



INTEGRATION ENGINEERING SAFETY MANAGEMENT

Crossrail Review and Approval of Contract Engineering Safety Management Deliverables

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2.0	Review. Clarification of the roles of the Lead Reviewer of the ESM deliverables and the CRL Contract / Project Manager

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1 Purpose

The purpose of this document is to outline the CRL internal review and acceptance process for Engineering Safety Management deliverables provided under the various Crossrail Contracts.

2 Scope

This document applies to the Crossrail Central Operating Section works (“COS”) and excludes adjacent On Network Works (“ONW”) where Network Rail is responsible for the Engineering Safety Management.

Scope is limited to the deliverables provided by the Crossrail Framework Design Consultants, and the Design & Build Contracts for Systemwide (railway systems), Stations, Shafts and Portals.

It excludes any additional endorsement of engineering safety deliverables which may be required by the recipient Infrastructure Managers (e.g. Rail for London (Infrastructure) Ltd, London Underground Limited, NRIL).

3 Definitions

AsBo	Independent Assessment Body
CRL	Crossrail Limited
ESM	Engineering Safety Management
ETA	Event Tree Analysis
FMECA	Failure Modes Effects & Criticality Analysis
FTA	Fault Tree Analysis
HF	Human Factors
IHA	Interface Hazard Analysis
IM	Infrastructure Manager
NoBo/DeBo	Notified Body/Designated Body
NR	Network Rail (Infrastructure Limited)
OHSA	Operational Health & Safety Analysis
NNTR	Notified National technical Rule
CSM	Common Safety Method Regulation
RAM	Reliability Availability Maintainability
RIRs	Railway Interoperability Regulations.
SIL	Safety Integrity level
TSIs	Technical Specifications for Interoperability

4 Background

Note: The CRL Contract / Project Manager remains responsible for signing off deliverables. The Lead Reviewer of the ESM deliverables will provide a recommendation of acceptance to the CRL Contract / Project Manager.

Engineering Safety Management deliverables will be reviewed and accepted by CRL in accordance with the following Crossrail procedures:

- Document Management Procedure (Ref 1)
- QRG 8.1 - Design - Review and Acceptance (Ref 2)

5 ESM Deliverables Review

5.1 Lead Reviewer

The Lead Reviewer of the ESM deliverables will be the CRL System Safety Manager allocated to the Contract.

5.2 Review Activity

The depth of review will depend on the type of the deliverable, the safety significance and the extent which formal acceptance is required within the Contract documentation.

The key Contract deliverables are described in:

- Crossrail Delivery Contracts Standard Engineering Safety Management Requirements Specification (Ref 3)

These are summarised in Appendix 1 along with a brief description and their required route for review, approval & acceptance.

The Lead Reviewer of the ESM deliverables will select the appropriate document reviewers based on necessary technical review activities as are listed in Appendix 2. Not all review activities will be necessary for each ESM deliverable. An eB work order will be raised listing the chosen reviewers.

5.3 Acceptance Decal

On completion of the review activity the outcome will be noted on the contract deliverable acceptance decal and returned to the Contractor.

The Lead Reviewer of the ESM deliverables will provide a recommendation to the CRL Project / Contract Manager once satisfied all review comments are satisfactorily resolved on the eB comment sheet. The CRL Project / Contract Manager will sign the acceptance decal on agreement with the Lead Reviewer of the ESM deliverables.

6 Reference Documents

Ref:	Document Title	Document Number:
1.	Document Management Procedure	CRL1-XRL-Z3-GPD-CR001-50001
2.	QRG 8.1 - Design - Review and Acceptance	CR-XRL-Z3-GUI-CR001-50025
3.	Crossrail Delivery Contracts Standard Engineering Safety Management Requirements Specification	CRL1-XRL-O8-GPD-CRG03-50001

7 Standard Forms / Templates

Ref:	Document Title	Document Number:
A.	None	
B.		

8 Appendices

Appendix 1 - ESM Deliverables Reviewers

Appendix 2: Contract ESM Deliverables

9 Appendix 1: ESM Deliverables Reviewers

Review Activity	Reviewer	Description of Review
Lead Reviewer	CRL System Safety Manager	<ul style="list-style-type: none"> Overall review of ESM approach Methodology follows approach of Contractor System Safety Plan Risks have been evaluated in conformance with the principles of the CSM Regulation (1. Codes of Practice; 2. Comparison with Reference System; or 3. Explicit Risk Estimation) Rationalise and coordinate comments
Overall Contract Compliance	CRL Contract/Project Manager	<ul style="list-style-type: none"> Contract compliance Consistency with overall contract scope Implications to successful contract delivery Liaison with other aspects of the contract
Technical Compatibility	CRL Lead Discipline Engineer(s)	<ul style="list-style-type: none"> Correct understanding of design & interpretation of technical & functional requirements Applicability of codes of practice, specifications and standards in relation to their claimed risk mitigation Logicity of the perceived hazards, their causes and proposed mitigation measures
Operations & Maintenance Compatibility	IM Representative	<ul style="list-style-type: none"> Compatibility with operations and maintenance concept Consideration of issues and residual risks to be managed by rules and procedures Review of safety operating constraints Review of minimum operation requirements
Interfaces Assessment	CRL Interface Manager	<ul style="list-style-type: none"> Interfaces are properly identified, understood and assessed through appropriate Interface Hazard Analysis Adequate liaison between interfacing contracts and other stakeholders
Human Factors Assessment	CRL HF Specialist	<ul style="list-style-type: none"> Human Factors considerations have been adequately addressed in the design and engineering safety evaluation
Engineering Safety Assessment	CRL ESM Engineer (for Contract)	<ul style="list-style-type: none"> Safety requirements have been adequately identified and met Hazards have been effectively identified, risk assessed and mitigation measures implemented, as appropriate Risks have been evaluated in conformance with the principles of the CSM Regulation (1. Codes of Practice; 2. Comparison with Reference System; or 3. Explicit Risk Estimation)
Reliability, Availability, Maintainability Assessment	CRL RAM Manager/Engineer	<ul style="list-style-type: none"> Reliability, availability & maintainability requirements that affect engineering safety have been adequately identified and met – including consistency check between RAM and safety.
Interoperability Compliance Review	NoBo/DeBo/AsBo	<ul style="list-style-type: none"> Consistent with NoBo/DeBo/AsBo understanding of TSI/NNTR compliance and achievement of their essential requirement regarding safety Conforms to CSM Regulation requirements regarding risk evaluation and assessment

10 Appendix 2: Contract ESM Deliverables

ESM Deliverable	Description	Contractor	Project Manager/Employer
System Safety Plan	To establish <i>Contractor's</i> ESM approach, agree preliminary list of contract ESM safety deliverables and programme for their delivery	Prepare & Approve	Review & Accept
System Software Safety Plan	If required, to confirm the <i>Contractor's</i> software development strategy is consistent with BS EN50128	Prepare & Approve	Review & Accept
Technical Reports	Such HAZID Reports, Risk Assessments, FTA, ETA, FMECA, OHSA, IHA etc. as necessary in support of Engineering Safety Justifications	Prepare & Approve	Review
Stage Gate ESM Report(s)	To confirm a suitable & sufficient depth of engineering safety management to pass design stage gates (e.g. 30%, 60%, 90% Completion)	Prepare & Approve	Review & Accept
System Safety Integrity Level (SIL) Requirements Report	To determine and agree the requirements, if any, for SILs assigned to system safety functions	Prepare & Approve	Review & Accept
System Safety Requirements Specification	As per BS EN 50126 (alternatively may be flagged safety related in the overall system requirements specification)	Prepare & Approve	Review & Accept
Product Breakdown Structure	To confirm the existing proven use of equipment proposed in the system design prior to procurement (i.e. "reference systems")	Prepare & Approve	Review & Accept
Product Safety Case(s)	As, and if, required owing to the proposed use of new/novel or bespoke equipment and prior to procurement	Prepare & Approve	Review & Accept
Design Engineering Safety Justification(s)	Preliminary document to confirm design is fit for purpose prior to installation, testing & commissioning	Prepare & Approve	Review & Accept
Engineering Safety Justification(s)	Final document prepared at successful completion of Testing & Commissioning such that the system can be safely brought into service	Prepare & Approve	Review & Accept
System Project Wide Hazard Record (PWHR)	Hazard log to confirm all hazards are successfully resolved such that the system can be safely brought into service	Prepare & Approve	Review & Accept