TECHNICAL ASSURANCE

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

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Current Document History:

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Revision	Effective/Prepared Date:	Author:	Reviewed by:	Approved by:	Reason for Issue
1.0	28-05-2015	[redacted]	[redacted]	[redacted]	First Issue
2.0	14-07-2016	[redacted]	[redacted]	[redacted]	Issue for implementation
3.0	18/01/2017	[redacted]	[redacted]	[redacted]	Update to Revision 3.0 and changes to workflow Appendix A

Revision Changes:

Revision	Status / Description of Changes
1.0	First issue.
2.0	Incorporate assurance changes to draft and issue for implementation.
3.0	Minor further amendments to post Gate 3 workflow and typographical corrections.
Section 6.0	Section 6.9 updated to state a relationship to be created in eB to the relevant RIR revisions for all GIRs.
Appendix A	EM replaced by PM in boxes 6.15 and 6.19 of 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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Contents

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 **Systemwide Design Gate Review Procedure (Ref 1**) which provides overarching instruction on design assurance.

Additional reference can be found in the source document, **Post IFC (Issued for Construction) Changes Crossrail Internal Guidance Note (Ref 9).**

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.
- to 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 Systemwide contracts within the Crossrail Central Section of the Crossrail Project.

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
PM	Project Manager
PMI	Project Manager's Instruction
PTR	Project Technical Request

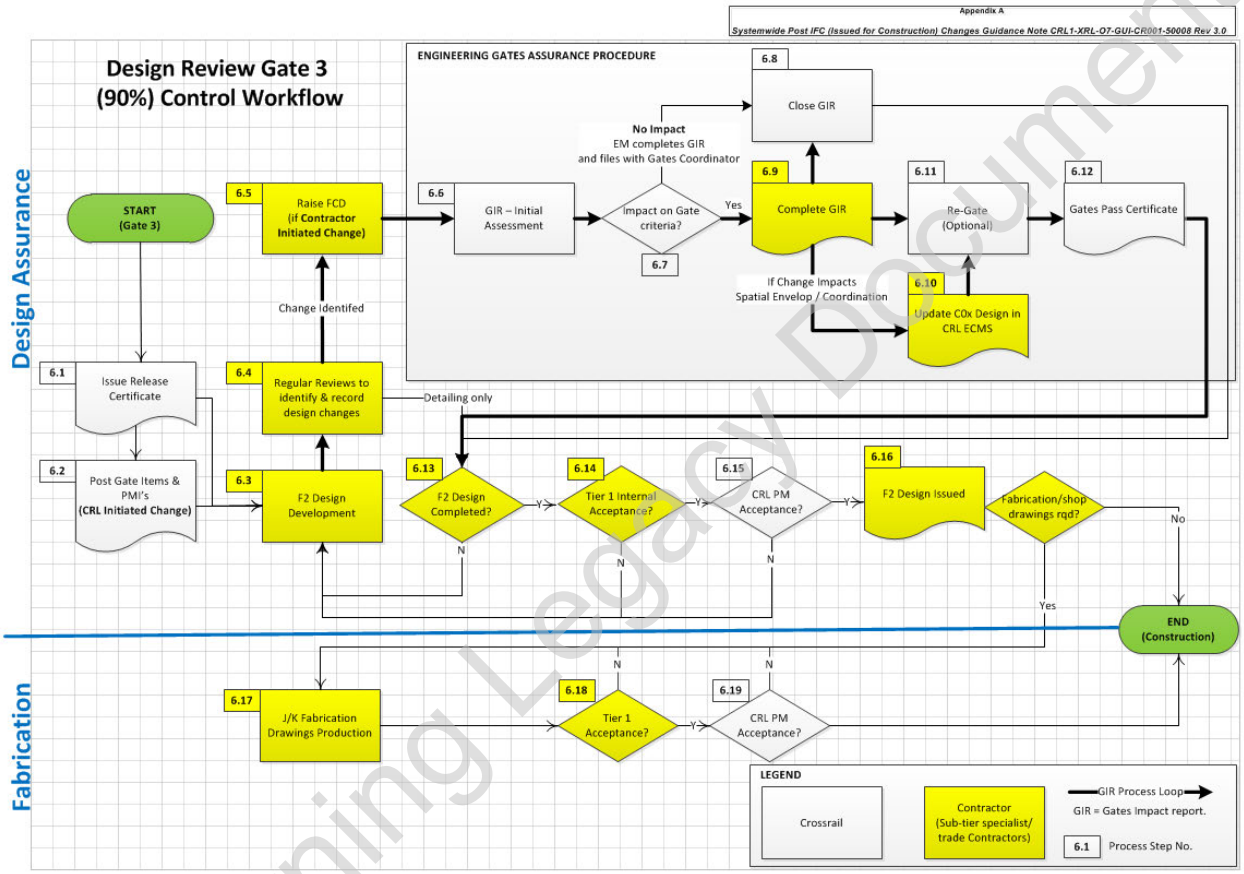
VAP	Verification Activity Plan
WPP	Work Package Plan

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.*



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6.1 Issue of Design Gate Review Release

The **Project Manager (PM)** issues Design Gate Review to **Contractor** in accordance with Ref 1 and using template Ref A.

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 Installation Development

The **Contractor** commences Post Gate design development from their accepted 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 Gate Risk Assessment Tracker (GRAT) is reviewed and the following potential sources of change to the gated design criteria are considered:

- PMI's which have been issued to **Contractor** by the *PM* (as per Step 6.2)
- Post Gate 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 Engineering Manager 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 Gate design development **(e.g. Contractors principle designer and specialist trade contractors / fabricators)** plus the **Crossrail EM**. On a VAP risk assessment basis, the **EM** 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 Gate design development if carried out by different contracting parties and/or in different design authorising environments to the Gated design.

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

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** shall engage the relevant **HoD f**or the review. The **EM** and **HoD** shall also consult with the **Contractor's Design Manager, Head of System Safety & Interoperability (**or delegated representative), **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** 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** 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** decides that the change potentially impacts the gated design the **EM** shall instruct the **Contractor** to complete the GIR.

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

If there are changes on the related Infrastructure Protection Works, the documents are copied to site through the **EM** 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 request that the **FDC designer** is instructed to consider the related questions on Spaceproofing, Design Life, Watertightness 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 revisions 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** 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** 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 Installation Design is completed

The **Contractor** assesses whether all installation 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** Installation design submission to CRL

The **Contractor** shall produce draft RIRs in advance of installation design drawings being formally submitted to allow CRL to determine in accordance with their VAP 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 Installation design

Where required to do so by the Works Information Crossrail reviewers (as per Step 6.14) respond to the **Contractor** with comments/acceptance within a period agreed with the **EM.**

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 Final Design Issued (for Construction)

The **Contractor** issues the final installation drawings.

- If further detailing is required (e.g. fabrication drawings, shop drawings) then move to Step 6.17.

- If the installation 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 Fabrication drawings production

The **Contractor's** designated specialist sub-contractors produce fabrication drawings from the accepted final design.

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

6.18 **Contractor's** internal acceptance of Fabrication drawing

The **Contractor** reviews and accepts the fabrication drawings in accordance with their internal process. In conducting this review the **Contractor** should make sure that the drawings are compliant with the accepted installation design (and therefore also compliant with the gated design).

The **Contractor** shall produce and submit draft RIRs in advance of fabrication drawings being formally submitted so that the *PM* (as advised by the **EM** (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 **EM** via eB who will where required by the WI 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 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 EM. On receipt of comments, and following the **EM's** own review of the drawings, the **EM** responds to the **Contractor** either accepting the drawings for fabrication or rejecting with comments if they do not comply with the accepted final detailed 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.	Systemwide Design Gate Review Procedure	CRL1-XRL-O7-GPD-CR001-50012
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 Works (CAM)	CRL1-XRL-W-GML-CR001-50001
6.	Issue of Design Documentation for Construction	CRL1-XRL-O4-GPD-CR001-50007
7.	Guidance Note – Acceptance of Fabrication Drawings through Contractor Designer.	CRL1-XRL-O7-GUI-CR001-50012
8.	Guidance Note - Best Practice Management of Revision Clouds on Drawings	CRL1-XRL-O7-GUI-CR001-50007
9.	Post IFC (Issued for Construction) Changes Crossrail Internal Guidance Note	CRL1-XRL-O7-GUI-CR001-50001

8 Standard Templates

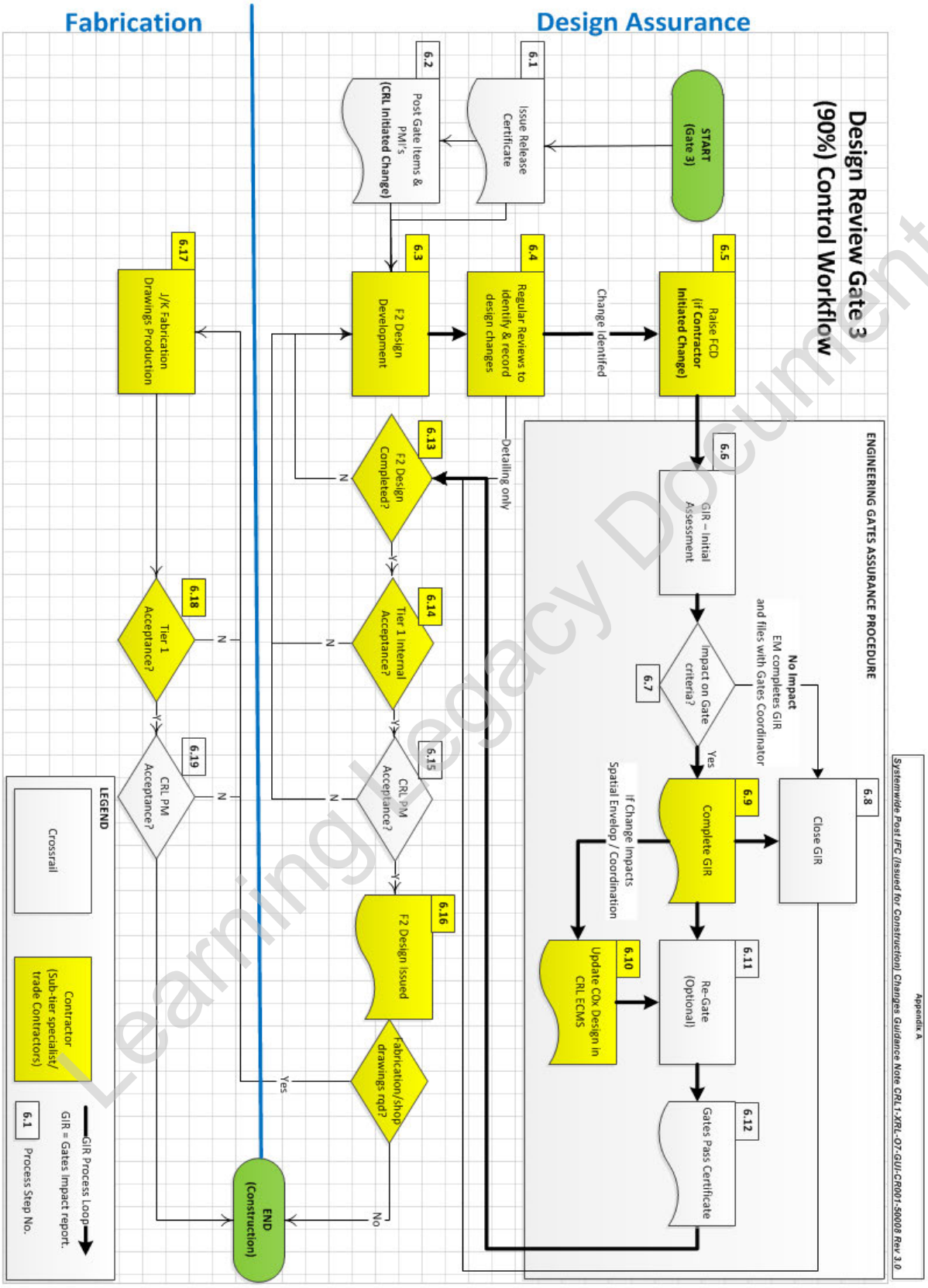
Ref:	Document Title	Document Number:
A.	Gates Pass Certificate	CRL1-XRL-O7-ZTM-CR001-50008
B.	Gate Impact Report Template	CRL1-XRL-O7-ZTM-CR001-50009

9 Appendices

Appendix A – Design Review Gate 3 (90%) Control Workflow

Appendix B – Questions and Answers

Appendix A - Design Review Gate 3 (90%) - Control Workflow



Appendix B – Questions and Answers

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* 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 another **Contractor** if it is encroaches into a spatial corridor allocated for their use. 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 Pan (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 changes 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.