

TECHNICAL ASSURANCE

Post IFC (Issued for Construction) Changes Internal Crossrail Guidance Note

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Revision Changes:

Revision	Status / Description of Changes
2.0	Updated to provide post Gate 3 design control workflow and associated workflow step descriptions. The workflow describes how the existing PTR and GIR processes can be pragmatically implemented to manage design change following design acceptance at Gate 3.
Reference	Amendments
Section 4	Terms and Definitions updated.
Section 6	Updated throughout to reflect new process in Appendix B.
Section 7	Reference 6, 7 & 8 added.
Appendix A	Design Assurance & Change Control Flowchart for Proposed and Existing IM(s) Assets Removed – guidance on involvement of IM’s now held within Section 6.
Appendix B	Appendix added.
Appendix C	Appendix added.
3.0	Minor further amendments to this Revision and to Post Gate 3 design control workflow.
Reference	Amendments
Section 4	Additions to Abbreviations list.
Section 6	6.9 – update to state a relationship to be created in eB to the relevant RIR revision for all Gate Impact Reviews (GIRS).
	6.14 – to include ‘self-assurance’ process action to be taken by the Contractor.
	6.15 – to include works information action in the beginning of the sentence.
	6.19 – to include works information in this section.
Appendix B	Appendix B EM replaced by PM in 6.15 and 6.19 of the workflow.
4.0	Amendment to include CRL System Safety and IM review and sign off for impact or change to assets Handed Over

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1 Introduction

Where there is a change to the Gated design post 'Issued for Construction (IFC)' stage, the Gate Impact Review process is used to demonstrate design assurance. This document provides guidance on when and how that process is implemented. This guidance note should be read in conjunction with the **Engineering Design Assurance Gates Procedure (Ref 1)** which provides overarching instruction on design assurance.

2 Purpose

The purpose of this Guidance Note is as follows:

- to clarify the process for managing design changes post IFC to make sure the integrity of the assured design;
- to provide clear visibility at each stage to make sure compliance with the CRL assurance process.
- Clarify where key stakeholders, principally RfL, will be required to acknowledge and endorse change during the transition to full handover of the Railway.

3 Scope

This procedure applies to Stations, Portals & Shafts MEP and Architectural work packages within the Crossrail Central Section of the Crossrail Project.

It does not cover Systemwide contracts or those projects undertaken by other bodies (LU and NR) under their own project management systems as part of the Crossrail programme.

4 Terms & Definitions

PM, Supervisor's Representative & Others are terms as per W.I.

Abbreviation	Definition
CEG	Crossrail Chief Engineers Group
CRL	Crossrail Limited
Designer	FDC (see below) or D&B Contractor
D&B	Design & Build
EM	Crossrail Engineering Manager
ECMS	Employer's CAD Management System (Crossrail ProjectWise)
EDMS	Employer's Document Management System (Crossrail eB)
ETRL	Engineering Technical Review Lead
FCD	Field Change Document (issued via PTR system)
FDC	Framework Design Consultant (Designer)
GC	Gates Co-ordinator
GIR	Gate Impact Report
GPC	Gates Pass Certificate
GRAT	Gate Risk Assessment Tracker
HoD	Head of Discipline within CEG
HoTA	Crossrail Head of Technical Assurance

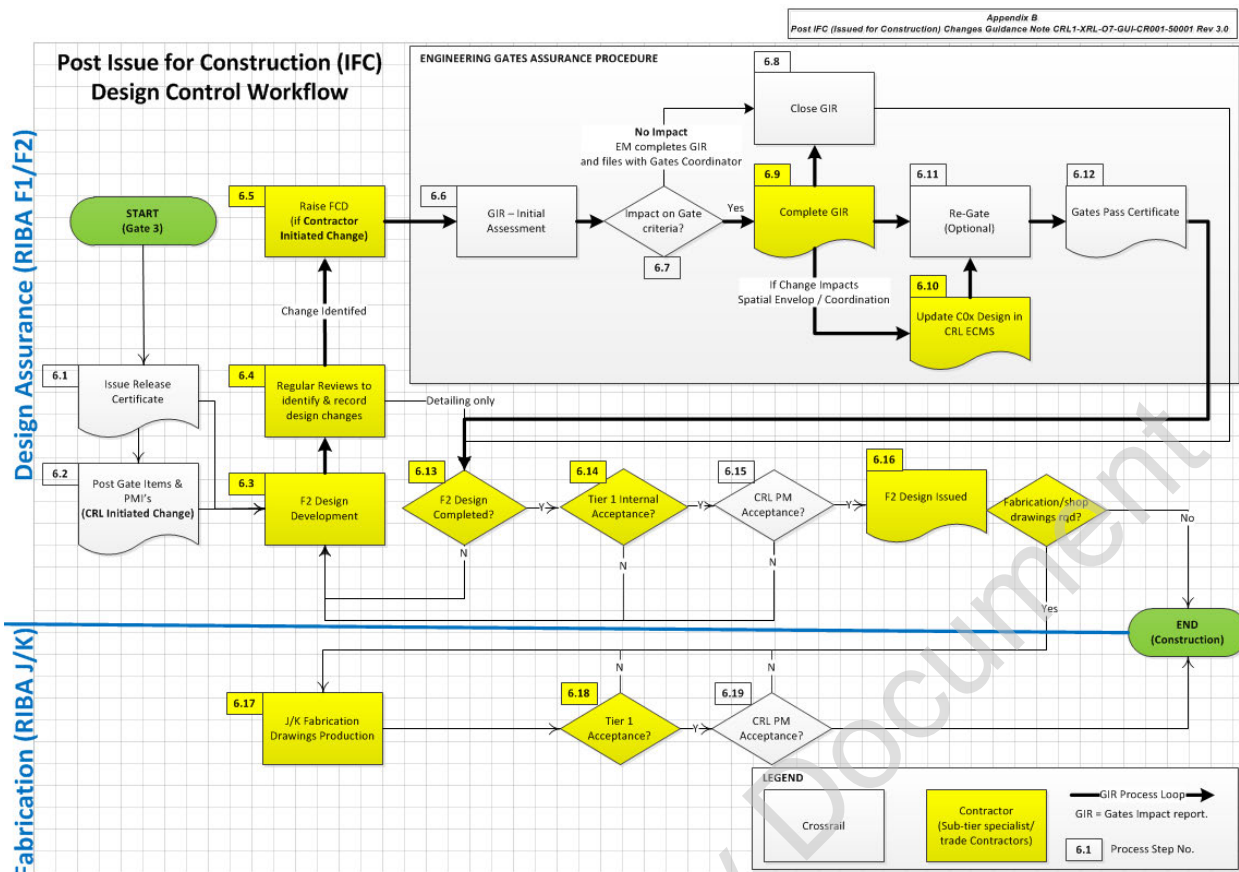
IFC	Issued for Construction
IM	Infrastructure Manager
LU	London Underground
MEP	Mechanical, Electrical & Plumbing
MoE	Manager of Engineering
NR	Network Rail
PDE	Principal Delivery Engineer
PTR	Project Technical Request
RIR	Register and Issue Record
SR	Supervisor's Representative
VAP	Verification Activity Plan
WI	Works Information
WPP	Work Package Plan

5 Responsibilities

Responsibilities are outlined within section 6 and Appendix B.

6 Procedure

See workflow diagram below (A4 copy as Appendix B) which contains corresponding step numbers as used below. **Bold highlights roles undertaking the main actions in each step of the workflow.** Also see Appendix C for the overall responsibilities between Crossrail EM and *Supervisor's Representative*.



6.1 Issue Gates Pass Certificate

The **HoTA** issues GPC to the **Contractor** in accordance with Ref 1 and using template Ref B.

6.2 Post Gate Items & PMI's

The **Contractor** shall maintain a Gate Risk Assessment Tracker (GRAT) or similar which details residual risk PMI's and other issues which are required and agreed by the Gates Panel to be managed to closure post Gate 3. The GRAT shall categorise the risk and define actions and mitigations to allow closure.

6.3 F2 Design Development

The **Contractor** commences RIBA stage F2 design development from their Gated RIBA stage F1 design to facilitate fabrication, manufacturing and procurement.

The **Contractor** is permitted to undertake this design development outside of Crossrail ECMS however this does not relieve the Contractor of their Contractual obligation to reflect changes to the Gates criteria back into the design within the Crossrail ECMS (as outlined in Step 6.10 and as per further guidance in the Q&A section)

6.4 Regular Reviews to Identify & Record Design Changes

The **Contractor** holds regular design reviews where the GRAT is reviewed and the following potential sources of change to the Gated design criteria are considered:

- General PMI's which have been issued to **Contractor** by the PM (as per Step 6.2)
- Post RIBA stage F1 design development (as per Step 6.3)

The purpose of the meeting is to manage design development and to identify and record any changes to the Gated design so they can be issued to the EM for further assessment.

These meetings should be led by the **Contractor's Design Manager** and attended by all parties employed by the Contractor to undertake Post RIBA stage F1 designs development (e.g.

Contractors principle designer and specialist trade contractors / fabricators) plus the Supervisor's Representative. On a VAP risk assessment basis, the EM/SR shall invite the relevant **HoD** to such meetings, and the **HoD** will identify and provide competent representative(s) to attend.

The Contractor should be particularly cognisant of potential changes arising through Post F1 design development if carried out by different contracting parties and/or in different design authorising environments to the RIBA F1 Gated design.

Contractor initiated design development changes shall be issued to Crossrail via an FCD (as per Step 6.5 below). Design development which is considered detailing only and does not constitute a change to the Gates criteria shall not be raised on an FCD.

6.5 Raise FCD (if Contractor initiated change)

The **Contractor** shall notify Crossrail of any Contractor initiated design development changes through the PTR process (as per Works Information Vol 2B, 14, 7, 2) by raising an FCD.

6.6 GIR – Initial Assessment

The Crossrail **EM/SR** undertakes an initial assessment of the Contractor and/or Crossrail initiated design change using the GIR template provided in Ref A.

The **EM** shall evaluate the design change to determine whether the Gates criteria of the Gated design require revalidation as per the GIR template. The **EM/SR** shall engage the relevant **HoD** for the review (this includes systems safety via the Head of Systems Safety and Interoperability or delegated representative).

The EM and HoD shall also consult with the **Contractor's Design Manager, HoTA** and the **IM representative**, as necessary, in assessing the full potential impact of the change against the Gated design.

6.7 Does the change impact on Gates criteria?

The **EM/SR** shall indicate on the appropriate box on PTR transmissions whether a formal GIR is required.

6.8 No Impact on Gates criteria – Close GIR

If the **EM/SR** decides there is no impact on the Gated design the GIR shall be updated to record this. The **EM** shall file a copy on site for record and provide a copy to the Gates and Assurance Inbox. The change will continue to be managed via the FCD process.

6.9 Impact on Gates criteria – Complete GIR

If on initial assessment the **EM/SR** decides that the change potentially impacts the Gated design the **EM/SR** shall instruct the **Contractor** to complete the GIR.

The **Contractor** completes the GIR initiated by the **EM/SR** in Step 6.6.

If there are changes on the related Infrastructure Protection Works, the documents are copied to site through the **EM/SR** so that a revised WPP can be prepared.

If there are changes to the Permanent Civils/Structural Works designed by the FDC, the EM shall instruct the **FDC designer** to consider the related questions on Space proofing, Design Life, Water tightness and Durability. The discipline signature box shall be completed by the relevant **FDC Discipline Engineer(s)**

The Gate Impact Report declaration shall be signed by the Contractor and the appropriate HoD (Including the CRL Head of Systems Safety & Interoperability or delegated lead). Where a design change has also been identified as impacting directly on an asset that has been Handed Over this will require the asset owner (IM) to sign. The report shall then be submitted to the CRL Gates & Assurance Team inbox for further review and assessment by the **HoTA**.

The **Contractor** shall create a relationship between the relevant RIR revision and the GIR in eB.

6.10 Update Gated C0x Design if change impacts spatial envelop / Coordination

When the change impacts upon the geometric representation, location, access requirements, operations or maintenance of the Gated design the Gated 3D models within the **ECMS** must be updated by the **Contractor**. These Gated 3D models shall then be used to generate the associated 2D drawings as per the CRL CAD Standards. Changes shall be clearly marked on the drawings in accordance with Ref 8. The 3D models (and associated re-runs of 3D model clash detection reports) and 2D drawings shall form part of the evidence presented by the **Contractor** should a re-Gate be required (as per Step 6.11). The **EM/SR** and **HoD** (plus any identified competent person(s)) shall decide which changes are incorporated back into the **ECMS**. See Q&A section below for further guidance.

The **Contractor** shall issue the revised drawings (and associated coordination models) on updated Contractor RIR's to facilitate onward issue to coordinating parties by Crossrail.

6.11 Re-Gate (if required)

The **HoTA**, in coordination with the **HoD**, shall decide whether a Re-Gate is required. A co-ordination meeting may be required.

- If a re-Gate is required then the HoTA shall advise the **EM/SR** to instruct the **Contractor** to provide supporting evidence for the re-Gate assurance process. The evidence required for submission at re-Gate is the same as for Gate 3, as outlined in Appendix A of Ref 1. The re-Gate shall then be conducted as per Ref 1. OR
- If a re-Gate is not required then the **HoTA** shall advise the **EM**.

6.12 Issue Revised Gates Pass Certificate

After successful completion of the re-Gate review or submission an additional GPC shall be released by the **HoTA**. The GIR, together with the GPC shall be sent by the **HoTA** to the **IM** for information, copied to the EM who shall revise the WPP if required.

6.13 Check whether F2 Design is completed

The **Contractor** assesses whether all F2 design development is complete and all outstanding post Gate items and PMI's are closed.

- If yes move to Step 6.14 where the Contractor internal acceptance process of the design is undertaken. OR
- If no move back to Step 6.3.

6.14 Contractor's (Tier 1) internal acceptance of RIBA F2 design

The **Contractor** reviews and accepts the RIBA F2 design in accordance with their internal self-assurance process. In conducting this review the Contractor should:

- Make sure the lead reviewer (who could be the Principal Designer) confirms that the RIBA F2 design is compliant with the Gated RIBA F1 design, checking that all changes have been through the necessary PTR and GIR processes. To confirm this it is recommended that **Contractor's Principal Designer** signs each of the RIBA F2 design drawings.
- Make sure that accepted changes that affect the spatial envelope of the Gated RIBA F1 design have been incorporated in the Gated C0x Design (2D drawings and 3D models) within Crossrail ECMS (as per Step 6.10).

The **Contractor** shall produce draft RIRs in advance of RIBA F2 design drawings being formally submitted under the NEC3 Contract to allow CRL to determine which documentation is required to be submitted for acceptance and which can be submitted for Information.

The **Contractor** shall then formally issue the RIR to the **Project Manager** via eB who will, where required by the Works Information, coordinate a review with the **EM** and **HoD** via standard eB review work order process. The **Contractor** should mark the issue purpose of the drawings on the RIR in accordance with the above (i.e. IFA (Issued for Acceptance) or IFI (Issued for Information)).

6.15 CRL review and acceptance of RIBA F2 design

When required to do so by the Works Information Crossrail reviewers respond to the **Contractor** with comments/acceptance within a period agreed with the **Supervisor's Representative**.

When all comments have been closed out the documents are provided as Code 1 by Crossrail in eB and transmitted back to the **Contractor**.

6.16 F2 Design Issued (for Construction)

The **Contractor** issues the F2 design drawings.

- If further detailing is required (e.g. fabrication drawings, shop drawings) then move to Step 6.17
- If the F2 design drawings level of detailing is sufficient for Construction needs then they shall be issued to site for Construction. The drawings shall also be issued to Others for interfacing and coordination in accordance with the RIR process (process ends).

Note: that it will be common for packages of work within a Gate scope will contain a combination of the two scenarios above.

6.17 J/K fabrication drawings production

The **Contractor's** designated specialist sub-contractors produce RIBA stage J/K design drawings from the accepted RIBA stage F2 design.

These drawings are permitted to be developed outside of Crossrail ECMS.

6.18 Contractor's (Tier 1) internal acceptance of RIBA J/K drawing

The **Contractor** reviews and accepts the RIBA J/K drawings in accordance with their internal process. In conducting this review the Contractor should make sure that the drawings are compliant with the accepted RIBA F2 design (and therefore also compliant with the Gated RIBA F1 design).

The **Contractor** shall produce and submit draft RIRs in advance of RIBA J/K fabrication drawings being formally submitted so that the PM (as advised by the **Supervisor's Representative** (who identifies competent person(s) through the **HoD** to review on their behalf as necessary)) on a VAP risk basis can declare which drawings require to be submitted for acceptance and which can be submitted for Information.

The **Contractor** shall then formally issue the RIR to the **Supervisor's Representative** via eB who will coordinate a review with the HoD via standard eB review work order process. The Contractor should mark the issue purpose of the drawings on the RIR in accordance with the above (i.e. IFA (Issued for Acceptance) or IFI (Issued for Information)).

6.19 CRL review and acceptance of RIBA J/K drawing

Where required to do so by the WI Crossrail reviewers (as per Step 6.18) respond with comments/acceptance within a period agreed with the **Supervisor's Representative**. On receipt of comments, and following the **Supervisor's Representative's** own review of the drawings, **Supervisor's Representative** responds to the **Contractor** either accepting the drawings for fabrication or rejecting with comments if they do not comply with the F2 accepted design.

When all comments have been closed out the drawings are provided as Code 1 by Crossrail in eB and transmitted back to the **Contractor** so that fabrication and construction can commence.

7 Reference Documents

Ref:	Document Title	Document Number:
1.	Engineering Design Assurance Gates Procedure	CRL1-XRL-O7-GPD-CR001-50015
2.	Assurance Gates Implementation Procedure	CRL1-XRL-O7-GPD-CR001-50017
3.	Change Control and Budget Management Procedure	CR-XRL-Z9-GPD-CR001-50003
4.	Contract Administration Manual	CRL1-XRL-W-GML-CR001-50001
5.	Systemwide Design Gate Review Procedure	CRL1-XRL-O7-GPD-CR001-50012
6.	Issue of Design Documentation for Construction Procedure	CRL1-XRL-O4-GPD-CR001-50007
7.	Guidance Note – Acceptance of Fabrication Drawings through Contractor Designer.	CRL1-XRL-O7-GUI-CR001-50013
8.	Guidance Note - Best Practice Management of Revision Clouds on Drawings	CRL1-XRL-O7-LRC-CR001-50007

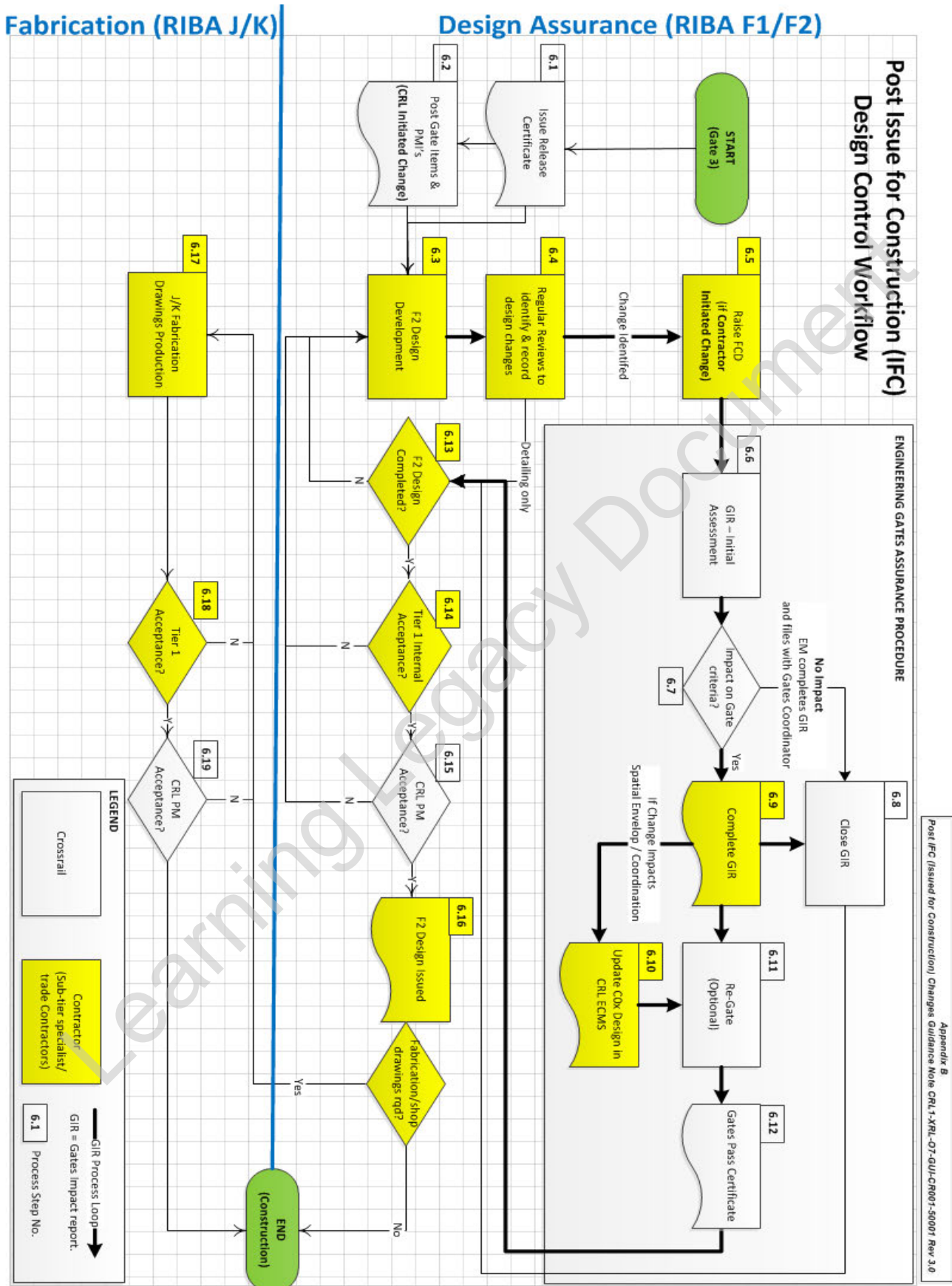
8 Standard Templates

Ref:	Document Title	Document Number:
A.	Gates Pass Certificate Template	CRL1-XRL-O7-ZTM-CR001-50008
B.	Gate Impact Report Template	CRL1-XRL-O7-ZTM-CR001-50009

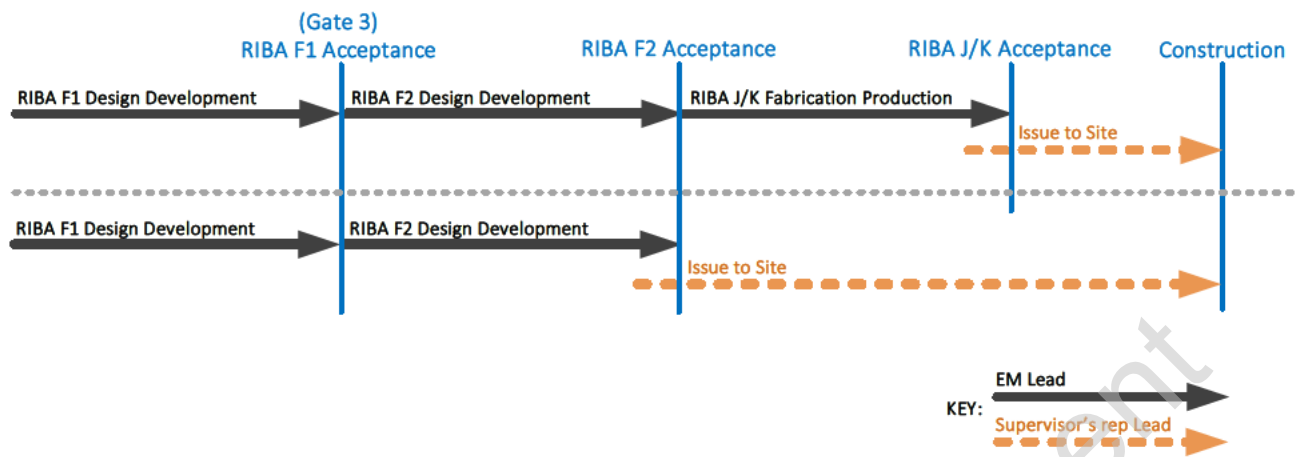
9 Appendices

Appendix A - Design Assurance & Change Control Flowchart for Proposed and Existing IM(s) Assets
REMOVED.

Appendix B – Post Gate 3 Design Control Workflow



Appendix C – Post Gate 3 Design Control Workflow - Crossrail Responsibilities View



Learning Legacy Document

Appendix D – Q&A

This section provides a number of common questions and answers intended to provide context and understanding of this guidance note.

Q1 – Is the Contractor allowed to develop Post F1 design deliverables from separate design authoring environment to Crossrail’s ECMS (ProjectWise) (as per step 6.4)?

A1 – Yes, Post F1 level of detail design is permitted to be authored outside of the Crossrail ECMS. As is outlined in this guidance note (and specifically Step 6.10) some of the design development is required to be updated back into the Gated design model and drawings within the ECMS. Additionally it is worth noting that all deliverable design drawings are still required to be issued to Crossrail through the EDMS (eB).

Q2 – Why is the Contractor allowed to develop Post F1 design outside of the Crossrail ECMS? Would it not be better for this design to be done within the ECMS to support coordination, as is required prior to Gate 3?

A2 – There are a number of issues associated with the post F1 design:

Firstly, the 3D models developed to enable fabrication and manufacturing are more detailed than required by Crossrail to support the two key functions of the 3D model, namely a) coordination and b) eventual operations and maintenance by the IM. Models developed for fabrication and manufacturing tend to be highly detailed and very large in size resulting in them being difficult to manage. CRL CAD Standards Appendix J defined the level of detail required in the 3D model.

Secondly, many of the Contractors have established advanced workflows to manufacture and fabricate directly from 3D models and 2D drawings and these processes often do not use the same Bentley design authoring tools as are required to author the RIBA F1 Gate 3 designs. These workflows bring significant cost savings for manufacturing, fabrication and procurement to the Contractor and Crossrail.

Q3 – Why does the design within the CRL ECMS need to be updated as part of the GIR Process as outlined in 6.10, will the changes not be captured as part of the as-built records?

A3 – The accepted Gated design produced within the CRL ECMS is being used by *Others* (including Systemwide) to coordinate their designs. If changes are not reflected back into the CRL ECMS then those coordinating Contractors will be developing their design against incorrect information.

For this reason, as outlined in 6.10 above, change that impacts upon the geometric representation, location, access requirements, operations or maintenance of the Gated design shall be updated back into the CRL ECMS and reissued to coordinating parties via the RIR process.

Q4 – Do all changes that impacts upon the geometric representation, location, access requirements, operations or maintenance of the Gated design need to be reflected back into the 3D models in the ECMS (step 6.10)?

A4 – No, the EM, supported by the HoD, and HoTA, should assess whether a change of this nature will impact upon coordinating parties. As an example, a relatively minor spatial repositioning of a riser could impact upon a Systemwide contractor if it encroaches into a spatial corridor allocated for their use. Another example could be that the Contractor redesigns the position of ducting for Systemwide equipment which moves the ducting from being in a corridor into being inside the same room as the equipment. This change could have an impact on the maintenance regime of the ducting as now the equipment in the same room with unacceptable restricted access. In both of these cases there is an impact on the 3D model coordination so these changes should be reflected back into the 3D models.

Changes not reflected back into the 3D model still require to be captured by the Contractor as part of their field change / redlining process to make sure the as built record is developed progressively.

Q5 – How do Crossrail accept the Contractor’s internal acceptance process (as per Step 6.14)?

A5 – The Contractor should update their Design Management Plan (DMP) to reflect how they maintain design control post Gate 3. This should include how they are reviewing design change post Gate 3 and how post Gate 3 design deliverables are assessed and accepted prior to issue to Crossrail for acceptance.

Q6 – Is the Contractor required to have a declaration accepting their post Gate 3 design deliverables and if so where is this declaration – on the drawings, an additional certificate or elsewhere (Step 6.14)?

A6 - The Contractor is required to put a decal on all deliverables (as per section 14.7.2 of WI Vol 2B).

Q7 - How do the Crossrail *Supervisor's Representative* or identified competent reviewers establish which F1 information against which to review the F2 deliverables (Step 6.15)?

A7 – It is important that any Post Gate 3 design change is progressively managed. The regular reviews by Contractor (Step 6.4) and EM (Step 6.6) of design change should mean all parties understand the progressing design and changes. It is recommended that the *Supervisor's Representative* is involved in the GIR process so they understand the context and detail of the changes. The Contractor could cross reference their F2 deliverable drawings back to the F1 drawings (for example by tracking this within the notes section of their F2 deliverables) to assist with correct and efficient review of the post F1 design by the Contractor and Crossrail. Similarly the F2 drawings can be related to the F1 drawings through creating document relationships between these deliverables in the EDMS (Crossrail eB).

Q8 - Why bring in CEG to review any Tier 1 F2 MEP drawings / MEP Information (as per Step 6.15), we have been through Gate 3?

A8 - There still is an element of design and coordination after Gate 3, and this element is critical to the success of the project. CEG understand and know the MEP design so it's using this advantage and applying this to the F2 design. CEG know the standards of F2 design and are familiar with BSRIA and good practice, and also have a vast amount of experience. This can help make sure F2 standard is kept high. Any reviews can be the same time as the FE's so there will be no delays, and would relatively be a simple exercise. It can simply be signed by CEG. The HOD will send their MEP representative to attend and sign (i.e. The MEP Coordinator (who will bring in other members of CEG if needed)), who has good working relationships with the FE's. CEG and the MEP Coordinators are critical to the success of the F2 design development through the constructions stages.