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PROGRAMME CONTROLS

Programme Risk Management Procedure

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1 Purpose

The purpose of this document is to set out Crossrail's requirements for risk management activities within its organisation, including the interface with its Contractors.

This procedure also supports compliance with the Joint Code of Practice for Risk Management of Tunnel Works in the UK.

2 Scope

. This procedure:

- Addresses management and communication of risk, where a risk is defined as an uncertain event or set of circumstances that, should it occur, will affect the project's objectives. This includes risk of any type, affecting schedule, safety, cost, quality, 3rd Parties, environment, reputation, etc.
- Applies to all parts (Delivery and Functional) and levels of the Crossrail organisation. The requirements for risk management activities by Crossrail's Contractors are described elsewhere, in their respective contract Works Information.
- Applies at all delivery stages (design, construction, commissioning and handover). (Note that some risks may continue to be active beyond the completion of one delivery stage, and so may be handed over to a new owner e.g. from designer to constructor, or from constructor to operator).
- Is not affected by and does not affect the requirements of other risk assessments and risk-based processes being used on Crossrail, the most notable examples of which are:
 - CDM
 - Geotechnical Risk Assessment
 - Early Warnings
 - Procurement and Investment Management
 - Risk and Contingency Management

However, these processes may make use of the outputs produced by this procedure. Risks identified through these other processes that would adversely affect the achievement of our project objectives shall be reflected in the risks that are managed and communicated through this procedure (see Section 11 below).

Note: A risk register developed using this procedure is not the same as the "Risk Register" referred to in the Conditions of Contract and maintained by the Project Manager in relation to early warnings.

3 Objectives

This Risk Management Procedure aims to ensure that:

- Risks associated with the work are identified, assessed and managed by the appropriate people in a consistent and cost-effective way.
- Assurance is provided to Senior Management and other stakeholders (industry partners, insurers, etc.), through the timely provision of appropriate and reliable risk information.

- Crossrail demonstrably meets the requirements of its risk management Policy and Plan.

4 Accountabilities and Responsibilities

The Risk Management Plan describes the risk management organisation. Ultimate responsibility for delivering the risk management obligations set out in the Risk Management Policy and Plan is placed with the Programme Director and the senior functional and delivery management team, with the Head of Risk Management responsible for developing a suitable risk management framework to enable this.

Specific accountabilities and responsibilities within this Risk Management Procedure are defined below.

- The Head of Risk Management shall:
 - Develop and deliver procedures and systems that enable Crossrail and its Contractors to meet the risk management obligations set out in the Risk Management Policy and Plan, and that reflect good practice, and ensure that these continue to be appropriate throughout the project lifecycle.
 - Ensure that the procedures and systems are communicated to those required to use them, and that competent Risk Managers are trained in their use.
 - Brief Contractors' Management teams to clarify requirements in relation to risk management. (Contractor's must ensure the competency of their team to meet the requirements).
 - Monitor, assess and report the status of risk management practices across Crossrail and its Contractors, and on the management of risk, and advise on corrective action if required.
 - Support the Programme Director in meeting his risk management obligations.
- Accountable Managers (managers accountable for delivery of an element of work i.e. the Programme Director, Sector Directors, Functional Managers, and Project Managers) shall:
 - Maintain a risk register in accordance with this Risk Management Procedure, for the scope and project objectives for which they are accountable.
 - Consider all categories of risk including but not limited to schedule, safety, cost, quality, 3rd Parties, environment, reputation.
 - Ensure that this Risk Management Procedure operates fully within their teams, and make adequate competent resource available to ensure that risk management obligations are met.
 - Ensure that all other relevant parties and perspectives (Sector Directors, Functional Managers, Project Managers, Contractors, stakeholders and specialists) are appropriately engaged in the identification, assessment and management of risks in their area.

Project Managers will also ensure that their respective Contractors risk management practices are in accordance with their Contracts.

Functional Managers will also support and cooperate with risk management activities in delivery, and will review and maintain risks relevant to their function.

- Sector Risk Managers (on behalf of their respective Sector Managers) shall:
 - Ensure that all teams for which the Sector Director is accountable follow this procedure, and alert them to non-compliances.
 - Ensure that all teams for which the Sector Director is accountable use the designated tools to maintain up-to-date data which is of suitable quality and risk management logic in accordance with the process, and alert them to significant errors.
 - Ensure records are held to demonstrate risk management practices that follow this procedure (e.g. records of meetings, approvals).
 - Ensure that Contractors for all teams for which the Sector Director is accountable understand their risk management obligations under their respective contracts, and alert them to non-compliances.
 - Liaise with the Head of Risk Management to ensure continued alignment in approach with requirements.

Note: While Risk Managers will assist their respective Accountable Managers in meeting the requirements of this procedure, Accountable Managers retain accountability.

- Risk Analysts will assist their respective Risk Managers.

5 Deliverables

The deliverables from this procedure are:

- Risk data recorded using approved systems,
- Risk reports (including risk information and statistics as required),
- Records of meetings and approvals, etc.

6 Risk Management Process Steps

The risk management process consists of 7 iterative steps as illustrated and described below. The critical steps are Identify, Assess and Respond:

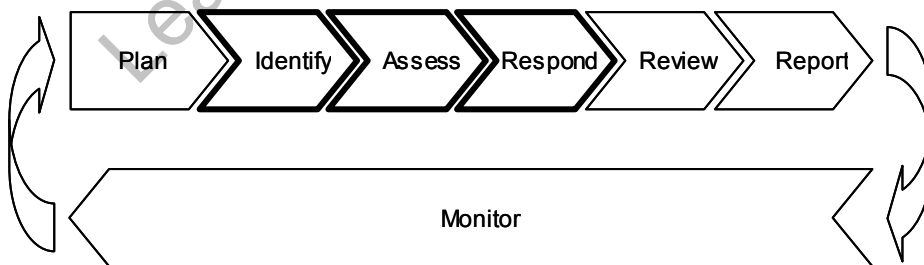


Figure 6.1 Risk management process steps

6.1 Step 1: Planning

To enable identification and effective management of the significant risks, it is vital first to have a clearly defined scope and objectives and then to address these at an appropriate level of detail. For example a Project Manager may initially have a single project level risk assessment, followed by risk assessments for specific contracts, scheduled to reflect the timing of the tendering process for these contracts.

The Accountable Manager shall:

- Develop and document a plan briefly describing which risk assessments will be carried out and when, and who will be involved. This will reflect the scope (including its complexity, interfaces and geographical spread) and the project objectives.
- Confirm that the plan can be accommodated in the Active Risk Managers (ARM) database folder structure (see Section 8 below).

6.2 Step 2: Identification

This step is to systematically identify those risks associated with the scope of work being considered that could significantly affect achievement of the project objectives. Risk identification must be carried out with the full involvement of the relevant parties to ensure the relevant perspectives and expertise are represented (e.g. appropriately qualified representatives from Delivery and Functions, Contractors, stakeholders and specialists as appropriate).

The Accountable Manager shall:

- Confirm the specific scope and objectives addressed by the risk assessment and gather any necessary or useful information (execution plans and drawings, other relevant risk information e.g. relevant risk registers, CDM Risk Registers, Geotechnical Design Risk Registers etc).
- Engage with all the relevant parties to systematically identify the risks that could significantly affect achievement of the project objectives. This is usually initially done through a facilitated workshop.
- For each risk, identify the Causes and the Effects.
- For each risk, identify the Risk Owner - in principle the person with the ability and appropriate authority to manage the risk - and confirm with them that they accept accountability for managing the risk. This should always be agreed through normal lines of authority.
- Enter the risks and their causes, effects, and owner, into the appropriate part of the ARM folder structure. The risk status will initially be "Unapproved".
- Ensure there is a simple mechanism for capturing risks identified outside formal risk identification workshops, and entering them into the appropriate part of the ARM folder structure.
- Subsequent to the initial risk identification workshop, periodically re-visit the list of risks to confirm they continue to reflect the prevailing circumstances. These re-visits may be triggered by significant identifiable events (e.g. passing of a milestone, change in delivery strategy or methodology), or simply gradual change over time.

6.3 Step 3: Assessment

Assessment of the severity of a risk drives management attention and supports planning for risk mitigation. A qualitative risk assessment scheme consisting of qualitative probability and impact

scales and a Probability Impact Diagram (PID) is provided within ARM (and is repeated in Appendix A for information) to ensure consistency.

The Accountable Manager shall engage with Risk Owners to:

- Identify the control measures already applied to each risk i.e. existing control measures. These may be pro-active (reducing the probability) or reactive (reducing the impact).
- Rank the probability and impact of each risk after taking into account the actual effectiveness of the existing control measures, using the qualitative risk assessment scheme provided within ARM (see Appendix A). This is called the Current risk severity.
- Repeat for Forecast Severity (see below).
- Enter the existing control measures and the associated current risk probability and impact scores into the ARM database.

When content with this assessment of each risk, the Accountable Manager shall change its status from “Unapproved” to “Active”, or “Rejected”. This should be within one month of the risk being entered into ARM.

Quantitative Risk Assessments (QRA) will be undertaken to provide an improved understanding of the risk profile and derive a more detailed understanding of certain cost and time risks. The output of QRA can also support decision making and monitoring of risk management activity and informs cost exposure in project and programme AFC. Forecast probability, cost and time data is assessed for each risk based on the causes and effects described, taking into account the existing controls and active responses. The collective exposure to risks is then assessed by the Risk Analyst using Monte-Carlo modelling techniques.

6.4 Step 4: Response

For each risk, the Risk Owner must establish an appropriate level of mitigation. Control measures in addition to those already existing may be needed to achieve this level of mitigation.

The Accountable Manager shall engage with Risk Owners to:

- Develop a satisfactory Response Plan for each risk as follows:
 - Identify a Response Strategy to Treat, Terminate, Tolerate or Transfer the risk.
 - Identify Response Actions to improve control measures as required. These shall be SMART.
 - Identify a Response Action Owner for each action and confirm with them that they accept accountability for implementing the action within the time allowed.

The risk owner is responsible for the development of the Response Plan, while the Response Action Owners are responsible for carrying out their individual actions.

- Rank the probability and impact of each risk after taking into account the anticipated effectiveness of the Response Plan, using the risk assessment scheme provided within ARM (see Appendix A). This is called the forecast risk severity.
- Enter the response plan and the forecast risk probability and impact scores into the ARM database.

When a response action is completed, the risk should be reassessed (i.e. repeat Step 3) to reflect any newly introduced existing control measure.

6.5 Step 5: Review

Regular review and challenge is essential to ensure that risks are being appropriately managed, and that the risk data remains accurate and reliable, reflecting any changes in circumstances or management activities.

The Accountable Manager shall on a regular basis:

- Engage with risk owners to ensure they have provided complete current and reliable data on their risks in the ARM database (for example, that the current and forecast risk severities reflect the actual effectiveness of the existing controls and the anticipated effectiveness of the response plans, and that response plans and existing controls are up-to-date), and also to challenge the continued relevance of the risk and the adequacy of the control measures and response actions. A review note summarising progress with controls or other relevant changes affecting the risk, shall be recorded in ARM for significant risks.
- Review and formally issue approval of his completed risk register (the contents of his folder in ARM.), enabling it to be used for reporting. In the event that they will not approve (part of) the completed risk register, e.g. due to the inadequacy of control measures and response actions, they will agree with the relevant risk owner those additional response actions necessary, prior to approval.

Project Managers shall in addition on a regular basis:

- Hold joint meetings with each of their contractors to review their Contractor's risk registers. Attendance by the Contractor's accountable senior manager is required.

6.6 Step 6: Reporting

Regular reports are necessary to inform and provide assurance to Sponsors, Senior Management and other key stakeholders, that risks are being appropriately managed. Reporting must be based on current data in ARM, which must be updated and reviewed in good time for the reporting cycle (see Step 5 above).

On occasion, it may be appropriate to escalate a risk to ensure it is assessed and/or managed by the person or party best placed to do so (able and with appropriate authority). For example where a more substantial or coordinated response is required than the current owner can authorise or implement, or where the risk severity or its effects on the wider project justify higher level assessment and/or management.

The Accountable Manager shall:

- Escalate through established lines of management accountability all risks in his risk register that may require the attention of Senior Management. This may take place at formal risk reviews, or through other simple mechanisms at other management meetings.
- Issue monthly reports in accordance with requirements (a format will be provided by the Head of Risk Management, and may be changed from time to time). Reports will include:
 - Key risk information.
 - Statistical data on numbers of active risks, unapproved risks, overdue actions, and others as appropriate.

All reports shall be reviewed by Line/ Senior Management in Accountability Reviews and other appropriate forums.

Note: Project Managers shall include in their reports risk information from their Contractors' risk registers.

6.7 Step 7: Monitoring

Continuous systematic and formal monitoring of implementation of the risk process and outputs will take place against appropriate performance indicators to ensure process compliance and effectiveness. Monitoring may take a variety of forms and range from self-assessment and internal audit to detailed reviews by independent external experts.

7 Risk Register Hierarchy

Risk data is organised into a hierarchy based on the work breakdown structure and on organisational roles, and is also reflected in the ARM folder structure. The hierarchy is also reflected in the Governance defined in the Risk Management Plan.

8 Systems

Active Risk Manager (ARM) is Crossrail's designated risk management system. It is a risk database developed by Strategic Thought Group Ltd, and has been configured to reflect the risk management requirements at Crossrail. It is used to record the most up-to-date risk data. It is the source from which risk reports are derived.

Data in the ARM Database is organised into folders based on the risk register hierarchy. Access to view or edit data is controlled appropriately to enable sharing of information where practicable, while protecting any commercial sensitivity, as well as data integrity.

Note on use of ARM by Contractors:

Each Contractor's accountable senior manager will maintain a high level risk register in ARM reflecting those risks inherent in his scope of work that they consider are material to the project objectives, which require his attention or review, and which are necessary to provide assurance to the respective Crossrail Project Manager that the key risks are being appropriately managed. This will form the basis of meetings with the Contractor and Project Manager to jointly review the Contractor's risk register.

Where a Contractor also maintains further risk assessments and registers as identified in his plan (see Step 1 above), reflecting the complexity, interfaces and geographical spread of his scope, it will log the associated risk data using an appropriate system of its own, agreed with the Project Manager, and will provide this data to the Project Manager on request in a suitable form, for review and audit.

9 Project Stages

As responsibility and accountability for a package of work changes over the project lifecycle from design to construction, and eventually to testing, commissioning and handover, there is likely to be an associated change of responsibility and accountability for the management of risks. Clarity of responsibilities and accountabilities and the continuity of risk management must be maintained. The Project Manager will ensure the effective management of the interfaces between project stages e.g. from design to construction. At the end of the delivery stage, the Project Manager will also ensure that actions in respect of residual risks (e.g. operational controls or further response actions) are included as part of the eventual transfer of the management of active risks to testing, commissioning and handover.

10 Gate Reviews

Design Governance gate reviews require evidence of risk management by the Designer. This will take the form of the current approved risk register, in a format and structure that reflects the scope of the Gate Review. The Project Manager shall review and incorporate this information into ARM as appropriate.

11 Interfaces with other risk based processes

As noted in Section 2 above, there are a number of other risk assessments and risk-based processes being used which are not affected by the requirements of this procedure, but which may produce risk information that should be reflected in the relevant risk registers to provide a complete and accurate picture of the Project's risk profile. For example:

- Where the CDM process identifies safety risks which may threaten the delivery of the H&S or other project objectives and which cannot be fully mitigated by the Engineering Design process, the risks must be reflected in the relevant risk registers. Project Managers will use applicable CDM risk registers to inform their risk registers, ensuring that these CDM risks are managed and communicated through the risk management process.
- Where a Geotechnical Risk Register includes risks which may threaten the delivery of the project objectives and which cannot be fully mitigated by the Engineering Design process, the risks must be reflected in the relevant risk registers. Project Managers will use applicable Geotechnical Risk Registers to inform their risk registers, ensuring that these geotechnical risks are managed and communicated through the risk management process.
- The Procurement process requires assessment of the level of financial risk exposure associated with the works being procured. Risk information from the procurement process shall be reflected in the relevant risk registers by the Project Manager at contract award.

Other processes not named above may also identify key risks to project objectives, which should be reflected in the risk registers.

12 Glossary

The following define the risk management vocabulary used in this procedure:

Accountable Manager – the person accountable for delivery of an element of work e.g. the Programme Director, Sector Directors, Functional Managers, Project Managers.

Cause – event/ circumstance that would lead directly to the risk occurring

Contingency – A pre-defined sum or percentage which is set aside specifically to cover the cost of a change, risk or unforeseen event. To be allocated and expended in accordance with the governance procedure against a defined scope.

Effect – scenario that results from the risk occurring

Existing Control Measures – control measures in place now, designed to reduce the likelihood and/or impact of the risk.

Project Objectives – the Crossrail Corporate Objectives cascaded from Senior Management. These objectives are used within Crossrail for risk identification

Risk - in this context means an uncertain event or set of circumstances that, should it occur, will negatively affect the project's objectives. This could be a threat of any type, affecting schedule, safety, cost, quality, 3rd Parties, reputation, etc

Risk Exposure – Potential exposure over and above an agreed baseline which could arise as a result of the impact of one or more risks'

Risk Register – a list of risks and related management information for a given Accountable Manager. In effect, this is the data held in the Accountable Manager's folder in ARM. Note: a risk register developed using this procedure is not the same as the "Risk Register" referred to in the NEC3 Conditions of Contract and maintained by the Project Manager in relation to Early Warnings

Response Action – a specific planned action that is intended to reduce the risk severity.

Response Action Owner – person responsible for implementing the response action.

Response Action Status:

- Active – a Response Action that is to be implemented.
- Closed (no longer appropriate) - a Response Action that is no longer to be implemented because it is not deemed valid or required.
- Completed – a Response Action that has been completed

Response Plan – the group of Response Actions developed in relation to a particular risk.

Response Strategy – the dominant approach taken to control the risk severity

- Treat – reduce the Probability and/or Impact of the risk
- Terminate –remove the source of the risk
- Tolerate – take no further actions in respect of the risk
- Transfer – transfer some or all of the risk ownership and liability to another party.

Risk Owner – person accountable for the management of the risk.

Risk Response Status – commentary summarising activity in the current reporting period in respect of the risk.

Risk Severity – combination of the Probability and Impact of the risk, as illustrated in the PID in Appendix A.

- **PID (Probability Impact Diagram)** – diagram illustrating the relationship between Probability, Impact, and the priority for management attention.
- **Probability** – an estimate of the probability of the risk occurring
 - current – allowing for the actual effectiveness of the existing control measures
 - forecast – allowing for the estimated effectiveness of the response plan(See Appendix A for scales used)
- **Impact** - an estimate of the effect of the risk on key business output variables
 - current - allowing for the actual effectiveness of the existing control measures
 - forecast - allowing for the estimated effectiveness of the response plan(See Appendix A for scales used)

Risk Status:

- **Unapproved** – This is the default status of risks entered onto the system. Unapproved risks have not been subject to management review and should be treated as 'draft'. Risks remain unapproved until they have been assessed and agreed by the Accountable Manager.
- **Rejected** – Rejected risks have been subject to management review and have been 'Rejected' by the Accountable Manager. This may be because the risk is not recognised as a genuine risk that should be subject to formal risk management (e.g. it may be an issue), or that the risk is already covered by another risk elsewhere on the system.
- **Active** – Active risks have been subject to management review and have been 'Approved' by the Accountable Manager. Active risks are those risks which are recognised as genuine risks that should be subject to formal risk management. Note that, once Active, the description, assessment or management information associated with the risks may change.
- **Closed** – Closed risks are risks that have previously been Active but are no longer valid. This may happen for a number of reasons: 1) the risk has expired 2) the risk has been managed 3) the risk is now described differently or is captured elsewhere on the system.
- **Impacted** – Impacted risks have materialised and are accepted into the baseline. Could apply to opportunity or threat.

13 Reference Documents

Ref:	Document Title	Document Number:
1.	Risk Management Policy	CR-XRL-Z-UPP-CR001-00011
2.	Risk Management Plan	CR-XRL-Z9-GPR-CR001-00014
3.	Quantitative Risk Assessment Procedure	CR-XRL-Z9-GPD-CR001-50004
4.		

14 Standard Forms / Templates

Ref:	Document Title	Document Number:
A	None	
B.		

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15 Appendices

Appendix A – Risk Assessment scheme (reflected in ARM)

RISK ASSESSMENT CRITERIA

Impact	1 Insignificant	3 Minor	20 Moderate	100 Major	1000 Severe
Health & Safety	No lost time event. Non-reportable accident or injury. Non-first aid accident.	Lost time event. Reportable minor injury. Multiple non-reportable minor injuries.	Major injury. Multiple reportable minor injuries.	Multiple major injuries.	One or more fatalities.
Environment	No measurable environmental impact or harm. No corrective action required.	Environmental impact confined to site. No significant harm but corrective action required.	3rd party impact. Short term environmental impact but no significant harm	Significant harm to environment that is repairable. Breach of legislation.	Significant harm to environment that is permanent or has long-term effects.
Capital Cost (impact on Anticipated Final Cost)					
Programme	<£500k	£500k - £5m	£5m - £10m	£10m - £50m	>£50m
Project	<£100k	£100k - £1m	£1m - £5m	£5m - £10m	>£10m
Smaller Project	<£20k	£20k-£200k	£200k-£1m	£1m-£2m	>£2m
Time (Critical Path Delay)					
Programme	< 2 weeks	2 weeks - 2 months	2 - 4 months	4 - 6 months	> 6 months
Project/ Smaller	Less than 2 days	2 days to 2 weeks	2 - 4 weeks	1 - 2 months	> 2 months
Reputation	Isolated local media criticism. Individual comment or feedback.	Local negative community media reporting over a period. Localised public and/or stakeholder negative comment.	Significant local media criticism. London or national media interest. National stakeholder statements.	Extensive prolonged negative reaction from London or National media, public and/or key stakeholders.	Persistent criticism from London and National media. Public exchanges with key customers or stakeholders.
Quality	Non-compliance with standard or procedure that can be managed.	Developed component or system may not receive approval through assurance process.	Failure of manufacture or construction of approved component or system to meet design or specification.	Failure of a major component or system leading to rejection.	Catastrophic failure of a major component or system to function in either temporary or permanent condition.
Crossrail Railway Operations	Loss or disruption of service resulting in minor increase in journey times. <£5m impact on operating cost or revenue. Small impact to customers.	Loss or disruption of service resulting in a change to service pattern. £5m - £20m impact on operating cost or revenues. Minor impact to customers.	Loss or disruption of service resulting in significant overcrowding. £20m - £50m impact on operating cost or revenues. Adverse impact to customers.	Loss or disruption of service resulting in a significant loss of train paths. £50m - £100m impact on operating cost or revenues. Significant impact to customers.	Loss or disruption of services resulting in suspension of services. >£100m impact on operating cost or revenues. Major impact to customers.
3rd party operations (Statutory undertakers, TTL, LAs, etc)	Insignificant impact on 3rd Party	Minor impact on 3rd Party	Significant impact on 3rd Party	Major impact on 3rd Party	Severe impact on 3rd Party
Probability	2 Very Low	4 Low	8 Medium	12 High	16 Very High
Probability Range	<1%	1% - 10%	10% - 20%	20% - 50%	>50%

Severity (Probability x Impact)	Severity Status
Greater than 1000	High
101 - 1000	Medium
Less than 101	Low

Threat	Probability	Impact				
		1 Insignificant	3 Minor	20 Moderate	100 Major	1000 Severe
Probability	16 Very High	16	48	320	1600	16000
	12 High	12	36	240	1200	12000
	8 Medium	8	24	160	800	8000
	4 Low	4	12	80	400	4000
	2 Very Low	2	6	40	200	2000