

HKICA Seminar: 22-02

Title: Auditing Europe's largest rail infrastructure project – Crossrail

Date: 24th September 2022

Organizer: Hong Kong Institution of Certified Auditors

Co-organizers: Civil and Materials Divisions of the Hong Kong Institute of Engineers



“Crossrail is Europe’s largest infrastructure project, and among the most significant infrastructure projects ever undertaken in the UK”.



CLASS
345
TRAINS

24th September 2022

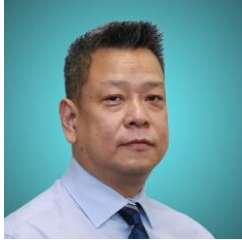
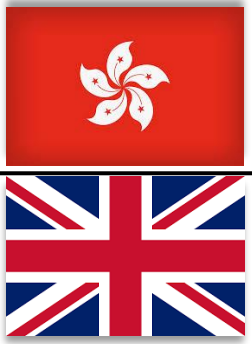
QMS Auditing on Crossrail (UK) – V6.0

Disclaimer: Any views or opinions represented in this presentation are personal and do not represent the views of any institutions or organisations that might be referred to, unless explicitly stated.

INTRODUCTION

- ❖ **About me**
- ❖ **Crossrail background**
- ❖ **Crossrail governance**
- ❖ **Auditing on Crossrail**
- ❖ **Audit reports**
- ❖ **Case Study: Canary Wharf**
- ❖ **Audit fundamentals**
- ❖ **Auditing challenges & benefits**
- ❖ **Audit success factors**
- ❖ **Cultural differences**
- ❖ **Discussions and Q&A**

ABOUT ME



Andy Yeung T S (楊德師)

Chief Engineering Assurance Manager – MTRCL

Skills & Competency

- Strategic Planning
- Corporate Transformation
- Enterprise Risk Management
- BIM, CDE & Digital Evolution
- Governmental Inquiries
- Incident Investigation
- Turnkey Project & Delivery
- Construction Management
- Performance Turnaround
- Troubleshoot & Resolution
- Departmental Planning
- Engineering & Technical
- UK Government National Security
- Corporate Governance
- Project Quality Assurance
- Self-Certification & Handover
- ICE, ECI, PPP, NEC3 & NEC4
- Safety Incident Investigation
- Root Cause Investigation
- 1st, 2nd & 3rd Party Auditing
- Operation & Maintenance Manual
- Standards: ISO 9001, ISO 14001, ISO 19650, ISO 27001, ISO 31000, ISO 44001, ISO 45001 & PAS 99

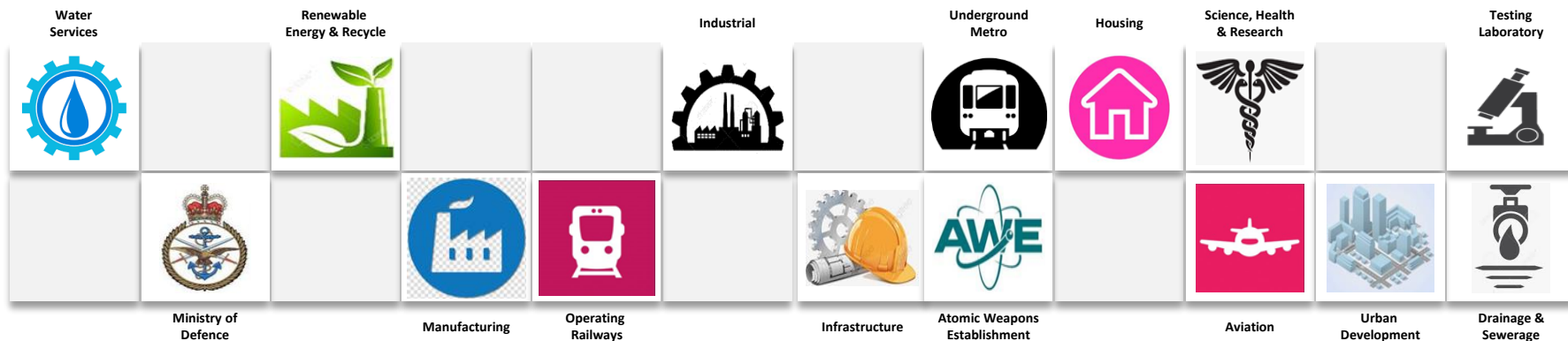


BACKGROUND

Qualification & Professional

- Fellow HKICA
 - HKICA SQME
 - HKICA QMS Certified Auditor
 - CCAA QMS Certified Auditor
- Fellow CQI
 - Chartered Quality Professional (CQP)
 - BQF RCA Certified Practitioner
 - Principal IRCA Auditor (QMS)
- Member IET
 - Associate CIOB
 - Master's Business Administration (MBA)
 - SMSTS Certified Professional

Industry & Sectors



JOINING MTR



**SCL Modification of couplers |
Deviation from design | Product
non-conformity | Defects**



**Growing public pressure |
Questions raised on use of publicly
funded projects | MTR integrity &
workmanship**



**Hong Kong Government under
spot-light | Review & investigate
| Start of Commission of Inquiry |
Independent Audit Panel**



Interim Report of Commission of Inquiry
into the Construction Works
at and near the Hung Hom Station Extension
under the Shatin to Central Link Project

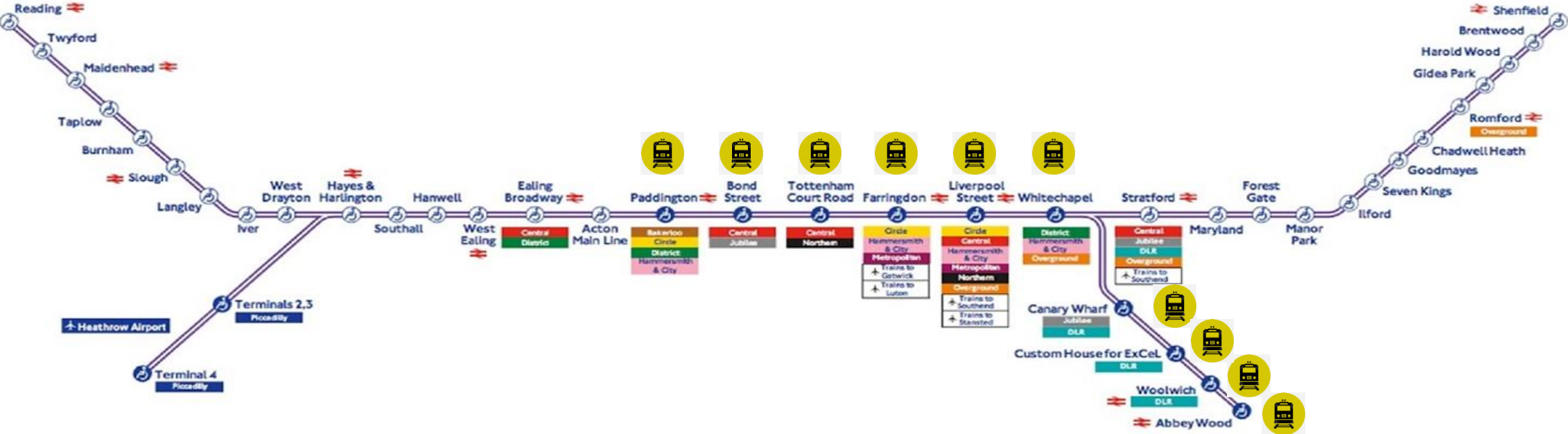
Mr Michael HARTMANN, GBS
Professor Peter HANSFORD, FREng FICE FAPM FRSA

February 2019

**Interim Report of Commission of
Inquiry into the Construction Works at
and near the Hung Hom Station
Extension under the Shatin to Central
Link Project**

Record Keeping | Documentation | Site Supervision | Site Management

Building The Elizabeth Line



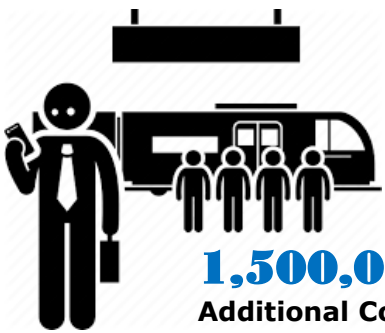
Crossrail in Numbers



10
New
Stations

100
Kilometers
Of Infrastructure

03
Counties
London
Berkshire
Essex



1,500,000
Additional Commuters

42 Kilometers
Of New
Tunnels



50 Kilometers
Of New Tracks



03
Integrated
Signalling
Systems

45 Maximum
Time to
London

41 Pass Through Stations



Crossrail New Stations

Paddington



Bond Street



Tottenham Court Road



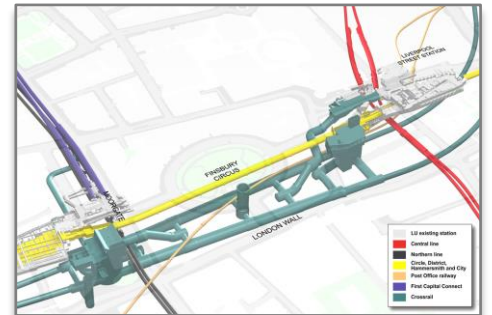
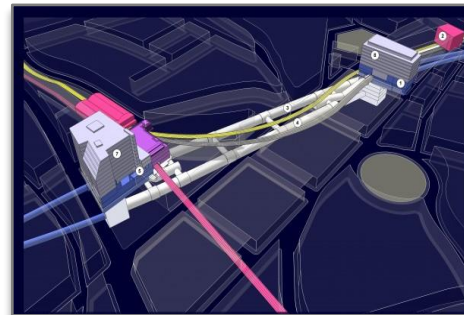
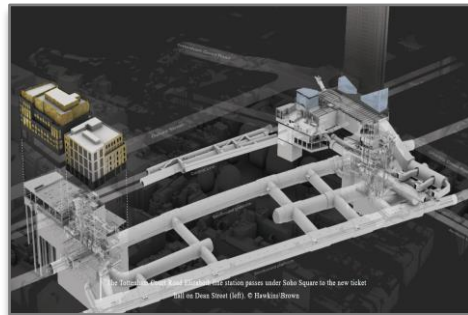
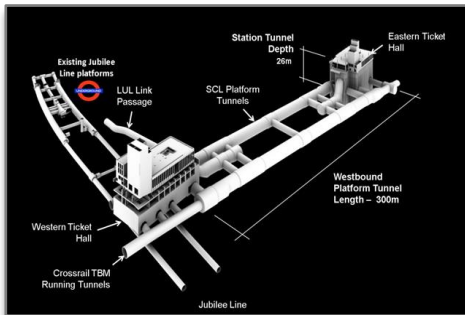
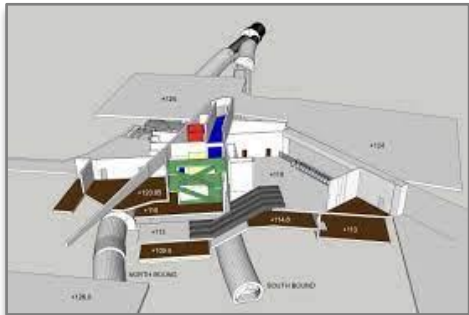
Farringdon



Liverpool street



Central London



Crossrail New Stations

Whitechapel



Canary Wharf



Custom House



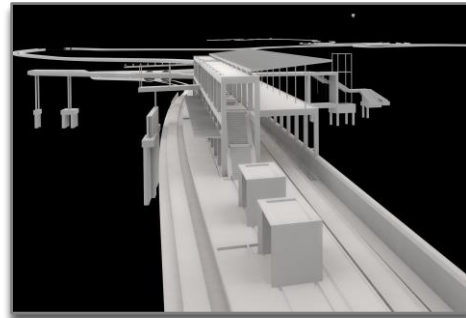
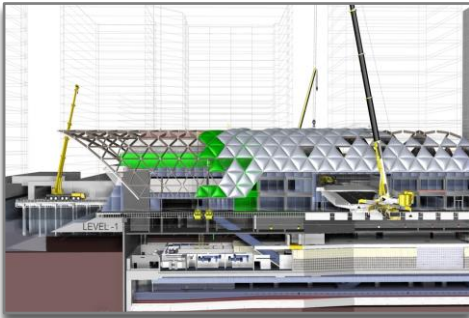
Woolwich



Abbey Wood



Outer London



Crossrail Governance



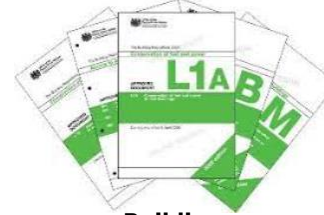
Construction Law



Rail Industry Standards



External Stakeholders



Building Regulations



ISO 9001 Certified



Works Information Volume 2B General Requirements



WORKS INFORMATION
Volume 2B – General Requirements

Document Number: CRL1-XRL-V3-XWI-CR001-50035
Version 2.0

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WI V2B Part 20 Quality Management



CENTRAL SECTION PROJECT

WORKS INFORMATION
Volume 2B – General Requirements
Part 20 – Quality Management

Document Number: CRL1-PDP-W-XWI-CRG03-00020

Version	Date	Prepared by	Checked by	Authorised by	Reason for issue
1.0	10-Dec-09	Rosh Gray	Mike Kemp	Alex MacKadam	For Condition 'E' Review
2.0	10-Dec-09	Rosh Gray	Mike Kemp	Alex MacKadam	Authorisation submission
3.0	10-Dec-09	Rosh Gray	Mike Kemp	Alex MacKadam	Issued for Tender
4.0	01-Apr-10	Rosh Gray	Mike Kemp	Alex MacKadam	Issued for Tender
5.0	20-Apr-11	Rosh Gray	Mike Kemp	Keith Bailey	Issued for Tender

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PDP Document Number: CRL1-PDP-W-XWI-CRG03-00020

WI V2B Part 13 Assurance, Records & Certification



CENTRAL SECTION PROJECTWORKS
INFORMATION

Volume 2B – General Requirements
Part 13 – Assurance, Records and Certification to be
Provided by the Contractor (Civils, Building & MEP Services)
Document Number: CRL1-PDP-W-XWI-CRG03-00013

Version	Date	Prepared by	Checked by	Authorised by	Reason for issue
4.0	01-Apr-10	Mike Kemp	Rosh Gray	Alex MacKadam	Issued for Tender
5.0	10-Apr-10	Mike Kemp	Rosh Gray	Alex MacKadam	Assurance working added
6.0	20-Apr-10	Mike Kemp	Rosh Gray	Keith Bailey	Certification requirements updated
7.0	10-Sep-10	Mike Kemp	Rosh Gray	Keith Bailey	Rewritten to include PFI/Out and MEP
8.0	09-Dec-10	Mike Kemp	Rosh Gray	Keith Bailey	AS Built Records Requirements updated
9.0	04-Feb-11	Mike Kemp	Rosh Gray	Keith Bailey	Delivery Procedures & Compliance added
					Project & Contractual Certification updated
					Asset Management and Traceability updated
					Interoperability Requirements related to AS-Built
					For CRL Approval

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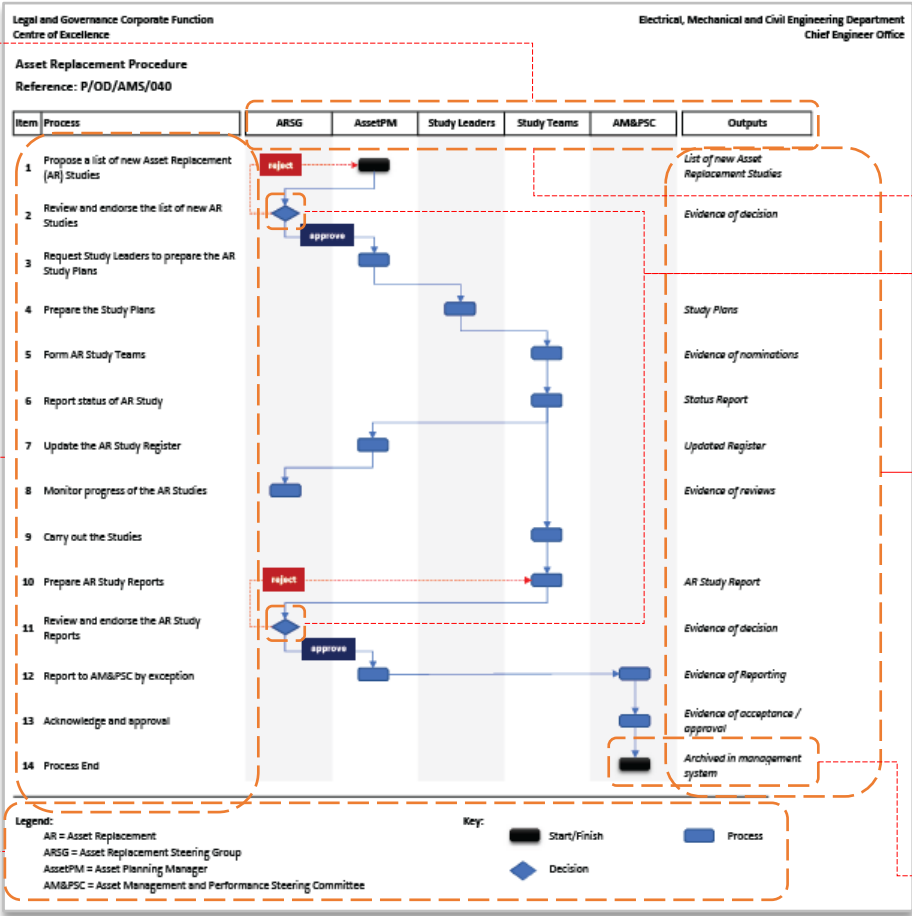
User Guidance Materials

Process Flowchart | Process Map

Stakeholders

Process | Requirements

Legend | Key

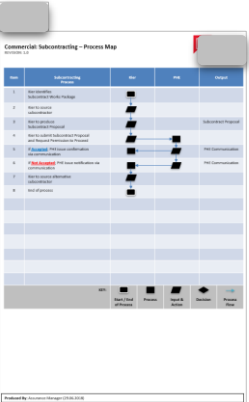
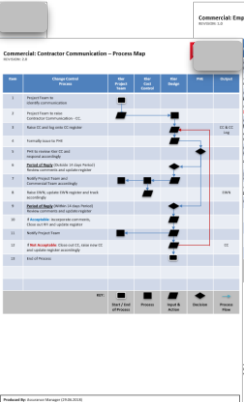
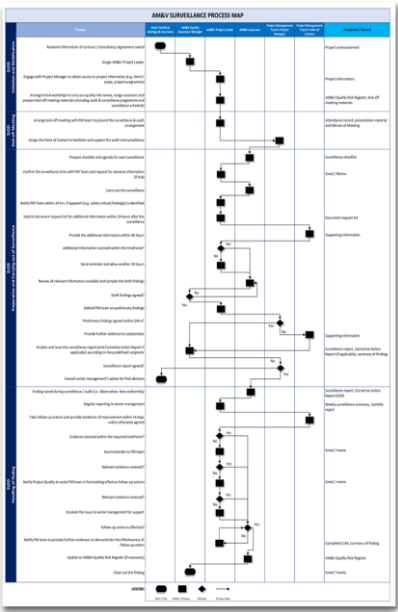
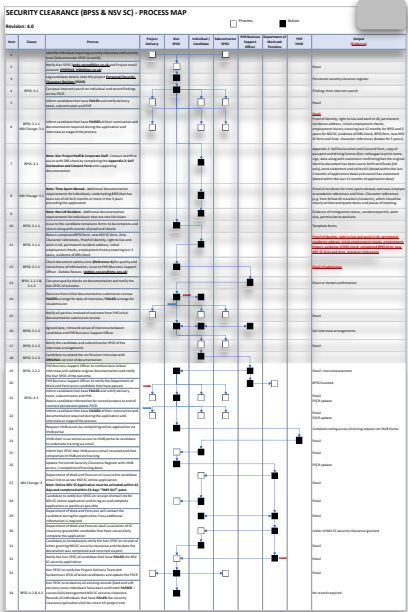


Accountability

Decision

Outputs

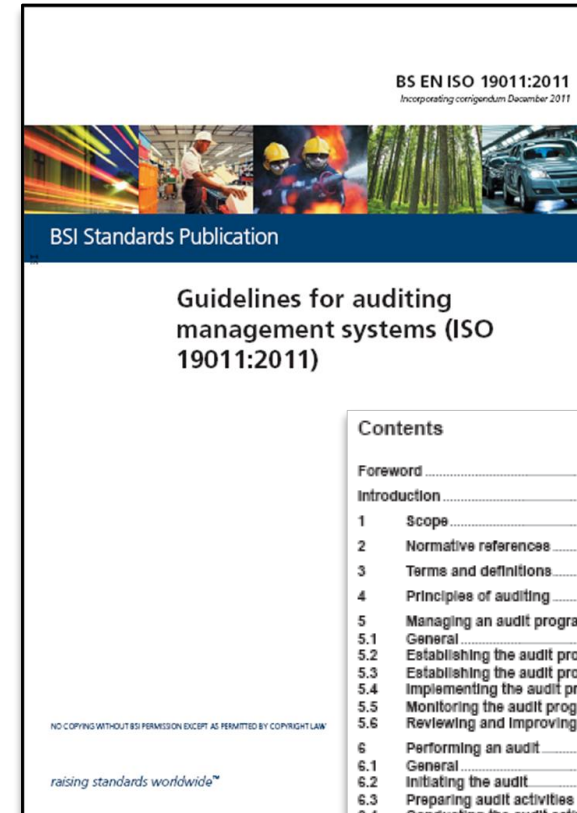
E-Document Management System



Crossrail Auditor Requirements

Quality Manager

- Named Key Person
- Independent of design and construction functions
- Report directly to Senior Director Level
- Full-time for the duration of the contract
- Experience in delivery functions
- Knowledge of contractor/supplier self-certification
- Member of the Chartered Quality Institute
- Registered to the International Register Certificated Auditors
- 15 year plus in construction
- 10 years managing quality
- Successfully pass Crossrail's Interview Assessment



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Method of Assessment

Audit:

- **Compliance-based Approach**
- **Systems & Processes**
- **Management Plans**
- **Complies with Requirements**
- **Non-conformance Management**
- **Risk Management**
- **Desk Top Review**
- **System Compliance**
- **Continues Improvement**

Surveillance:

- **Risk-based Approach**
- **Workflows & Practices**
- **Control Systems - ITPs**
- **Product Conformity**
- **Defect Management**
- **Risk Identifications**
- **On Site Assessment**
- **Product Conformity**
- **Incident Investigation**

Audit & Surveillance Planning

Planned / Period Actual/Period				Audit Type Reference		Auditor Auditee		Audit Scope		Risk Level Perceived Risk		Assessment Criteria		Report Reference		Audit Status	Remarks
Audit Date				Audit Type	Audit Ref.	Auditor	Auditee	Audit Scope	Risk Level	Perceived Risks	Assessment Criteria	Report Ref. (eB)	Audit Status	Remarks			
Planned	Period	Actual	Period														
21.02.2017	12	24.03.2017	13	II	2017-001	T Newport	SRW	MEPH - WAD permit management	M	Unauthorised access	Adequacy and effectiveness of the WAD process and adherence to controls in place	C405-SKC-O4-RGN-B071_WS077-50116	Code 4	Code 4 (06.07.2017) Rev 2.0 to be produced for open actions			
09.03.2017	13	09.03.2017	13	II	2017-002	T Newport M Simpkin	SRW	MEPH	M	Delay to certification	Verification of records for Redline Drawings / As Built KD12 & KD19 (Intermediate Level)	C405-SKC-O4-RGN-B071_WS077-50122	Code 3	Code 3 (11.07.2017) Rev 2.0 to be produced for open actions			
01.04.2017	1	03.04.2017	1	II	2017-003	T Newport	SRW	MEPH - material delivery	H	Non compliant materials	Documented process in place and robustness of controls for receipt, inspection and checks of goods against purchase orders and relevant requirements	C405-SKC-O4-RGN-B071_WS077-50115	Code 1	CLOSED (04.07.2017)			
11.04.2017	1	11.04.2017	1	A	2017-004	Costain	CSJV	Costain Group Internal Audit	M	Compliant with Costain corporate governance and business management system	Costain corporate governance, project QMS and quality control processes	n/a	n/a	CLOSED (Internal reporting purpose only)			
12.04.2017	1	12.04.2017	1	II	2017-005	A Yeung O Sonubi	SEE Rail (Robert Stevens Steel Fabricator)	Robert Stevens Fabrication Yard	M	Readiness and capability to deliver	ISO 9001 sampling, facility review and readiness of pre commencement work	C405-SKC-O4-RGN-B071_WS077-50112	Code 1	CLOSED (02.05.2017)			
18.04.2017	1	01.05.2017	2	II	2017-011	T Newport	Honeywell	BMS	M	Non compliant products and delay to programme	Validate readiness review through verification of relevant documentations i.e ITP, MCR, RAMS etc.	C405-SKC-O4-RGN-B071_WS077-50120	Code 2	Code 2 (17.06.2017). Rev 2.0 to be produced for incomplete report and open actions			
20.04.2017	1	20.04.2017	1	II	2017-006	A Yeung B Darkwa	Wessex	BoH Metal Works	M	Non compliant products and delay to programme	Validate readiness review through verification of relevant documentations i.e ITP, MCR, RAMS etc.	C405-SKC-O4-RGN-B071_WS077-50113	Code 2	Awaiting changes to Architectural Specification (86microns)			
25.04.2017	Not Planned	24.04.2017	1	II	2017-007	T Newport G Newman	SRW	Protection of Assets	H	Damage to completed works	Verification/Validation of completed works/assets being suitably protected	C405-SKC-O4-RGN-B071_WS077-50114	Code 4	Code 4 (06.05.2017) Rev 2.0 to be produced for open actions			
25.04.2014	Not Planned	25.04.2014	1	I	2017-008	A Yeung	SEE Rail	Contractor Compliance	H	Non-compliant to works information	Compliance checks of ISO 9001, UKAS, Contract Acceptance for all tiers	C405-SKC-O4-RGN-B071_WS077-50118	Code 1	CLOSED (15.06.2017)			
14.04.2017	1	22.06.2017	3	I	2017-016	D Osborne	CSJV	Competency Management	H	Non compliant products and delay to programme	Validate robustness of CSJV Competency Management process and verification of evidences	C405-SKC-O4-RGN-B071_WS077-50129	Code 1	CLOSED (19.08.2017)			
26.04.2017	1	26.04.2017	1	A	2017-014	Calvin Blackler	Costain	Technical Risk Management Plan	M	Compliance with the WI and internal processes	Operation, Electrical, Mechanical and Quality	C405-SKC-O4-RGN-B071_WS077-50124	Code 1	CLOSED (23.05.2017)			
27.04.2017	1	05.05.2017	2	II	2017-012	T Newport	SRW	C660 Material checks	H	Non compliant materials	Scope redefined as: •Quantity called off was delivered •Type called off was delivered (Speakers ,dome cameras etc.) •Condition on arrival •Suitable storage conditions	C405-SKC-O4-RGN-B071_WS077-50125	Code 2	Code 2 (17.06.2017). Rev 2.0 to be produced for incomplete report and open actions			
09.05.2017	2	09.05.2017	2	II	2017-013	T Newport G Newman	Carrier	FAT for Chiller	H	Compliance to criteria	Validate throught FAT test documentation as per sepecification	C405-SKC-O4-RGN-B071_WS077-50123	Code 1	CLOSED (23.05.2017)			
16.05.2017	2	08.06.2017	3	I	2017-009	A Yeung B Darkwa	CSJV	Design Assurance	H	A design that does not meet the assurance requirements	Works Information Part 7 Design Management	C405-SKC-O4-RGN-B071_WS077-50105	Code 4	CLOSED (23.09.2017)			

Audit Types (Risk-based) & Categories

First, Second- & Third-Party Audits

Stakeholders

JV Partners	{ Commercial Gate Reviews (Milestones) ISO 9001 Certification
Crossrail	{ Works Information Undertakings & Assurance (PA) Legal Requirements
Transport for London Rail for London London Underground	{ Any of the above Product Conformity Engineering Safety

Project

Project Team	{ Works Information Management Disciplines Industry Standards
Subcontractors	{ ISO 9001 QMS Project Management Plans Process by Disciplines
Suppliers	{ Procedures & Controls Product Quality & Compliance Product Warrantees

Audit Findings & Classifications

CAT I, II & III | Defects Disallowable Cost

❖ Findings

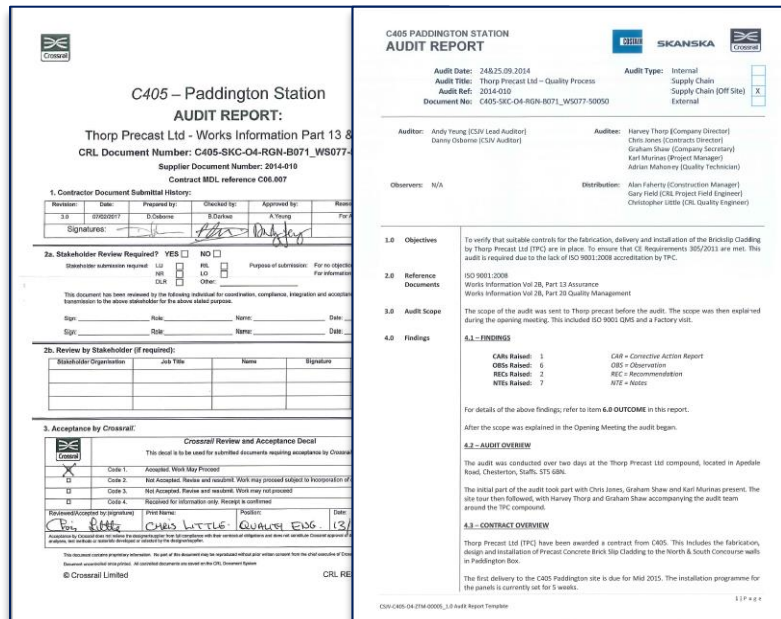
Non-Conformance	{	Procedural Compliance Product Conformity – Defects Repeat incidents
Observations	{	Near Misses Substandard Performance Emerging Risks
Recommendations	{	Improvement Opportunities Preventative Actions Cultivation of Knowledge
Good Practices	{	World Class / Innovative Above and Beyond Standards Beneficial to Others

❖ NCR Classifications

- Damaged
- Design
- Material Breakdown
- Material Non-conformity
- Planning
- Supervision & Management
- System Defects
- Workmanship
- Documentation & Records
- Equipment Breakdown
- Incomplete Work
- Incorrect Installation
- Testing & Commissioning
- Manufacturing Defects

Audit Report: Brick-slip Cladding

ISO 9001 Certified



C405 - Paddington Station
AUDIT REPORT:
Thorp Precast Ltd - Works Information Part 13 &
CRL Document Number: C405-SKC-04-RGN-8071_WS077-
Supplier Document Number: 2014-019
Contract MDL reference C06.007

1. Contractor Document Submission History:

Revision	Date	Prepared by	Checked by	Approved by	Rev
1.0	2014-09-03	Chris Jones	Chris Jones	Chris Jones	1

2a. Stakeholder Review Required? YES ☒ NO ☐
Stakeholder submission required: ☐ No ☐ Yes ☐
Purpose of submission: For no objection ☐ For information ☐
This document has been reviewed by the following individual for construction, compliance, integration and acceptance for submission to the above stakeholder for its above stated purpose.
Sign: _____ Name: _____ Date: _____
Sign: _____ Name: _____ Date: _____

2b. Review by Stakeholder (if required):

Stakeholder/ Organisation	Job Title	Name	Signature

3. Acceptance by Crossrail:

Crossrail Review and Acceptance Decal

This decal is to be used for submitted documents awaiting acceptance by Crossrail.

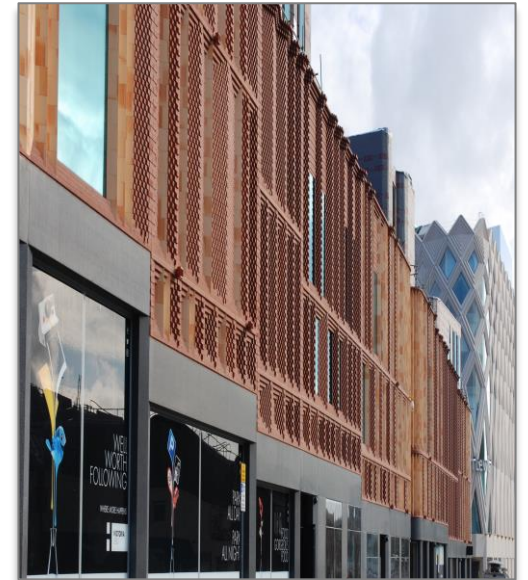
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Criteria 1: Account Work May Proceed	<input checked="" type="checkbox"/>
Criteria 2: Not Accepted. Review and resubmit. Work may proceed subject to incorporation of	<input type="checkbox"/>
Criteria 3: Not Accepted. Review and resubmit. Work may not proceed	<input type="checkbox"/>
Criteria 4: Required for information only. Proceed to completion	<input type="checkbox"/>

Reviewed/Checked by (signature): _____ Date: _____
Reviewed/Checked by (name): **CHRIS LITTLE** Position: **QUALITY ENGINEER**
Reviewed/Checked by (title): **CHRIS LITTLE** Position: **QUALITY ENGINEER**
Reviewed/Checked by (signature): _____ Date: _____
Reviewed/Checked by (name): _____ Position: _____
Reviewed/Checked by (title): _____ Position: _____
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C405-C405-04-2704-00000_3.0-Audit Report Template 1/7 x 4

Audit Objective:

Validate adequate controls for manufacturing, delivery and installation of the Brick-slip Cladding as per contract requirements.



Audit Scope:

- Contract overview
- ISO 9001 & Industry Standards**
- Quality Manual
- Quality Plan
- Quality Procedures
- Internal Audits
- Material & CE Requirements**
- Document Control Systems
- Internal Training & Competency
- Design & Project Review**
- Inspection Records
- Concrete Testing & Calibration
- Site Tour & Observations
- Good Practices & Awards

Audit Report: Escalators

Overseas QMS

C405 – Paddington Station AUDIT REPORT:			
OTIS Escalators (Breclav) – Compliance to ISO 9001, Quality Addendum and WI Part 13, 14, 20 & 28 CRL Document Number: C405-SKC-OA-RGN-B071_W5077 Supplier Document Number: 2016-001 Contract MDL reference C06.067			
1. Contractor Document Submittal History:			
Submittal No.	Date	Submitted By	Approved By
01	17.03.2016	Seany Deane	Andy Young
2a. Stakeholder Review Required? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>			
This document has been reviewed by the following individual for coordination, compliance, integration and acceptance in accordance with the above submittal for the above stated project.			
Sign:	Name:	Date:	
2b. Review by Stakeholder (if required):			
Stakeholder Organisation	Job Title	Name	Signature
3. Acceptance by Crossrail:			
Crossrail Review and Acceptance Detail			
This detail is to be used for submittal documents requiring acceptance by Crossrail.			
Code	Accepted/Work May Proceed	Code	Accepted/Work May Proceed
01	Code 1: Accepted/Work May Proceed	02	Code 2: Not Accepted/Review and resubmit. Work may proceed subject to incorporation of
03	Code 3: Not Accepted/Review and resubmit. Work may not proceed	04	Code 4: Reviewed for information only. Receipt is confirmed
4. Findings			
C405 Rated: 0 OBS Rated: 0 REC Rated: 0 EPC Rated: 10			
C405 – Breclav is a sister company of Otis UK responsible for the manufacture and assembly of 33 new escalators for C405 Paddington Station contract.			
The subject of this audit is to assess Otis Breclav management systems are adequate in delivery of the scope of works effectively and provided the assurance in ensuring compliance with the works information.			
The audit is based on sampling of records and documentation. The scope of the audit focuses on the Breclav Quality Management System, Quality Control Procedures and Competency of the Workforce in satisfying in the delivering the scope of works in accordance with the contract requirements.			
The information assessed in producing this report is based on records available at the time of the audit. The assessment focuses on Otis Breclav Manufacturing and Assembly facility Quality Management System and sample information from current works undertaken at C405 Paddington Station. Findings from this report will be to identify any gaps with their systems with the view that addressing these findings ensure compliance with the works information.			

Audit Objective:

Validate management systems are adequate to ensure the delivery in the scope of works provision for transportation and logistic arrangements.

OTIS



Audit Scope:

- TfL Approved Supplier
- Q-Plus Procedure
- Inspection Schedule & Q-Plus Plan
- Sampling of "Steps & Truss"
- Sampling of "Main Drive"
- ISO 9001 Certification
- Training & Competency
- Design Management
- Defects Management
- **Procurement Management**
- E3 Assessment (China)
- Assembly Checkpoints
- **Welding Procedure Specification**
- Safe System of Works (ITP)

Audit Fundamentals | Project Cycle



Set Clear Goals & Expectations



Structured Framework



Risk-based Approach



Contractor Self-Certification

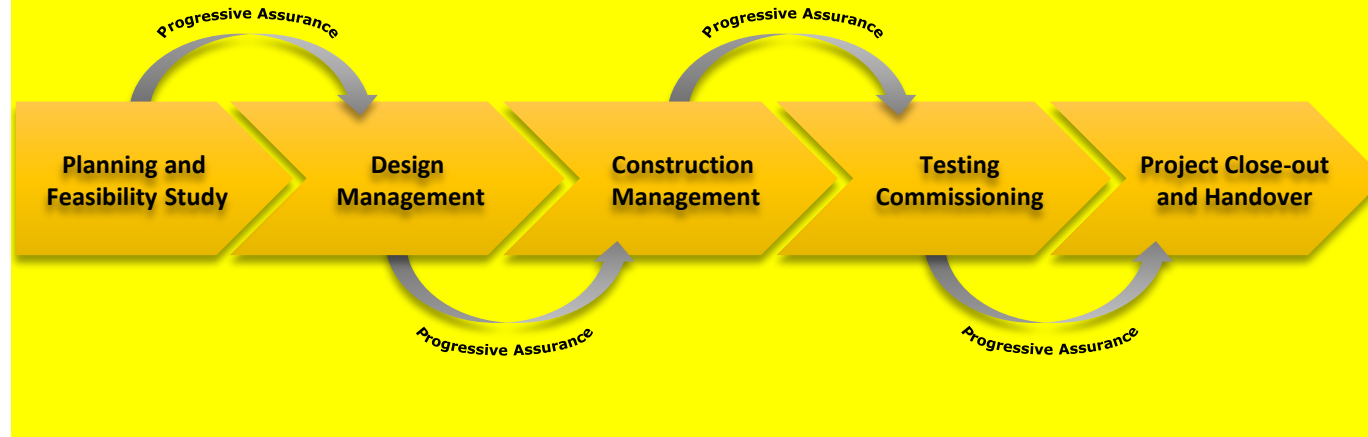


Ensures Compliance



Uphold Quality Workmanship

Rail New Projects Cycle



Demonstrate Product Conformity



Reduces Waste & Reworks



Improve Efficiency & Effectiveness



Determine Root Cause



Prevent Recurrence

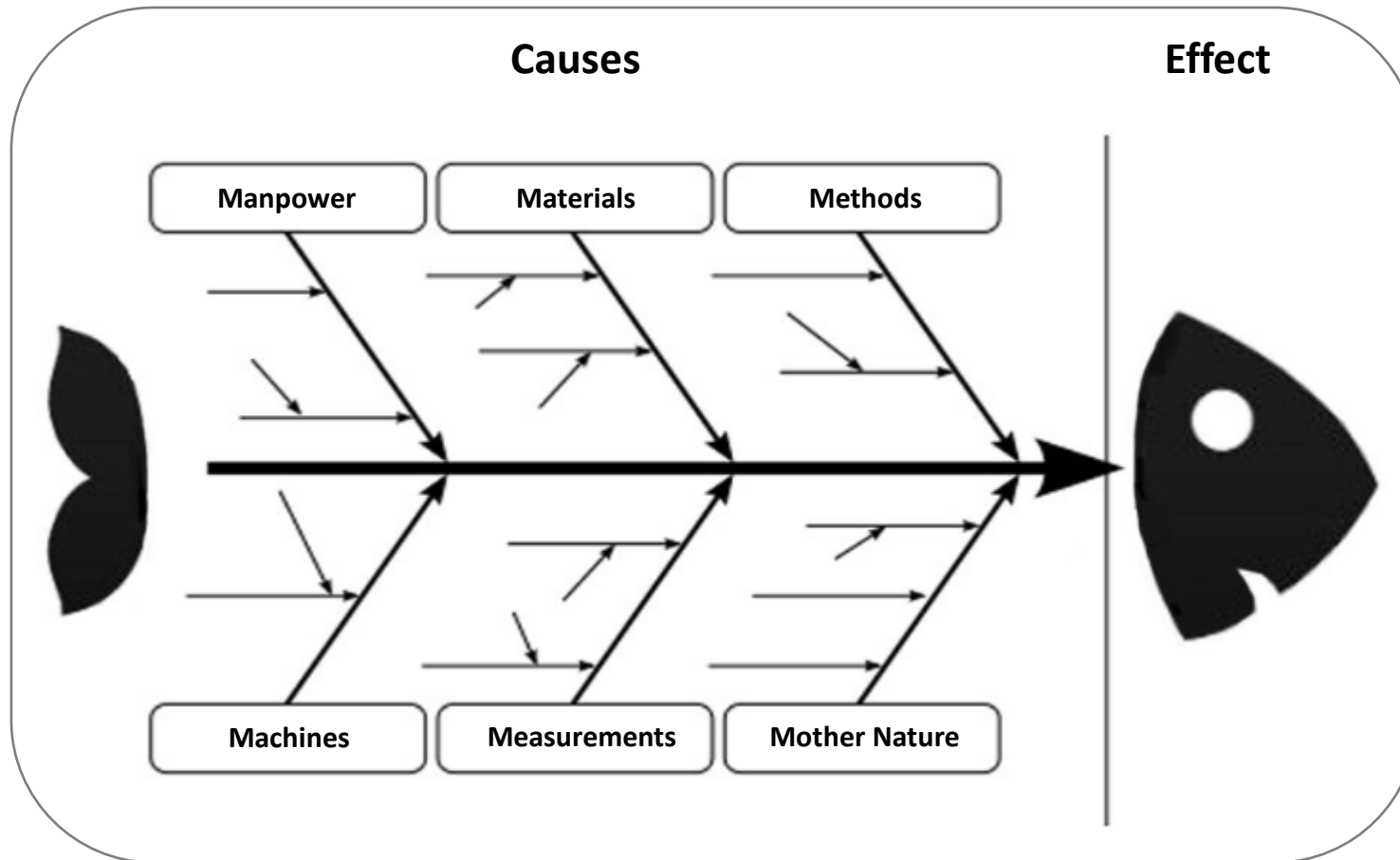


Drive Continuous Improvement



Progressive Assurance

Fishbone (Cause and effect) Diagram



Crossrail Canary Wharf Station

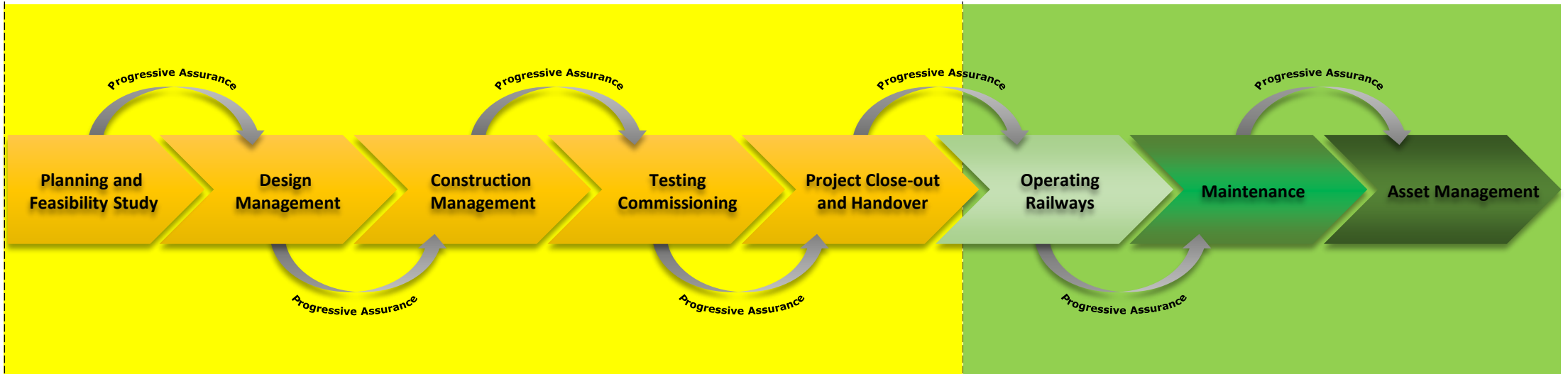


Progressive Assurance

**Contemporaneous
Records
&
Desire Outcome**

Operating Railway Lifecycle

Rail New Projects Cycle



Rail Operations Cycle

Auditing Challenges

- Auditee Perception of Audits
- Lack Management Support
- Complex Process Interfaces
- Subjective & Abuse Power
- Seen as Criticizing & Unhelpful
- Availability of Individuals



- Avoiding Program Disruptions
- Accessibility of Information
- Confidentiality & Data Protection
- Subject Matter Experts Supports
- Understanding Threats & Opportunities
- Quantifying Added Values

ISO Certification |



| Repeat Business

"Succumbing to Peer Pressure"

Auditing Benefits

A robust management system protects the workforces



Avoiding reworks reduces wastage leading to cost savings



Cost and time savings on projects will generate profits



Sustainable businesses offers secured employment



An effective control system ensures product conformity whilst avoiding rework

Achieving 'Right First Time' will save time and add programme benefits

A profit generating organization will provide the basis for sustainable business

Auditing Success Factors

- **Recognized as SME**
- **Embedded as advisors**
- **Jointly work towards solutions**
- **Participation of senior leaders**
- **Key meetings includes Quality section**
- **Proactive reporting of defects**
- **Supply chain promoting quality**
- **Prompt respond to findings**
- **Sharing and communicate good practices**
- **Effective preventative measures**
- **Drive continuous improvement**
- **Quality is celebrated.....!!!**



**“Spirit of
Collaboration”**

Cultural Differences



- **Praise, seen as disrespectful**
- **Mistakes, are penalized**
- **Tasks driven vs result driven**
- **Non-conformance, seen as negative and not learning opportunity that are encouraged**
- **Tick-Box & Deliver on Expectations**
- **Root Cause vs Case Closed**
- **Correction & Prevention**

“Auditors must look to find ways to encourage people to Work Better”

“Recognition of Genuine Efforts is to be encourage and celebrated”

Bottom Line

**Upholding the
“Code of Practice”**

INTEGRITY

Choosing courage over comfort;
choosing what is right over
what is fun, fast or easy; and
choosing to practice our values
rather than simply professing them.

BRENE BROWN | TheMindsJournal

MINDJOURNAL

Source:

Questions & Answers

For further information

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