

Completing the Elizabeth line

5 April 2023



Contents

1. How it's brought together
2. Getting grip with complexity
3. Progressive assurance
4. Consistency
5. Strong Controls

Systems Assurance - Safety

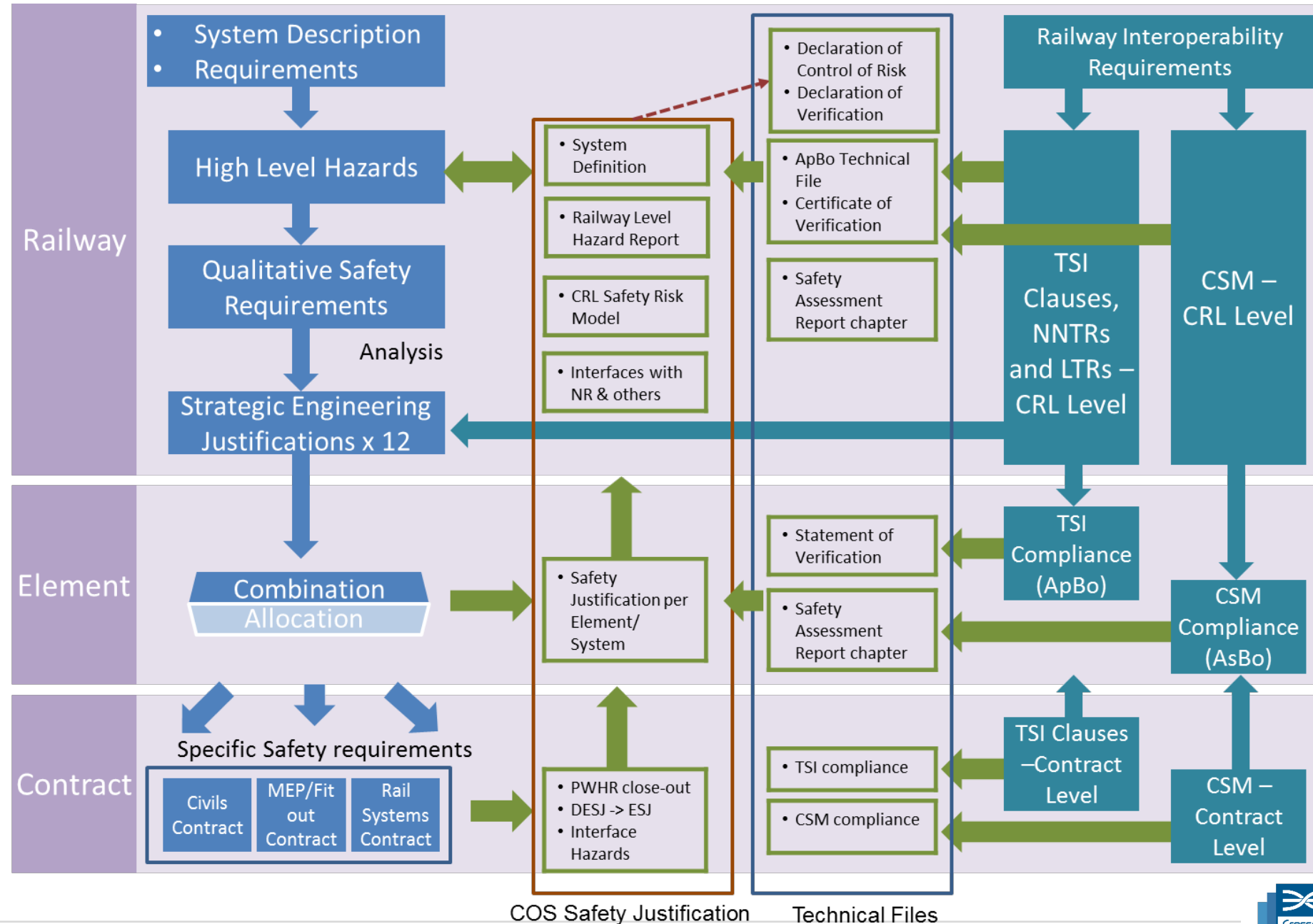
Hayat Zerkani Head of System Safety & Interoperability



1. How It's brought together

Legislative Framework

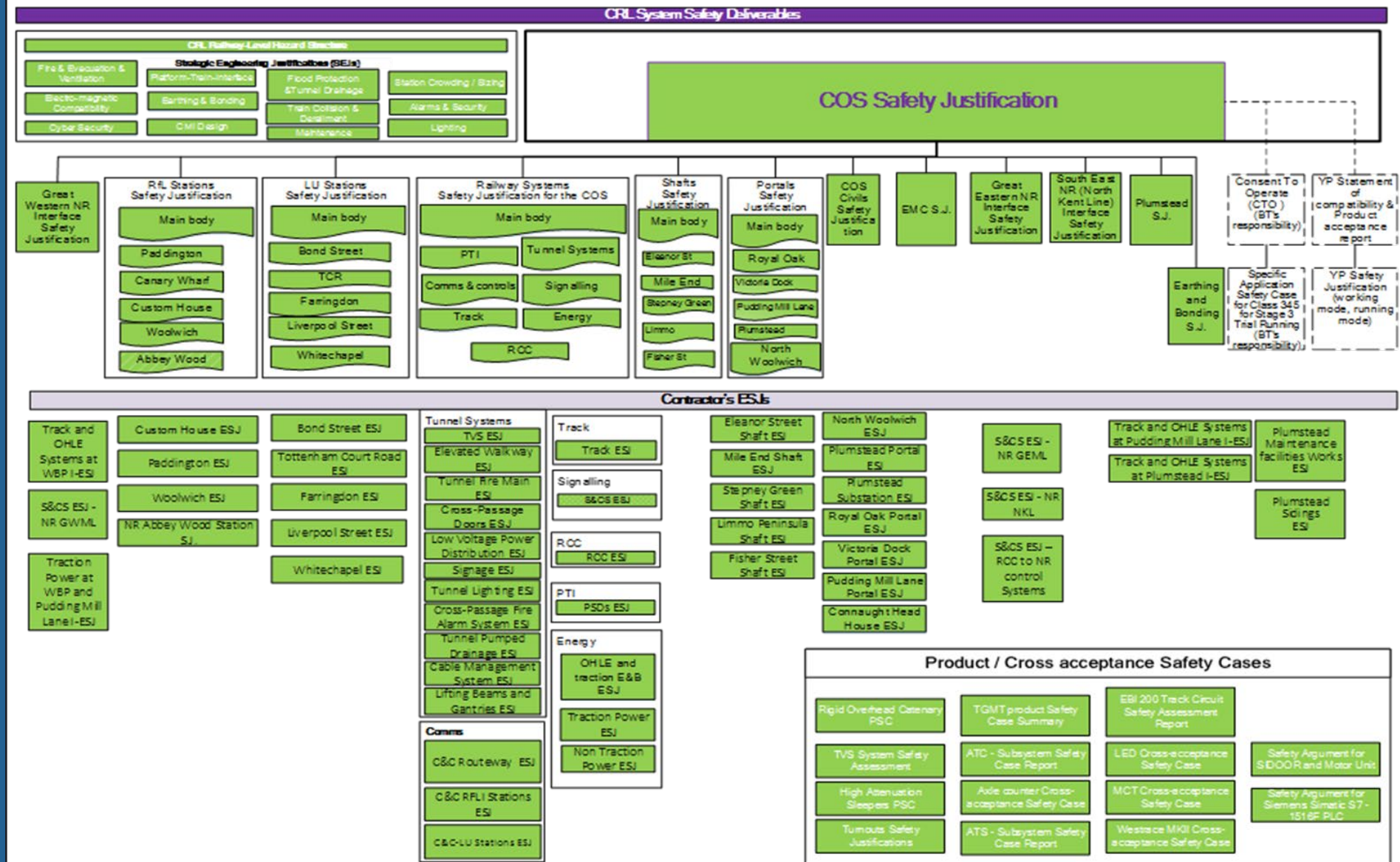
- Interoperability Directive [2008/57/EC]
 - TSI compliance
 - Approved Body (ApBo)
- Safety Directive [2004/49/EC]
- Common Safety Method Regulation [Regulation (EU) 402/2013]
 - Significant Change
 - Assessment Body (AsBo)



2. Get a grip on Complexity

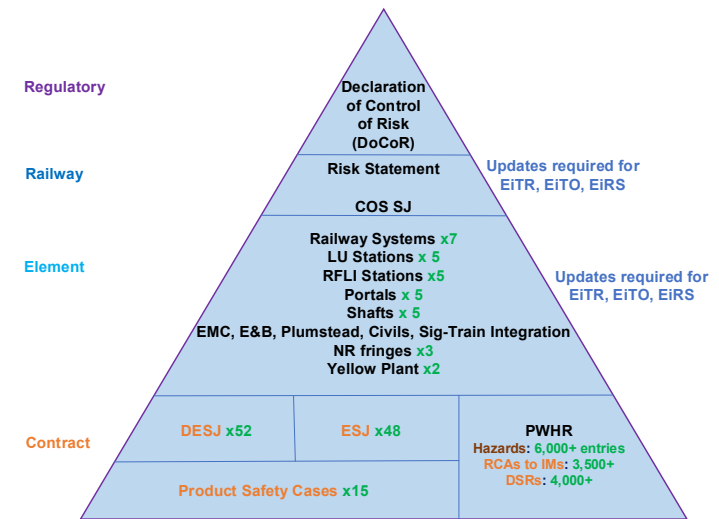
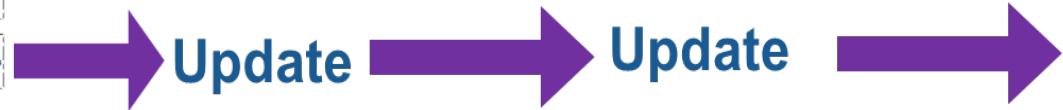
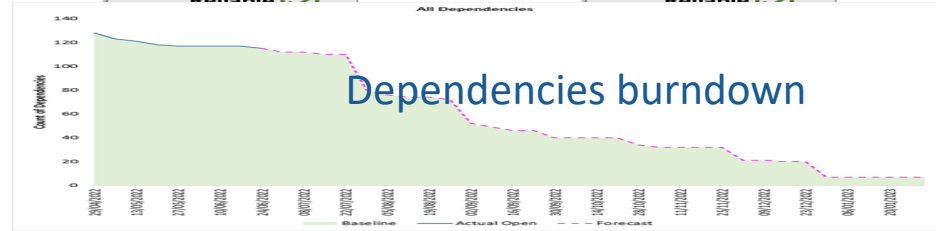
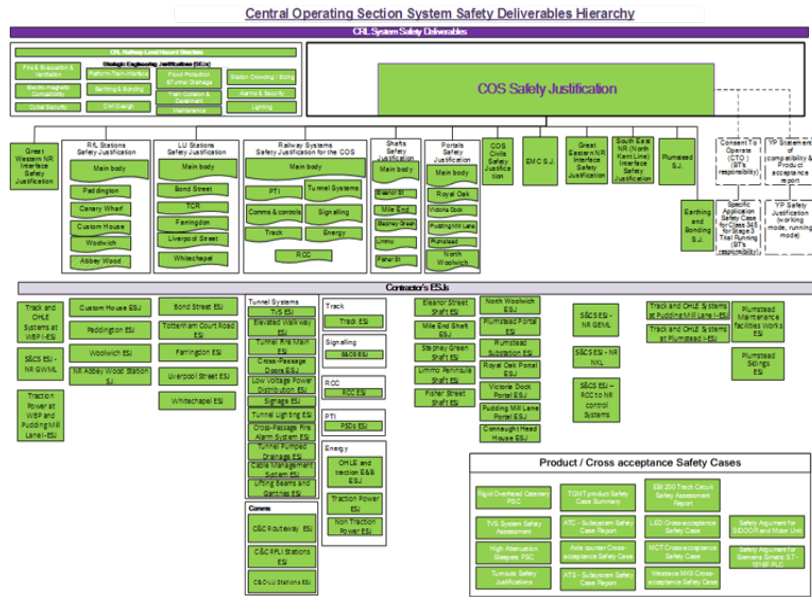
- Each contract produced Engineering Safety Justifications (ESJs) – (Design ESJs at Final Design Overview, FDO), built in some cases on Product Safety Cases
- CRL produced the Integrated Safety Justifications (1 per element / railway system – (Interim Safety Justifications at FDO)
- CRL produced Integrated COS SJ and CESAC (Crossrail Engineering Safety and Assurance Case)

Central Operating Section System Safety Deliverables Hierarchy



3. Progressive Assurance

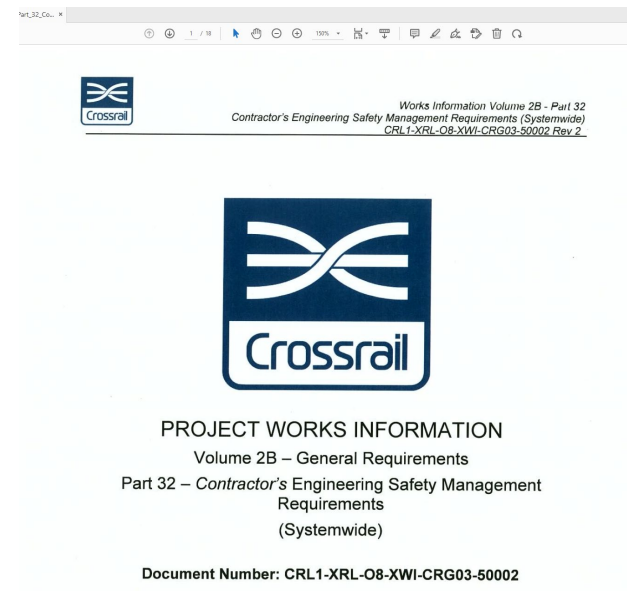
- In 2019, introduction of the staged railway configurations
- CRL Safety Assurance strategy reset: management of agreed deferred functionality to allow progress to next configuration
- Safety Justifications with dependencies
- Agree acceptable dependencies with stakeholders:
 - Structured Engineering Judgement (STEJ)
 - Agree mitigations (e.g. Operating restrictions)
- Summarise status of dependencies and acceptability in 'Risk Statement'
- Accepted by System Review Panel RAB-C and later RFLI ITAP
- Sign 'Declaration of Control of Risk'
- Update deliverables for each configuration




4. Consistency of safety management approach through all contracts

- Project Works Information for all contractors
- CRL ESM Reference Manual (Plan and other procedures) as a basis for all, used by AsBo to audit against
- Single Hazard Record (PWRH) for all
 - Core satisfaction to CSM
 - Allowed and evidenced Risk Control Action Transfer to IM/Operator
 - Risk Acceptance defined
 - Safety Requirements closure evidenced
- CRL Central team review/acceptance of all deliverables/hazards

Contractor's ESM Requirement

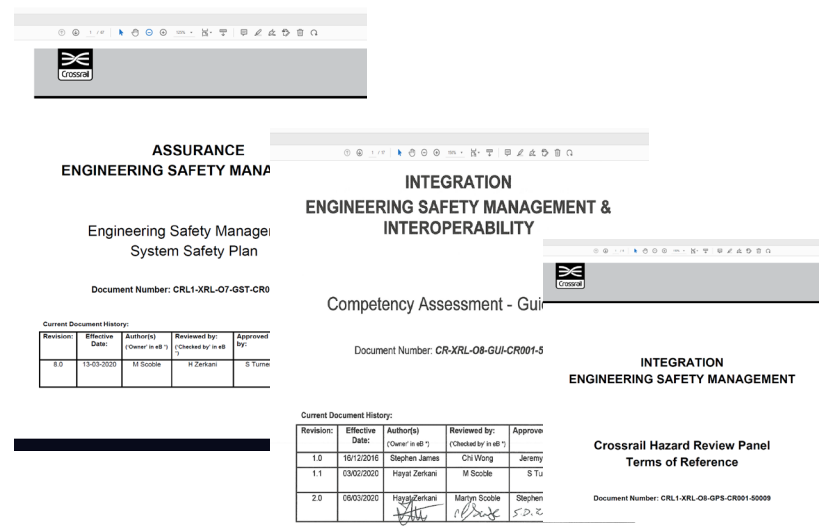


Works Information Volume 2B - Part 32
Contractor's Engineering Safety Management Requirements (Systemwide)
CRL1-XRL-08-XWI-CRG03-50002 Rev 2



PROJECT WORKS INFORMATION
Volume 2B – General Requirements
Part 32 – Contractor's Engineering Safety Management Requirements (Systemwide)
Document Number: CRL1-XRL-08-XWI-CRG03-50002

ESM Reference Manual



ASSURANCE
ENGINEERING SAFETY MANAGEMENT

Engineering Safety Management System Safety Plan
Document Number: CRL1-XRL-07-GST-CR0

Revision	Effective Date	Author(s)	Reviewed by (Checked by in all)	Approved by
0.0	13/03/2020	M Scoble	H Zerkani	S Tu

INTEGRATION
ENGINEERING SAFETY MANAGEMENT & INTEROPERABILITY

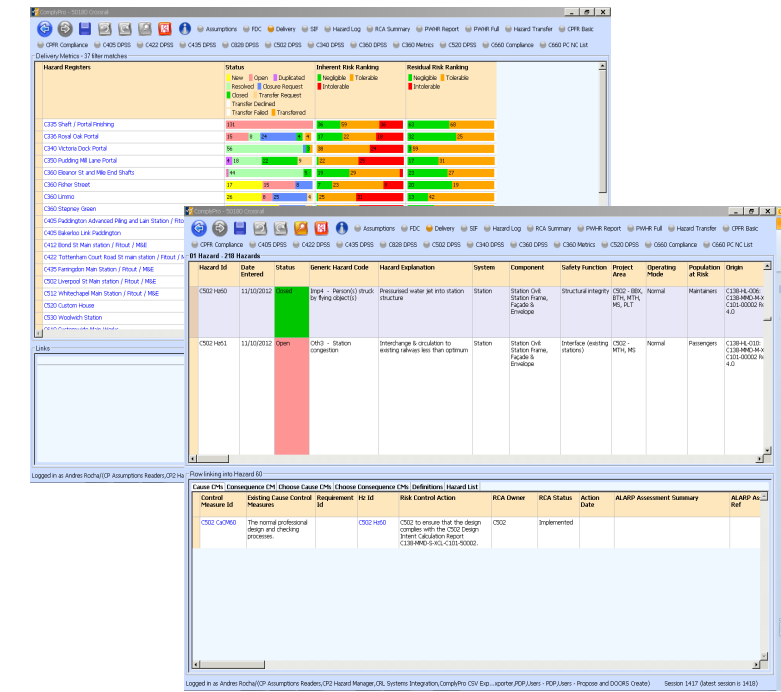
Competency Assessment - Guidance
Document Number: CR-XRL-08-GUI-CR001-5

Revision	Effective Date	Author(s)	Reviewed by (Checked by in all)	Approved by
1.0	16/12/2016	Stephen James	Chi Wong	Jeremy
1.1	03/02/2020	Hayat Zerkani	M Scoble	S Tu
2.0	06/03/2020	Hayat Zerkani	Martin Scoble	Stephen

INTEGRATION
ENGINEERING SAFETY MANAGEMENT

Crossrail Hazard Review Panel Terms of Reference
Document Number: CRL1-XRL-08-GPS-CR001-50009

One Hazard Record for all (PWRH)



Summary of Hazard Registers:

Hazard Register	Status	Inherent Risk Ranking	Residual Risk Ranking
C305 Shaft / Portal Finishing	Open	High	Medium
C306 Road Out Portal	Open	High	Medium
C307 Victoria Dock Portal	Open	High	Medium
C308 Pudding Hill Lane Portal	Open	High	Medium
C309 Queens St and Hill End Shafts	Open	High	Medium
C300 Pinner Street	Open	High	Medium
C300 Limes	Open	High	Medium
C300 Stapeve Green	Open	High	Medium
C405 Paddington Advanced Ring and Lane Station / Platform	Open	High	Medium
C405 Bayswater Lane Station	Open	High	Medium
C402 Bond St Main Station / Platform	Open	High	Medium
C402 Tottenham Court Road St main station / Platform	Open	High	Medium
C405 Farringham Main Station / Platform / ME	Open	High	Medium
C302 Liverpool St Main Station / Platform / ME	Open	High	Medium
C312 Whitechapel Main Station / Platform / ME	Open	High	Medium
C320 Custom House	Open	High	Medium
C330 Woodwharf Station	Open	High	Medium

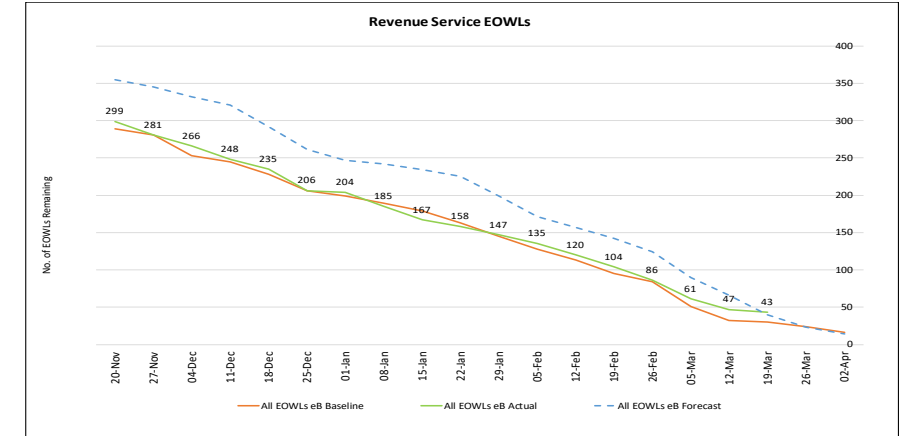
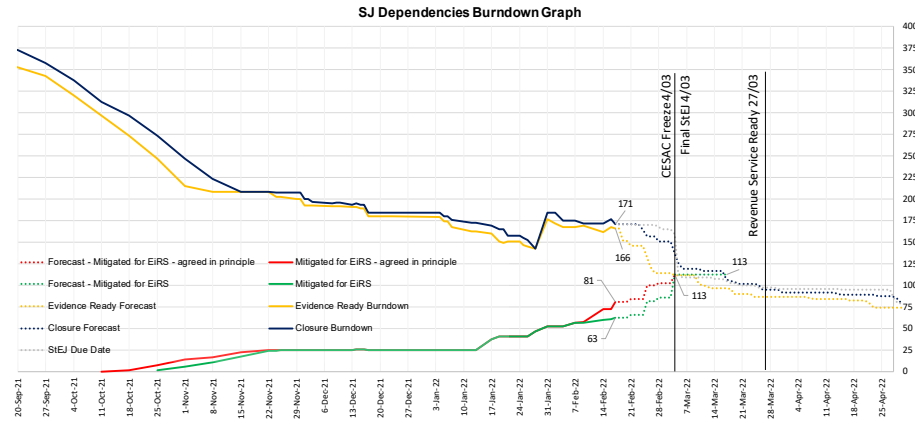
Hazard Details for C302 H401:

Hazard ID	Date Entered	Status	Generic Hazard Code	Hazard Explanation	System	Component	Safety Function	Project Area	Operating Mode	Population at Risk	Origin
C302 H401	11/10/2019	Open	C302 - Station congestion	Interchange & circulation to existing services less than optimum	Station	Station Civil Station Frame, Facade & Structure	Structural Integrity	C302 - BAY, FACADE & STRUCTURE	Normal	Passengers	C302-H401, C302-H402, C302-H403, C302-H404, C302-H405, C302-H406, C302-H407, C302-H408, C302-H409, C302-H410, C302-H411, C302-H412, C302-H413, C302-H414, C302-H415, C302-H416, C302-H417, C302-H418, C302-H419, C302-H420, C302-H421, C302-H422, C302-H423, C302-H424, C302-H425, C302-H426, C302-H427, C302-H428, C302-H429, C302-H430, C302-H431, C302-H432, C302-H433, C302-H434, C302-H435, C302-H436, C302-H437, C302-H438, C302-H439, C302-H440, C302-H441, C302-H442, C302-H443, C302-H444, C302-H445, C302-H446, C302-H447, C302-H448, C302-H449, C302-H450, C302-H451, C302-H452, C302-H453, C302-H454, C302-H455, C302-H456, C302-H457, C302-H458, C302-H459, C302-H460, C302-H461, C302-H462, C302-H463, C302-H464, C302-H465, C302-H466, C302-H467, C302-H468, 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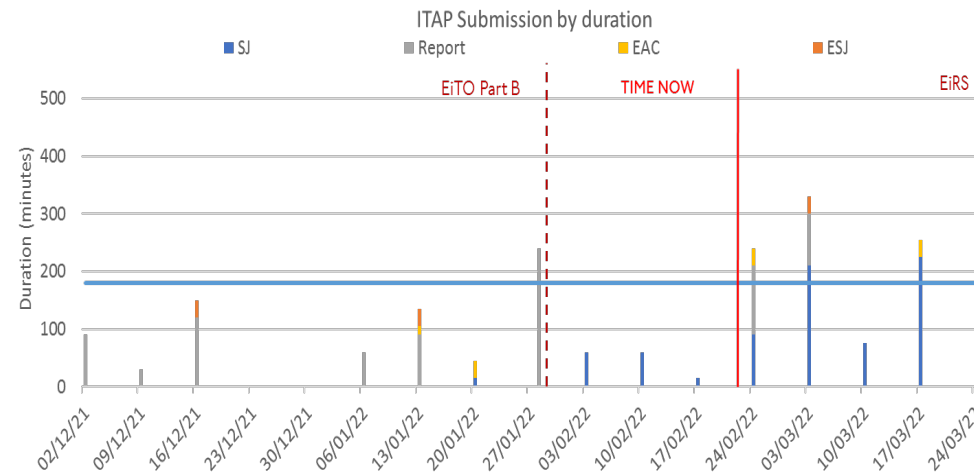
5. Robust Control Mechanism, Focus, Completeness

- Robust Controls: Aligning Dependencies with outstanding works and programme of delivery
- Focus on the deliverable easier by remote working:
 - Tools that can be used by all remotely
 - Strong working relationship well established before COVID
- Completeness:
 - Top down approach to hazard and risk management
 - Bottom up approach
 - Robust review process: Contractor/ISA, CRL, AsBo, RFLI/LU then RAB-C
- Everything by the book from the start! However, not always popular!

Robust Controls



Focus and Remote working



ORR confirms green light for Elizabeth Line

