

INTEGRATION

Engineering Safety Management Surveillance & Audit Process

Document Number: CRL1-XRL-O8-GPS-CR001-50006

Current Document History:

Revision:	Effective Date:	Author(s) (‘Owner’ in eB *)	Reviewed by: (‘Checked by’ in eB *)	Approved by:	Reason for Issue:
2.0		Jignesh Patel	Jignesh Patel	Jeremy Bates	2 Year Review

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CRL1-XRL-O8-GPS-CR001-50006 Rev 2.0

Previous Document History:

Revision	Prepared Date:	Author:	Reviewed by:	Approved by:	Reason for Issue
1.0	21-09-11	C Bloxsome	K Harvey	M Kilby	For comment

Revision Changes:

Revision	Status / Description of Changes
2.0	2 Year Review; Reference documents updated

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1 Purpose

Throughout the Project lifecycle CRL shall undertake audits and assessments in accordance with its quality management system in order to ensure compliance to the prescribed processes. These shall include surveillance and auditing of Designers' engineering safety management activities in conformance with the CRL System Safety Plan [Ref 1].

This procedure describes the process for the performance of engineering safety management (ESM) surveillance and audit carried out by the CRL Delivery Team, facilitated principally by the CRL Project Managers for the Delivery Contracts with assistance from the CRL System Safety Team.

2 Scope

The scope covers the external surveillance and auditing of Delivery Contractors, Subcontractors and Suppliers in regard to the following areas:

- ESM Process – in conformance with individual Contractors' System Safety Plans;
- Hazard Identification;
- ESM Hazard Log/Project Wide Hazard Record;
- Safety Assessments;
- CDM/ESM Interface Management;
- Safety Integrity Level (SIL) Assessments;
- Engineering Safety Justifications.

It excludes internal surveillance and audit of CRL's compliance with its engineering safety management obligations which will be independently facilitated via the CRL Quality Assurance Team.

It includes the attendance at external audits by the CRL "Contracting Entity" appointed Notified Body, Designated Body and Independent Assessment Body as may be required in compliance of the Railway Interoperability Regulations.

3 Definitions

ALARP	As low as is reasonably practicable
AsBo	Independent Assessment Body
CAR	Corrective Action Report
CDM	Construction (Design & Management) Regulations 2007
CMDL	Contract Master Document List
CRL	Crossrail Ltd
CSM	Common Safety Method Regulation
DeBo	Designated Body
ESM	Engineering Safety Management

HAZID	Hazard Identification
HAZOP	Hazard and Operability
NNTR	Notified National Technical Rule
NoBo	Notified Body
PWHR	Crossrail Project Wide Hazard Record
RIR	Railway Interoperability Regulations
SIL	Safety Integrity Level
TSI	Technical Specification for Interoperability

4 Surveillance & Audit Basis and Reference Documents

The overall CRL engineering safety management system is described in the following documents:

CRL Engineering Safety Management System Safety Plan	[Ref 1]
CRL Engineering Safety Management - System Safety Plan Implementation Strategy	[Ref 2]
CRL Engineering Safety Management Hazard Management Procedure	[Ref 3]

The ESM responsibilities of the Delivery Contracts are agreed with CRL via the following documents prepared by the Contractor:

Contractors' System Safety Plans	For each Delivery Contract
Contractors' Hazard Log recorded in the Project Wide Hazard Record (PWHR)	Web-based PWHR – one for each Delivery Contract, coordinated by CRL
Contract Accepted Programme	For each Delivery Contract – including programme of ESM activities
Contract Master Deliverables List	For each Delivery Contract – including agreed list of safety deliverables

5 Surveillance Process

There are a number of different means of surveillance. Contractors' ESM activities are monitored and surveyed by the CRL Project Manager and/or System Safety Team as described below:

- **Project Wide Hazard Record (PWHR).** The PWHR is the key tool whereby the CRL System Safety Team will monitor the Contractors' ESM activities and confirm how the hazards identified are being mitigated [Ref 3].
- **Project Manager Meetings.** Fortnightly progress meetings will be held with the CRL Project Manager, with engineering safety management being a core agenda item. The

Contractors' Engineering Safety Manager and a CRL System Safety Team representative shall attend these meetings when requested and where there are significant engineering safety issues to discuss.

- **Contract Master Document List (CMDL).** The Contractor is required to agree and list the safety deliverables for the Contract [Ref 4]. Completion status against this list will be monitored via the CRL Project Manager Meetings with the Contractor. The CRL System Safety Team has access to the CMDL database for routine monitoring.
- **Contractors Monthly Progress Reports.** The status of engineering safety management activities shall be a core item on the Contractors' formal written monthly progress report to the Project Manager. This will include performance against the "Agreed Programme" for the Contract which includes ESM activities. The reports are copied to the CRL Head of System Safety.
- **ESM Reports for Design Gates Reviews.** Formal ESM reports will be prepared by the Contractors for the design assurance Gate Reviews (e.g. 30%, 60%, 90% completion) to confirm the acceptable status of ESM activities. These will be reviewed and accepted by the CRL System Safety Team.
- **ESM Workshops.** System Safety Team representative may attend ESM workshops organised by the Contractor (such as HAZID and HAZOPs) as observers.

6 Audit Process

The ESM audit process will be undertaken in accordance with the Audit Procedure [Ref 5].

A schedule of planned audits shall be arranged by the CRL Delivery Audit Manager and agreed with the CRL Head of System Safety during the audit co-ordinations meetings, held bi-weekly.

Generally, the periodicity of ESM audits of Delivery Contractors will be as follows:

1. within 3 months of CRL acceptance on Contractors' System Safety Plan;
2. prior to equipment procurement and 3 months before planned delivery of the Product Breakdown Structure giving equipment approval status;
3. 3 months prior to planned delivery of Design Engineering Safety Justification;
4. 1 month prior to planned delivery of final Engineering Safety Justification (optional depending on outcome of audit 3)

The audit preparations including: the pre-audit meeting; audit timetable; and auditees will be co-ordinated by the CRL Lead Auditor with input from the CRL Head of System Safety.

During the system safety audit interviews the auditor will note on the checklist the response from the auditee and record details of supporting evidence presented by the auditee. Generally, the auditor will inform the auditee of any areas of concern as they arise.

The CRL Lead Auditor shall be responsible for the preparation of the Audit Report including the assessment of the important findings as Corrective Action Reports (CAR), Observations or points of good practice. The Wash-up Meeting, Audit Report, Closing Meeting, and follow up of CARS will be undertaken as part of the Audit Procedure [Ref 5].

6.1 Interoperability

The Delivery Contractor has responsibilities regarding application of the Railway Interoperability Regulations (RIR) to the central section of the Crossrail Project.

CRL will appoint a Notified Body (NoBo) and Designated Body (DeBo) to assess conformity of the Contractors design with the applicable TSIs and NNTRs, and to prepare the necessary Technical Files to evidence this.

The Contractor is also required to comply with the Common Safety Method (CSM) Regulation to demonstrate the safety adequacy of their proposed design. CRL will appoint an Independent Assessment Body (AsBo) to independently assess conformance of the Contractors' engineering safety evidence with the CSM.

The NoBo/DeBo/AsBo may also be given the opportunity to attend CRL planned audits to assist in their conformity assessment. They will prepare their own audit checklists in advance for agreement as described above.

7 Guidance Checklist

Ref	Item
1.	Demonstrate compliance with the Contractors' System Safety Plan.
2.	Demonstrate that the development of the Contractors' System Safety Plan is in line with the current Contract lifecycle stage.
3.	Demonstrate how the ESM activities align with the overall Contract "Accepted Programme".
4.	Confirm preparation of safety deliverables in conformance with Contract Master Deliverables List (CMDL).
5.	What are the current methods being used for Hazard Identification. Demonstrate effectiveness of the Hazard Identification Process(es).
6.	Demonstrate the management of hazards that have been identified at the interfaces with other Contractors, Infrastructure Managers and (or) Operators.
7.	Demonstrate how the stakeholders and Infrastructure Managers are involved in the Hazard Identification Process.
8.	Demonstrate how hazards are being managed and recorded in the PWHR.
9.	Demonstrate how Designers are addressing risk control actions.
10.	Show how the system is being designed to reduced risk to a level that is tolerable and ALARP.
11.	Show how the interface between CDM/ESM is being managed.
12.	Demonstrate how SIL requirement/assessments are being addressed.
13.	Show how the development of Engineering Safety Justifications is being developed.
14.	Provide evidence of internal ESM auditing by Contractor and external auditing of Subcontractors & Suppliers.

8 Reference Documents

Ref:	Document Title	Document Number:
1.	Crossrail ESM System Safety Plan	CRL1-XRL-O7-GST-CR001-00001
2.	CRL Engineering Safety Management - System Safety Plan Implementation Strategy	CRL1-XRL-O8-STP-CR001-50007
3.	Crossrail ESM Hazard Management Procedure	CRL1-XRL-O8-GPD-CR001-50002
4.	Crossrail Delivery Contracts Standard Engineering Safety Management Requirements Specification	CRL1-XRL-O8-GPD-CRG03-50001
5.	Audit Procedure	CR-XRL-O-GPD-CR001-50002

9 Standard Forms / Templates

Ref:	Document Title	Document Number:
A.	Not used	
B.		

10 Appendices

Not used