
Contingency Management Models

Example 1: Contingency allocated in accordance with exposure
- Budget led contingency allocation based on categories of risk owned by Client and Sponsor.
- Contingency allocation sized against the risk exposure of each party.
- Allows stretch target for risk reduction for one or more parties, by allocating contingency less than assessed exposure.

Example 2: Contingency allocated according to overall project confidence levels
- Forecast led contingency allocation based on risk assessed levels of confidence.
- Likely to be adopted where sponsor and/or client are risk mature (or plans are in place to become so), risk allocation is clear and a well-developed QRA is available.

Example 3: Contingency allocated according to overall project confidence levels
- An organisation may benefit from maintaining a 'portfolio' contingency to cover extra-ordinary risks.
- This approach can accommodate a range of different project models within an overarching framework.
- Managing risk and holding contingency at the portfolio level can be more efficient than providing each project with contingency to cover common risks.

Supporting Material: Risk and Contingency (ii)

Point Estimate

P95, P80, P50 describe the confidence in achieving a certain outcomes. For instance a "P80 Cost" means that 80% of the possible cost outcomes are forecast to below that number.
Supporting Material: Risk & Contingency Allocation

The allocation of the contingency budget can best be informed by first establishing clear accountability for the management of risk within the tiers of the project’s governance structure (refer Governance Module). Financial authorities and contingency budgets that are proportionate to the risk exposure managed at each level can then be set (see example below).

That risk allocation provides significant further benefit by enabling an informed debate as to which risks are to be placed with the supply chain for management when defining the procurement strategy (see Procurement Module) and contract model. Explicitly describing that risk allocation in the contract has proved valuable to projects such as Crossrail.

### RISK EXAMPLE

<table>
<thead>
<tr>
<th>Project Risks</th>
<th>CONTINGENCY EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Contractor performance delivery to cost and schedule</td>
<td>• Budgets at Project level:</td>
</tr>
<tr>
<td>• Contract Design</td>
<td>• Delivery Budgets for known cost items</td>
</tr>
<tr>
<td>• Interfaces internal to Project (scope, design, schedule, logistics)</td>
<td>• Contingency for Project Risks</td>
</tr>
<tr>
<td>• Failure to provide timely and accurate information to the Contractor</td>
<td>• Set as stretch target (typical e.g. 90% of remaining forecast);</td>
</tr>
<tr>
<td>• Local interfaces with third parties</td>
<td>• Project Managers responsible for managing forecast down to budget</td>
</tr>
<tr>
<td></td>
<td>• Project Managers have authority to spend subject to scheme of authorities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area Risks</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interface between Projects within Area (scope, design, schedule, logistics)</td>
<td>• Budgets at Area level include:</td>
</tr>
<tr>
<td></td>
<td>• Contingency for Area Risks</td>
</tr>
<tr>
<td></td>
<td>• Set as stretch target</td>
</tr>
<tr>
<td></td>
<td>• Area Directors responsible for managing Forecast down to Budget</td>
</tr>
<tr>
<td></td>
<td>• Area Directors have authority to spend subject to scheme of authorities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programme Risks</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Requirements, specifications, scope changes</td>
<td>• Budget at Programme level includes:</td>
</tr>
<tr>
<td>• Employers Design</td>
<td>• Contingency for Programme Risks</td>
</tr>
<tr>
<td>• Interface between Areas (scope, design, schedule, logistics)</td>
<td>• Programme Budget set as stretch target</td>
</tr>
<tr>
<td>• Failure to provide timely decisions or assurance</td>
<td>• Area Directors objective to manage Risk to within Budget</td>
</tr>
<tr>
<td>• Systems integration</td>
<td>• Accessed by application to Programme Change</td>
</tr>
<tr>
<td>• General interface with third parties</td>
<td></td>
</tr>
<tr>
<td>• Political, Economic, Social, Technological</td>
<td></td>
</tr>
<tr>
<td>• Catastrophic risks</td>
<td></td>
</tr>
<tr>
<td>• ‘Extra-ordinary’ delivery risks with significant impacts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Board Risks</th>
<th>Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Impact of external events not connected to the works</td>
<td>• Budget at Board level includes:</td>
</tr>
<tr>
<td>• Failure of Executive</td>
<td>• Remaining contingency available within overall Control Budget</td>
</tr>
<tr>
<td>• Strategic relationships with Sponsors, stakeholders and partners</td>
<td>• Board Budgets set as stretch target</td>
</tr>
<tr>
<td>• Cost overrun in excess of all other funded contingency</td>
<td>• Programme Directors objective to manage Risk to within Budget</td>
</tr>
</tbody>
</table>

Informs

When defining risk exposure it may be helpful to refer to the factors considered to contribute to optimism bias, set out in table 3 of the HMT Supplementary Green Book Guidance.
Supporting Material: Incentives

Incentives drive behaviours and can be an effective form of risk management. However, it is often the case that the parties delivering a project are subject to different incentives – misaligned incentives create a significant source of risk. Incentives need not just be hard financial incentives; often politics or risk to reputation provide equally strong incentives. Incentives might be used to align parties around strategic objectives or to focus effort on completing a specific task. In each case, by considering the relationship between objectives, risk and the promoted behaviours, the value of an incentive can be tested.

The importance of understanding incentives is widely recognised - the Infrastructure Client Group’s ‘Alliancing Code of Practice’ highlights incentives as a powerful means of promoting collaboration by aligning behaviours. By mapping incentives relative to the delivery of the Business Case, owned by the Sponsor, potential conflicts can be identified (see below the size of the circle representing influence). In response, changes to Execution Strategy (see separate module) can be made to promote greater alignment. Keeping the incentive map under review as the project progresses and relationships change is vital to manage risk exposure.

1. The sponsor describes the optimum balance between long-term and short-term benefits, and long-term and short-term costs in the form of the Business Case (often expressed as a benefit cost ratio) - represented as the centre of the cross-hairs [Figure 1].

2. The Business Case is delivered through cooperation between the sponsor, client, operator and supply chain. Each party has an influence of over the risk to the Business Case - indicated by the area of each circle.

3. Often, competing priorities, and commercial pressures, polarise individual attention on to either short-term or long-term gain, and away from the delivery of the Business Case – shown by the divergent points on the graph.

4. An incentive provides a means to align behaviour around the collective management of risk to the Business Case — indicated by the arrow [Figure 2].

For example: Projects such as Terminal 5, Thames Tideway Tunnel have drawn on alliancing principles, and put in place a collective programme level incentives to align objectives and promote a collaboration in managing programme wide risk.

Tip:
Sponsor, Client and Market, capability and risk appetite, are vital considerations when designing incentives. Each needs to be clear about the value of the incentive, as a means of risk mitigation.
Supporting Material: Control in Delivery

As project organisations develop, it is critically important to implement internal controls and risk management to provide assurance to Sponsors and Stakeholders.

An early understanding of uncertainty and risk should inform key decisions made in the initiation phase, but risk management must be embedded in the later stages of project delivery in order to improve the confidence of project success. Projects typically convert a blurred and unstructured view of uncertainty into a more formal, structured and manageable definition focussing on risk. Embedding risk management requires a combination of 'Top Down' structural factors to set the correct context and environment for managing risk, along with a number of ‘Bottom Up’ factors including capabilities, processes, systems and tools.

TOP DOWN: SET CONTEXT AND ENVIRONMENT FOR RISK MANAGEMENT

**GOVERNANCE**
- Link risk management capability to organisational maturity
- ‘Contractualise’ Risk Management (e.g. Crossrail PDA requires reporting of probabilistic outputs of cost and schedule confidence against defined Intervention Points)

**LEADERSHIP**
- Establish ‘Tone from the Top’
- Recognise risk and uncertainty link with project maturity
- Appreciate the benefits of managing risk
- Management and Board engage in strategic risk management

**ORGANISATION & CULTURE**
- Configure organisation to respond to key risks
- Create culture and values which support risk managing behaviours
- Recognise risk management as a core capability
- Record in individual Job Descriptions and incentivisation

**MANAGEMENT**
- Establish clear Baseline
- Define Assumptions
- Control change
- Review key risks and risk management performance
- Consider risk in key decisions

**PARTNERSHIP & PROCUREMENT**
- Define allocation of risk between the parties
- Understand commercial and transactional risks
- Ensure corporate incentives aligned
- Develop supply chain risk management capability

**STAKEHOLDER ASSURANCE**
- Understand perspectives and requirements for Stakeholder Assurance
  - Sponsors
  - Funders
  - Partners
  - Regulators
  - Insurers

**INITIATION PHASE**

** Processes**
- Set common risk language
- Clear hierarchy for risks with defined escalation paths
- Formal Risk Management process – measurable, manageable
- Embed risk management in Business as Usual activities

**Quantitative Assessment**
- Provide a quantitative language to deal with risk and uncertainty
- CPA in Cost and Schedule Forecasting
- Clear distinction between Risk and Contingency

**People**
- Use risk approaches to drive positive behaviour
- Develop in house capability
- Functional specialists; Broad organisational competence

**Systems & Tools**
- Establish risk based audit and assurance
- Conduct supply chain assurance
- Provide consistent and comprehensive reporting

**Audit & Assurance**
- Establish risk based audit and assurance
- Conduct supply chain assurance

**Outcomes**
- Focus on risk reduction, lessons learned
- Share best practice
- Benchmark internally and externally

BOTTOM UP: DEVELOP AND IMPLEMENT THE MECHANISMS FOR MANAGING RISK AND UNCERTAINTY

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Final Check
## Final Check

**Will the proposed risk management approach:**

1. Cover the concerns identified by your core complexity-capability assessment?

2. Cover gaps identified by answering the considerations in the module?

3. Provide an appropriate level of risk identification, mapping and mitigation for the life-cycle stage of the project?

4. Reflect the current and future required capability of the client, sponsor and market in the approach?

5. Inform the governance and risk and contingency allocation for project developments and delivery?

6. Identify incentives to be included in KPI's and procurement approaches in order to align objectives?
Further Guidance
**Crossrail Risk Allocation**

Risks are managed by the party best place to manage them. Funding for risk impacts should reflect the risk allocation shown below.

<table>
<thead>
<tr>
<th>Contractor owned risks as defined in the contract for example:</th>
<th>Project Any risk not allocated to any other party for example:</th>
<th>Area Interface between Projects within Area including: -P2P schedule interfaces, -P2P design interfaces, -P2P site management interfaces.</th>
<th>Programme Catastrophic events connected to our works: - Failure to obtain timely decisions from CRL Board or Sponsors - Railway integration - Rolling Stock and Depot procurement - Failure to secure global approvals from Industry Partners for design or asset acceptance - Failure to provide property and access - Failure to procure Tier 1 contractors - Financial assumptions and indirect costs - 'Extra-ordinary' delivery risks not included within Projects (e.g. Significant ground condition impacts, asbestos, logistics etc.) - Construction impact of design including: - Design development pre IFC issue - Inaccuracies/ incompleteness/ inadequacy of design - CAT III checking (Design risk allocation under review*) Note: Systemwide Area risks currently retained in Programme</th>
<th>Board Catastrophic events not connected to our works: - Failure of CRL Executive - Strategic relationships with Government, Sponsors, stakeholders and partners - Cost overrun in excess of all other funded contingency - Unfunded Sponsor changes e.g. Plumstead sidings (or unfunded Material Events) - Board instructed scope change - Further categories of risk as agreed</th>
<th>Sponsor Change in scope or execution originated by sponsors - Material Event (i.e. Change in law, excess inflation) - Failure of CRL or Industry Partners - Railway service performance - Operations procurements - Force majeure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor: - Contractor and supply chain performance - Production rates - Change to material and subcontractor prices - Impact on local stakeholders - Construction quality - Contract/ site management - Delivery in accordance with approved schedule - Contract specific risks</td>
<td>Project: - Contractor performance (through pain/gain mechanism) - Interface between Contracts within Project - Failure to provide timely and accurate information to the Contractor - Late design not supporting the construction schedule - Interface with third parties at project level - Delivery in accordance with Master Control Schedule - Inter-contract scope omission (intra-project) - Consequences of OCI - Unforeseen site conditions</td>
<td>Area: - Interface between Projects within Area including: -P2P schedule interfaces, -P2P design interfaces, -P2P site management interfaces. - Inter-project / inter Area scope omission - Interface between Areas</td>
<td>Programme: - Catastrophic events connected to our works: - Failure to obtain timely decisions from CRL Board or Sponsors - Railway integration - Rolling Stock and Depot procurement - Failure to secure global approvals from Industry Partners for design or asset acceptance - Failure to provide property and access - Failure to procure Tier 1 contractors - Financial assumptions and indirect costs - 'Extra-ordinary' delivery risks not included within Projects (e.g. Significant ground condition impacts, asbestos, logistics etc.) - Construction impact of design including: - Design development pre IFC issue - Inaccuracies/ incompleteness/ inadequacy of design - CAT III checking (Design risk allocation under review*) Note: Systemwide Area risks currently retained in Programme</td>
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</tr>
</tbody>
</table>

Crossrail Ltd
Glossary

Asset Manager
The asset manager is the organisation (or parts of) that is responsible for day-to-day operations and maintenance of the asset. The asset manager may be a part of the sponsor or client organisations or a separate entity. Similarly the operator and maintainer of the assets might be separate entities.

Asset management is the coordinated activity of organisations to realise value from their assets.

Capability
The Routemap uses capability to describe the ability of the sponsor, client, asset manager and market to organise for effective and efficient delivery. It refers to a part of the business and not the individual as most barriers to effective practice are rooted in systemic issues and not individual action.

Client
The client is the organisation that is responsible for fulfilling the requirements and delivering the benefits. The client translates the requirements from the sponsor and manages the delivery outcomes. The client selects the most appropriate supplier/s to meet project objectives.

Complexity
Project complexity is a measure of the inherent difficulty of delivering a project based on factors such as: stakeholder alignment; interconnectedness of projects; systems & organisations and the level of innovation required etc. The Routemap uses the Delivery Environment Complexity Assessment (DECA) published by the NAO for complexity assessment.

Client Model
The Client Model refers to how the client organisation will structure and resource the responsibilities for project execution between the client, advisors/partners and supply chain (e.g. thin/fat client). This is a key consideration in determining organisational design and procurement strategy.

Delivery Model
The Delivery Model refers to the organisational entity that will be appointed to deliver the project (e.g. establishment of a special purpose vehicle). This is a key consideration in determining governance arrangements.

Infrastructure
Infrastructure includes the networks and systems that supply and support reliable and effective domestic and international transport, digital communications, energy, flood protection, water and waste management.

Market
A market is a group of organisations that integrates and competes to provide goods or services to one or more clients. The construction and infrastructure market is often characterised by a large number of suppliers and SMEs.

Procurement Model
The approach taken and the contracting model used to procure the supply chain.

Project
Throughout this guide the term project is used to mean both project or programme.

Sponsor
The sponsor organisation secures the funding, owns the business case and is responsible for specifying the requirements to the client. The Sponsor ensures that the project remains strategically aligned and viable, and that benefits are on track to be realised. In some contexts the Sponsor and Client could be from the same organisation.

Target Operating Model
The end state of how the asset will be: used; funded; owned; operated and maintained.

Glossary
IUK would like to thank the following organisations that contributed time and expertise to the development of the Routemap.

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