CROSSRAIL: MOVING BIM FORWARD

How Crossrail is using BIM through the design, construction, operations and maintenance of the railway

Malcolm Taylor
Head of Technical Information
Crossrail Ltd

MOVING LONDON AND BIM FORWARD

Agenda

- Crossrail overview
- What is BIM?
- BIM in:
    - Planning
    - Design
    - Construction
    - Operations & Maintenance
- Benefits


1 World Class Railway

Programme

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

Bill

Funding

Land & Property Acquisition

Engineering Design

Tunnels & Station Procurement

Enabling Works

Central Section Works Tunnelling & Stations

Sys. Procurement

Systems Installation

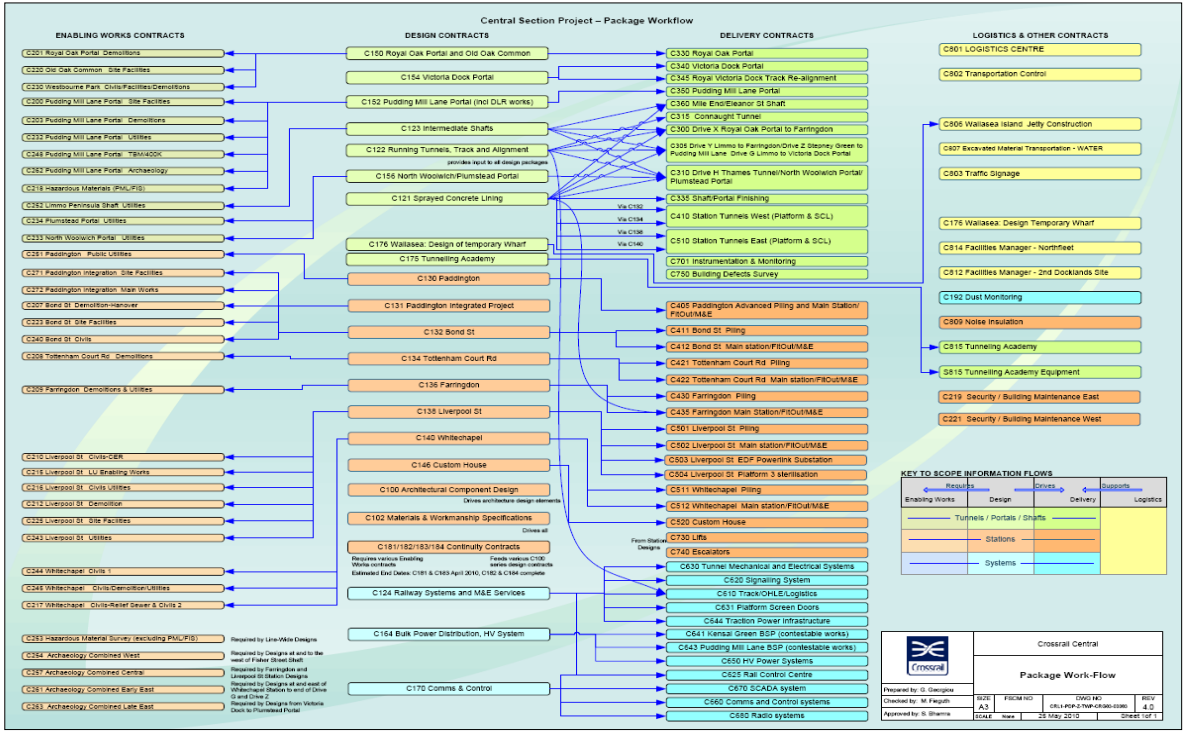
Rolling Stock and Depot – Spec, Procure, Build (CRL)

Testing / Commissioning

Trial Operations/ Staged Opening

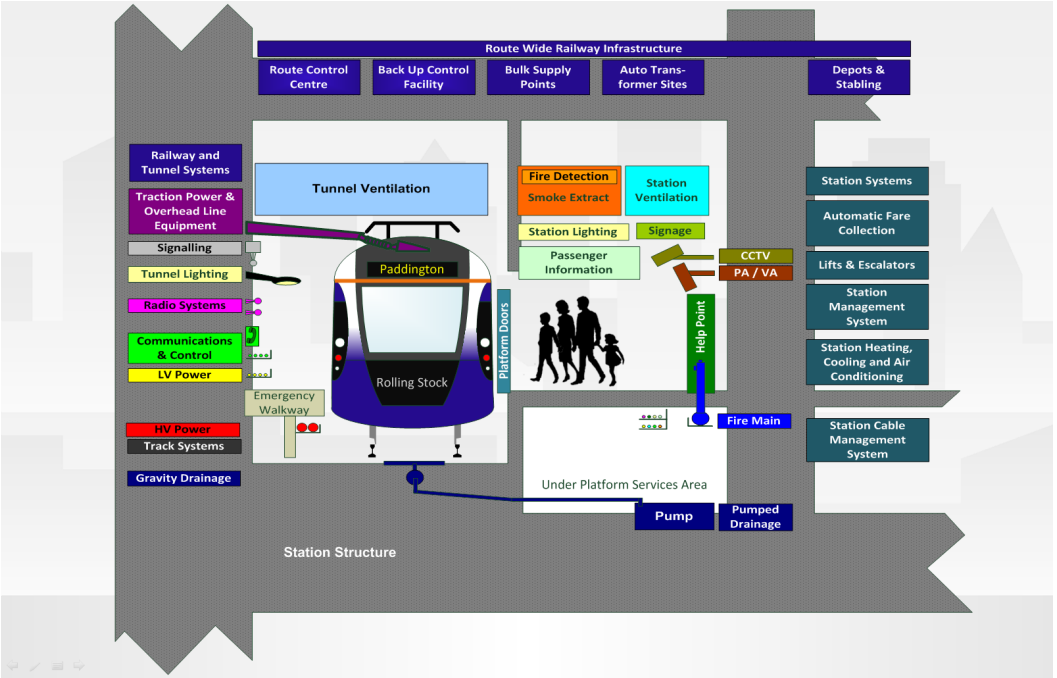
Contractual Complexity

- 34 Enabling Works Contracts
- 23 Design Contracts
- 45 Delivery Contracts
- 14 Others



Technical Complexity

- Multiple Disciplines
- Multiple Interfaces
- Shared Spaces

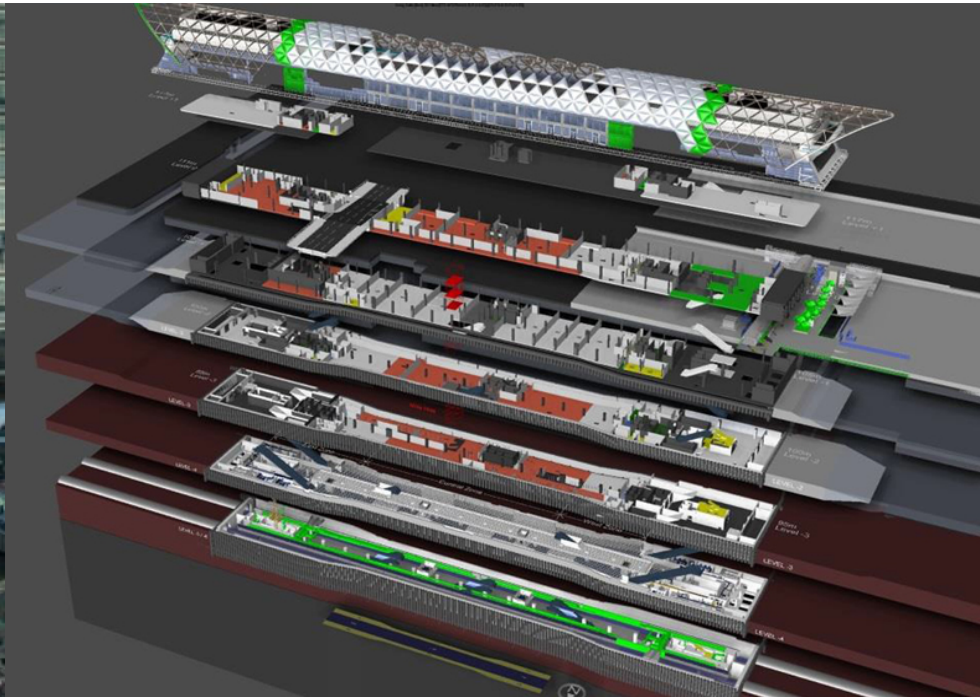



What is BIM?

Building Two Railways

Physical

Digital



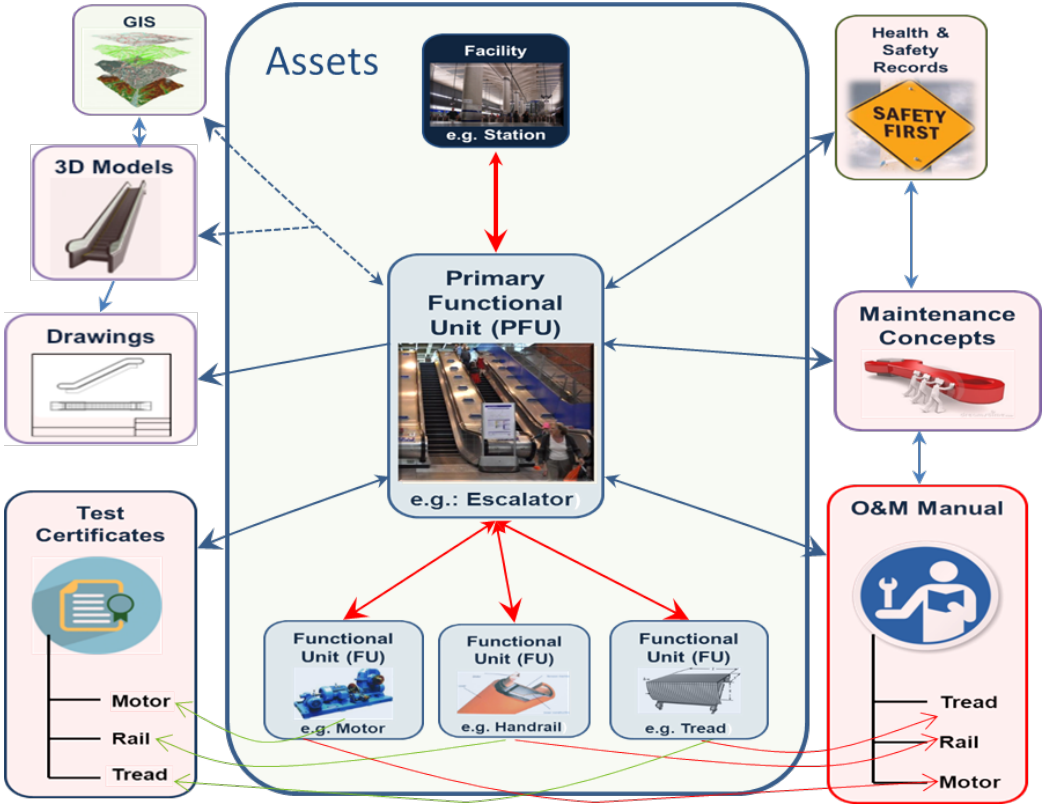
Key Characteristics

The Environment

- A defined end-game for data
  - Information requirements set out
  - Classifications and data structure
  - Procurement critical

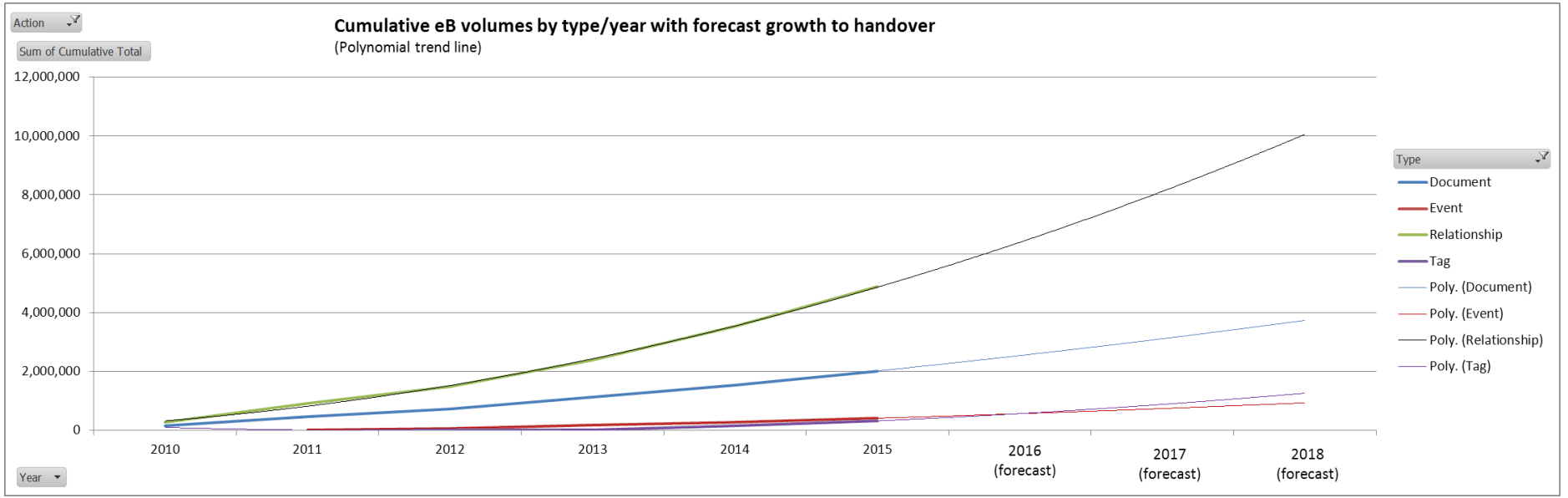
- A Common Data Environment (CDE)
  - EDMS and ECMS
  - Used by everyone
  - Owned and managed by the Client

- BS/PAS 1192
  - Roles, deliverables and processes

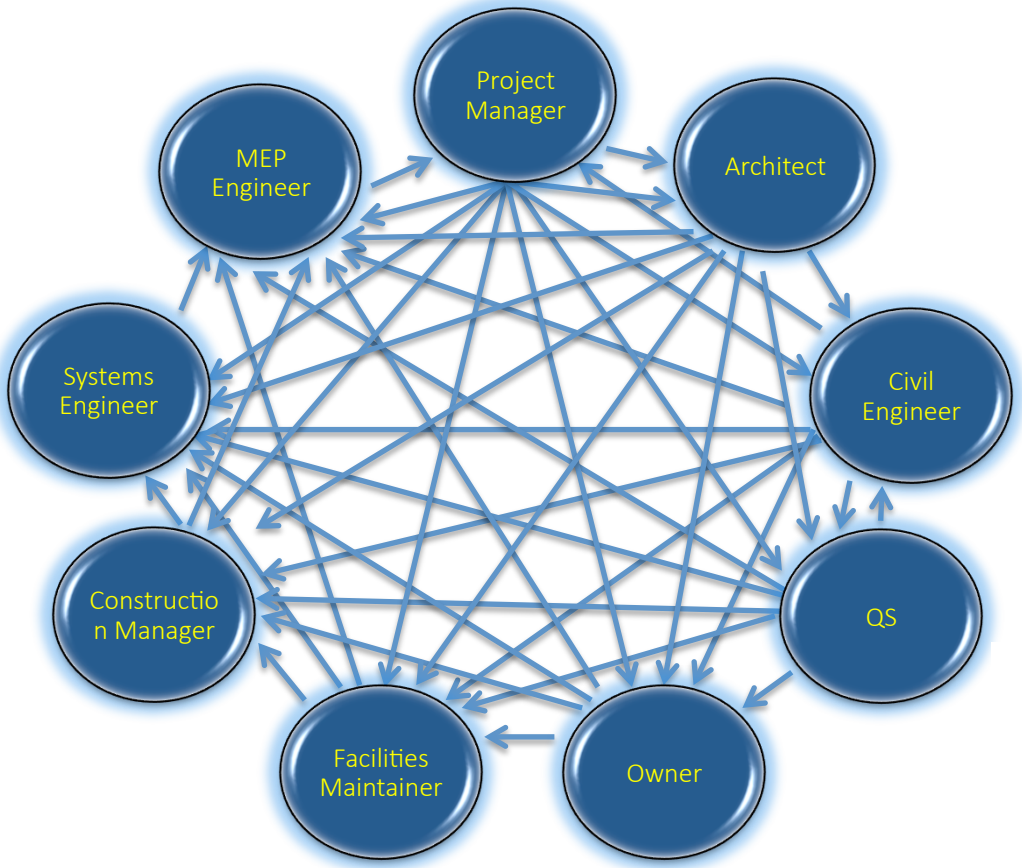


Planning Data Needs…..

- Plan your information needs through the life cycles e.g. the CRL data store

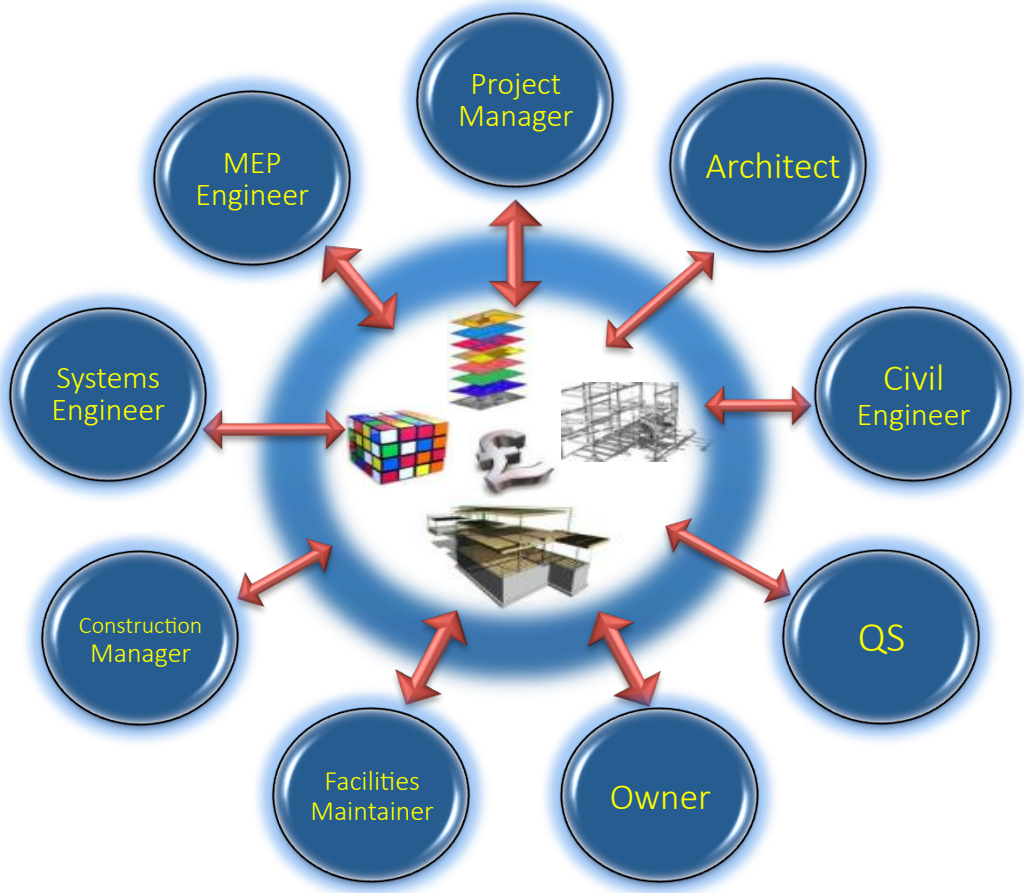


Project Delivery Originally



A reminder of the old world…

Role of Crossrail – Enabler of BIM



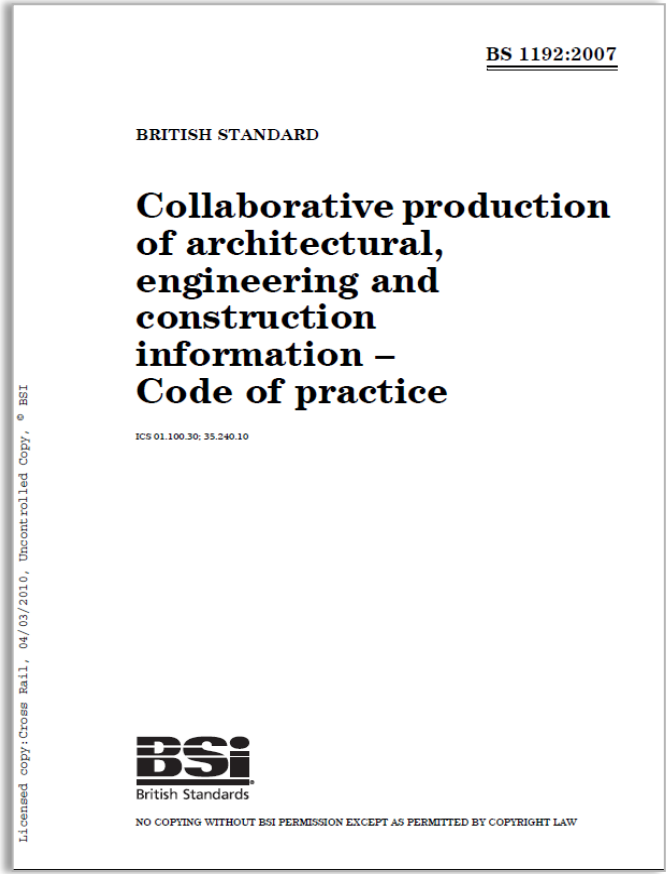
Embracing new technologies:

… the process of generating and managing building information during its life-cycle.

… model-based technology linked with project information databases.

…a common data environment.

BS1192 informed Data Environment


BS 1192:2007

BRITISH STANDARD

Collaborative production of architectural, engineering and construction information – Code of practice

ICS 01.100.30; 35.240.10

BSI British Standards

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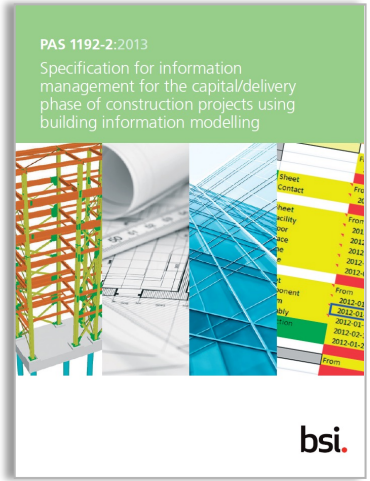
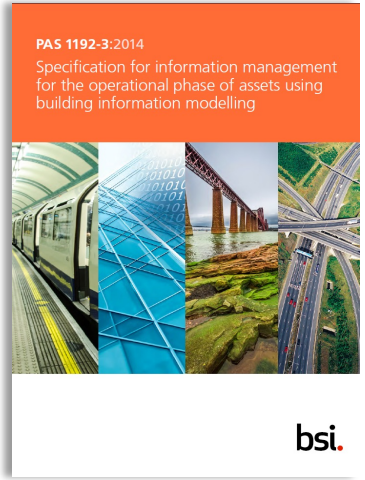
BS 1192

The methodology for managing the production, distribution and quality of construction information throughout the project life-cycle and supply chain.

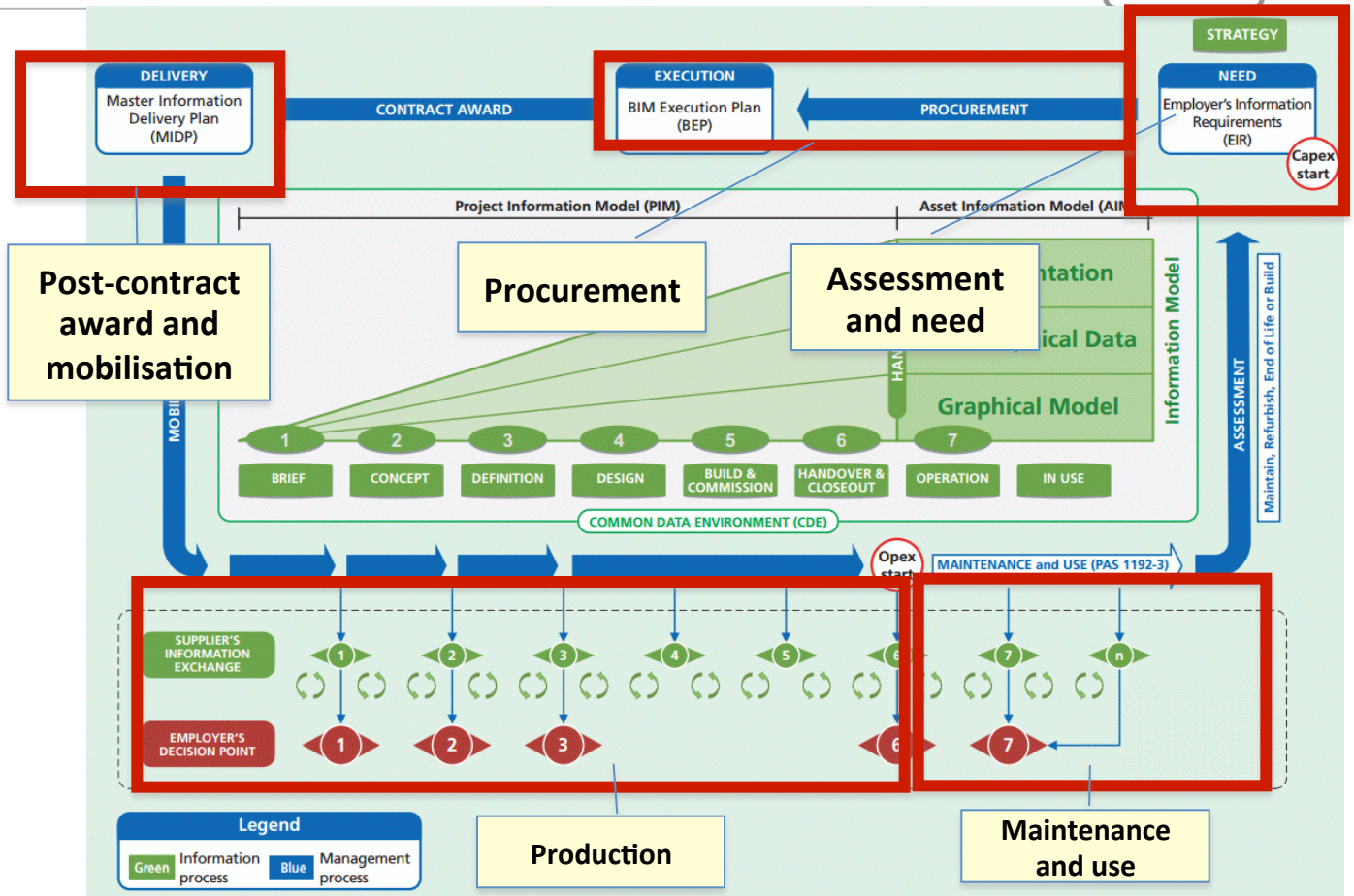




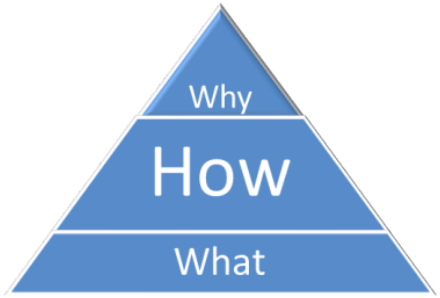
Process

Requirements

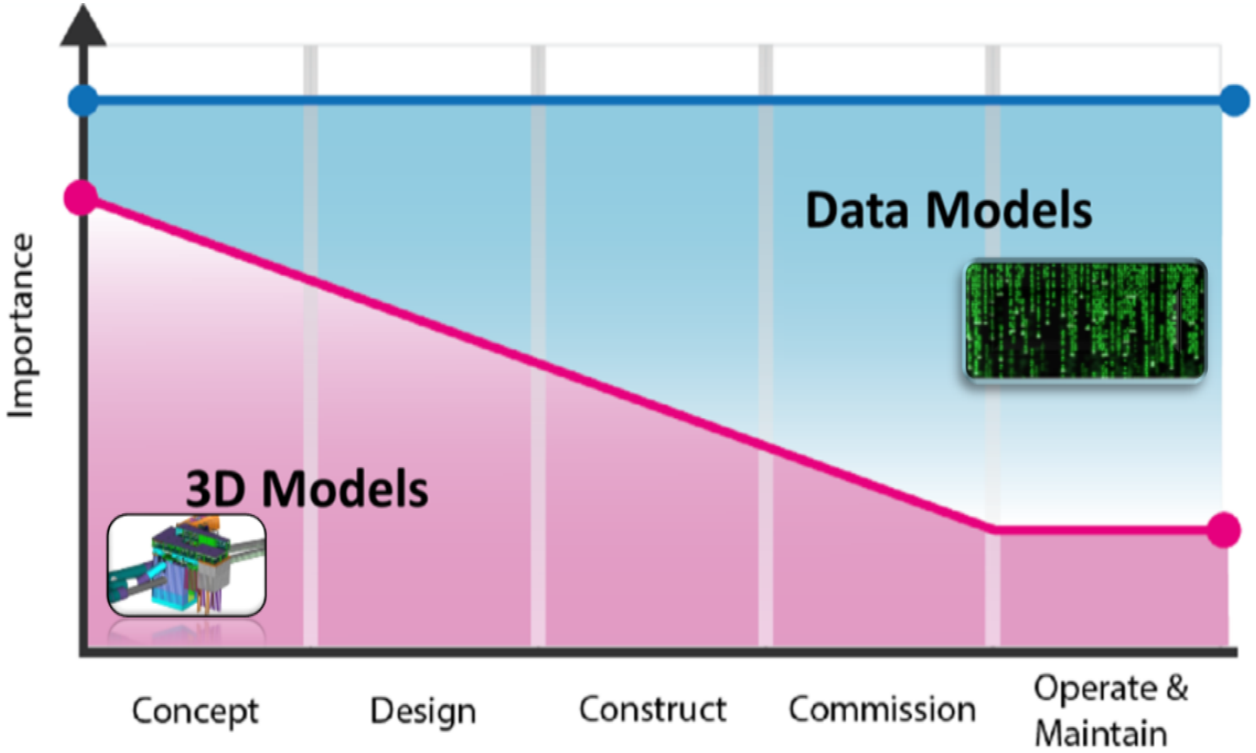
- Fully described
- Life cycle



Graphical / Non-Graphical Models



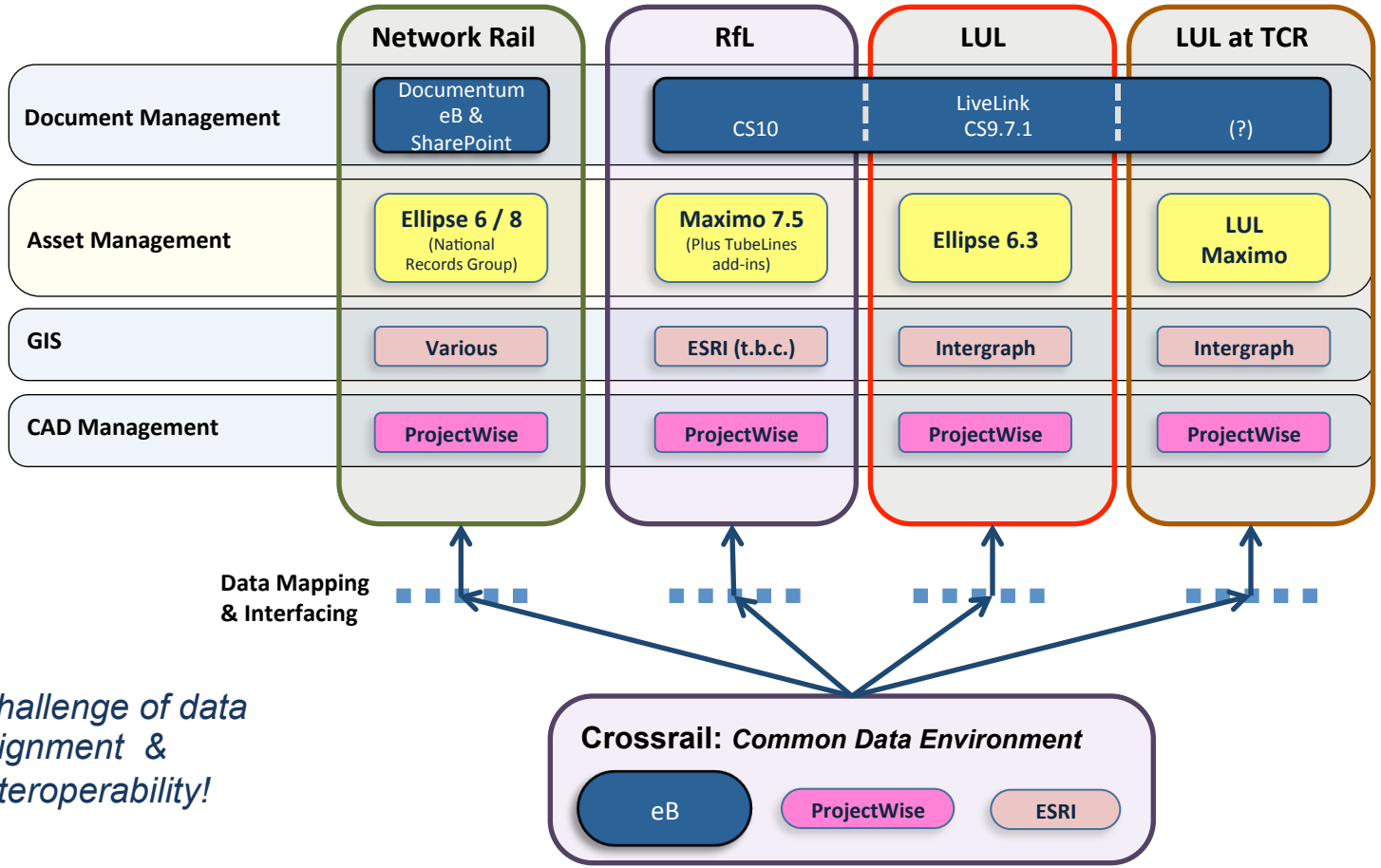
- Information
- Data environment
- Data integrity
- Collaboration
- Technology
- Asset life-cycle
- New processes
- New project culture



“The End in Mind”

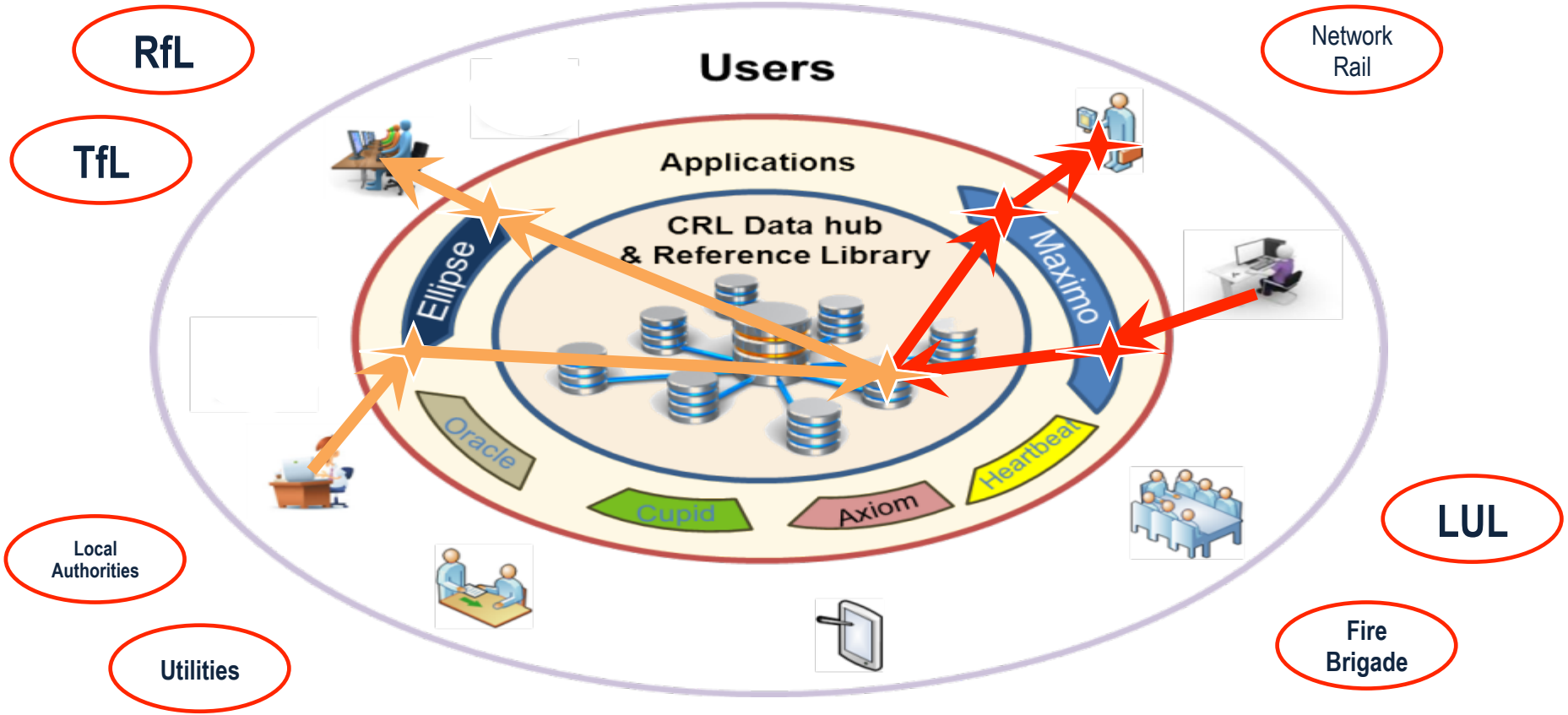
Starting with the end in mind…….

Our problem in Crossrail ……→

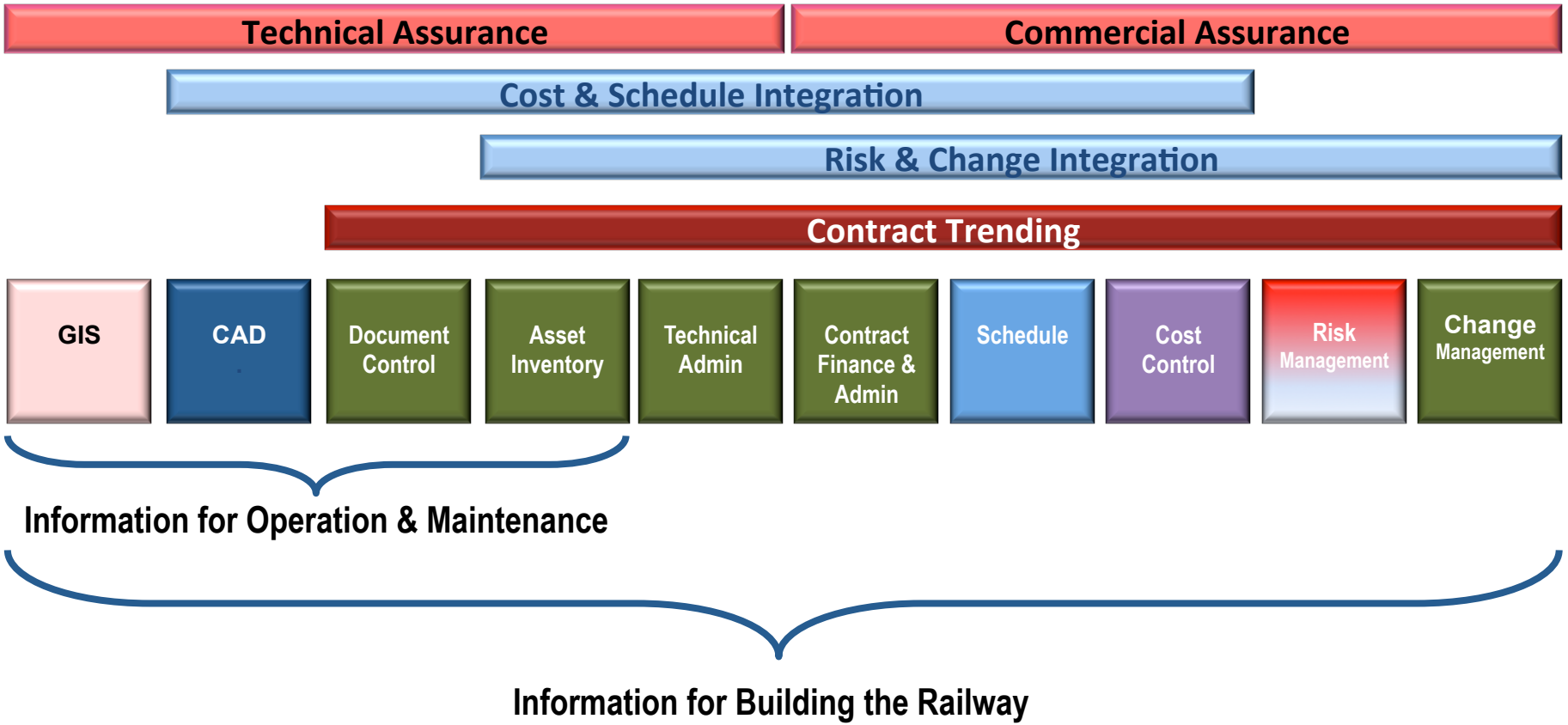


Challenge of data alignment & interoperability!

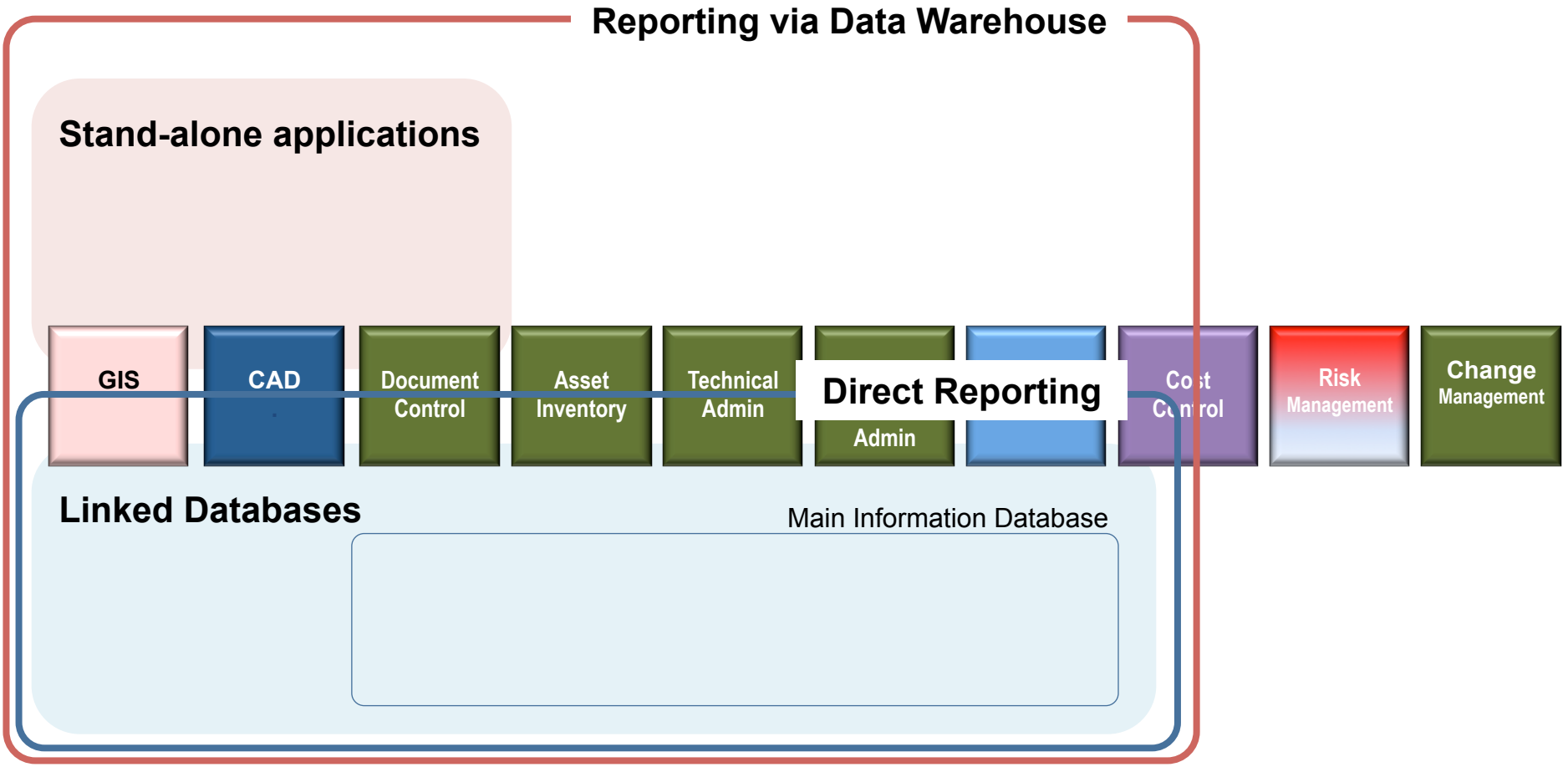
Data Centric in Operations & Maintenance



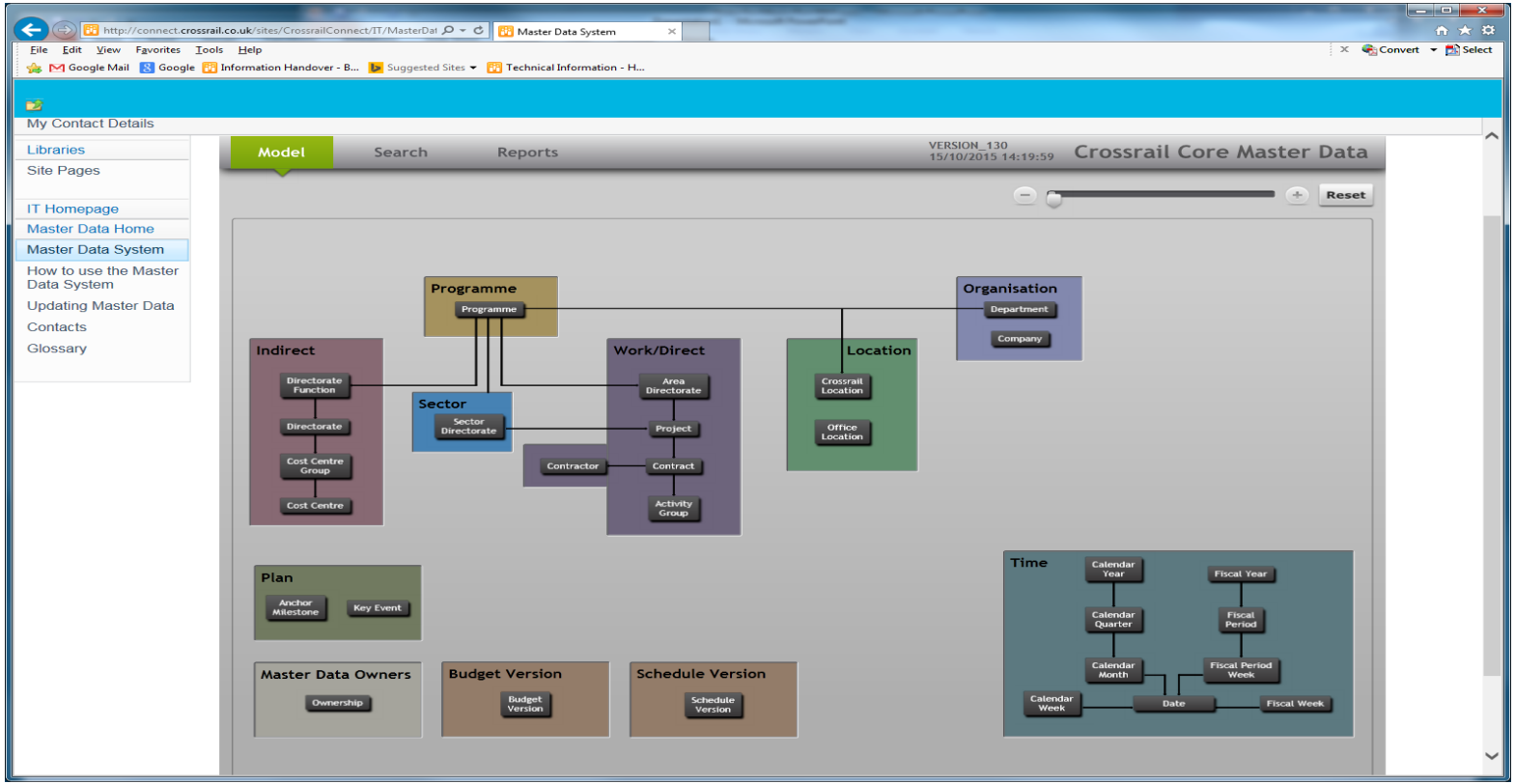
Information Applications

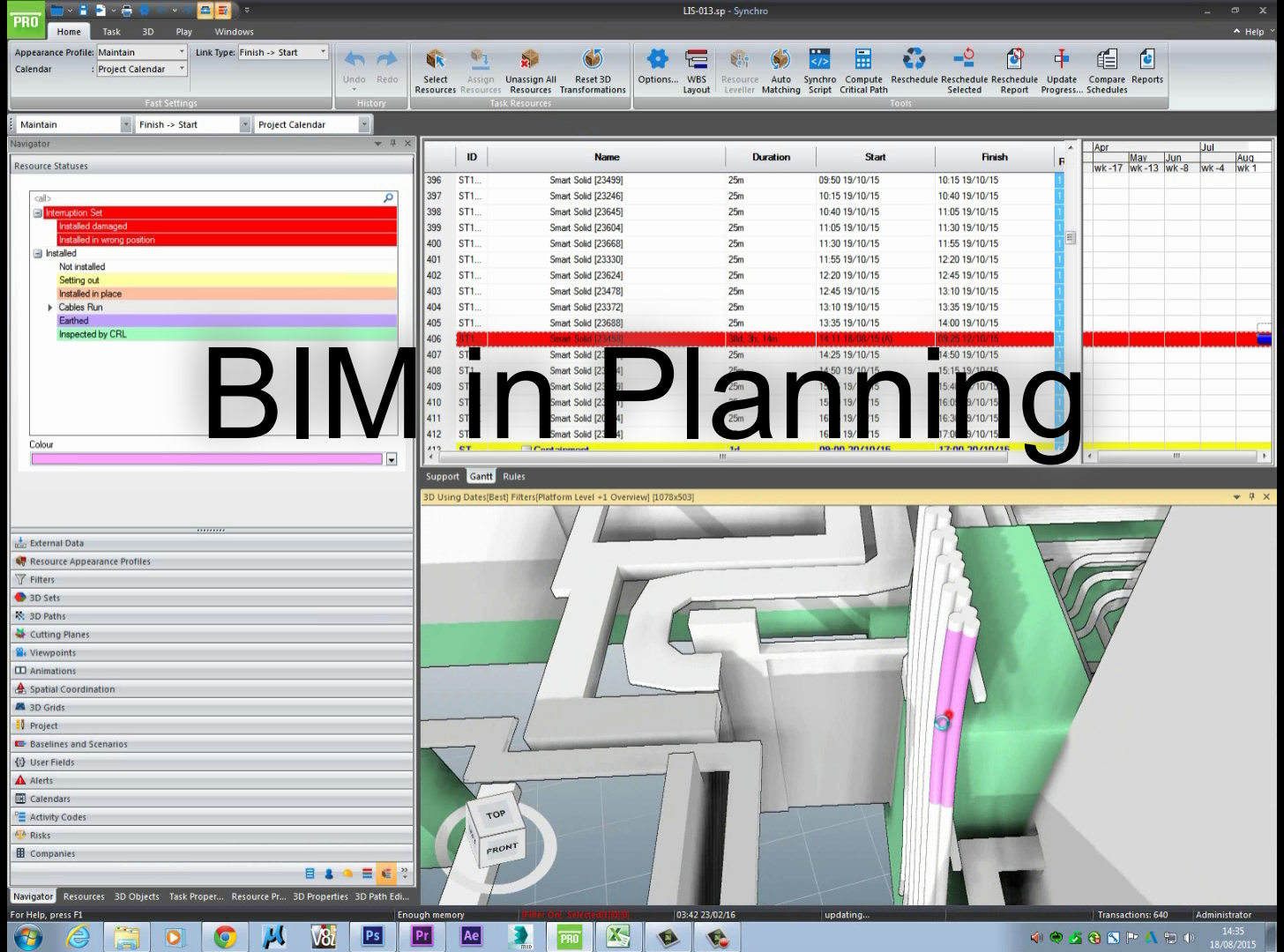


Information Applications



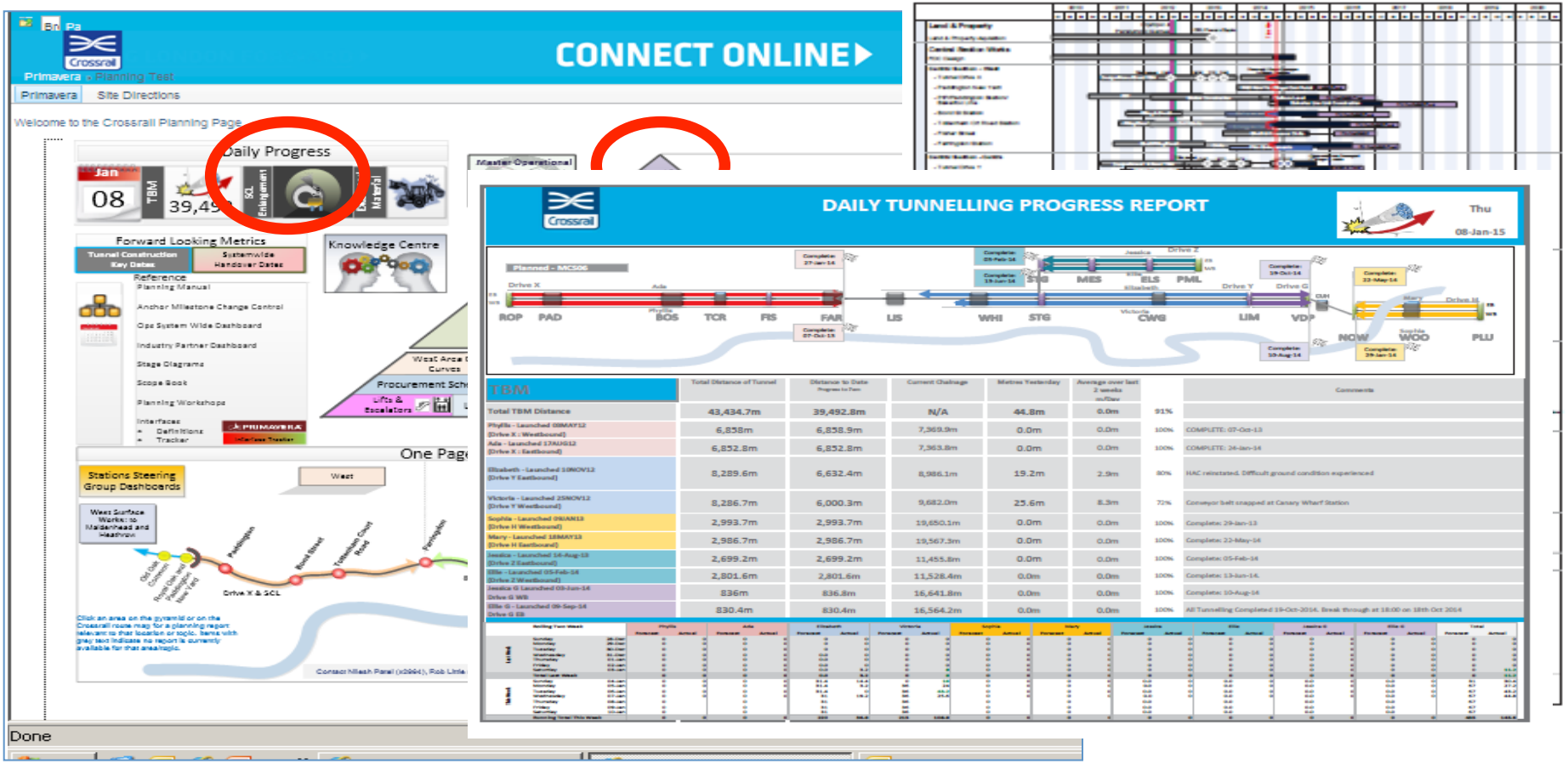
Master Data Management



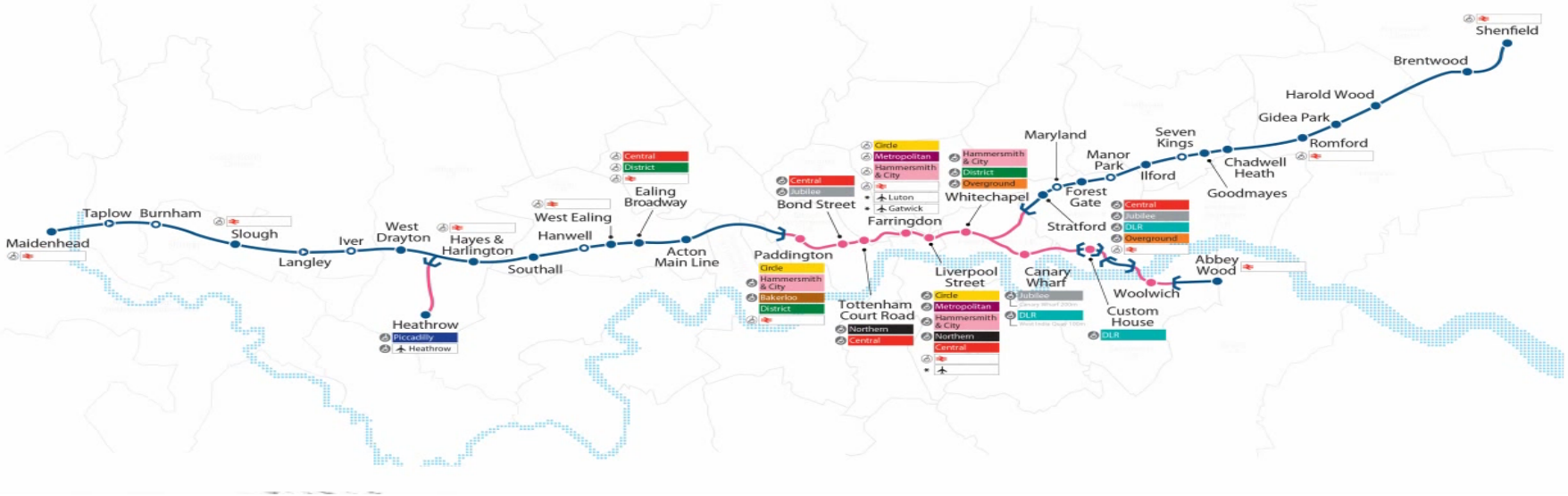


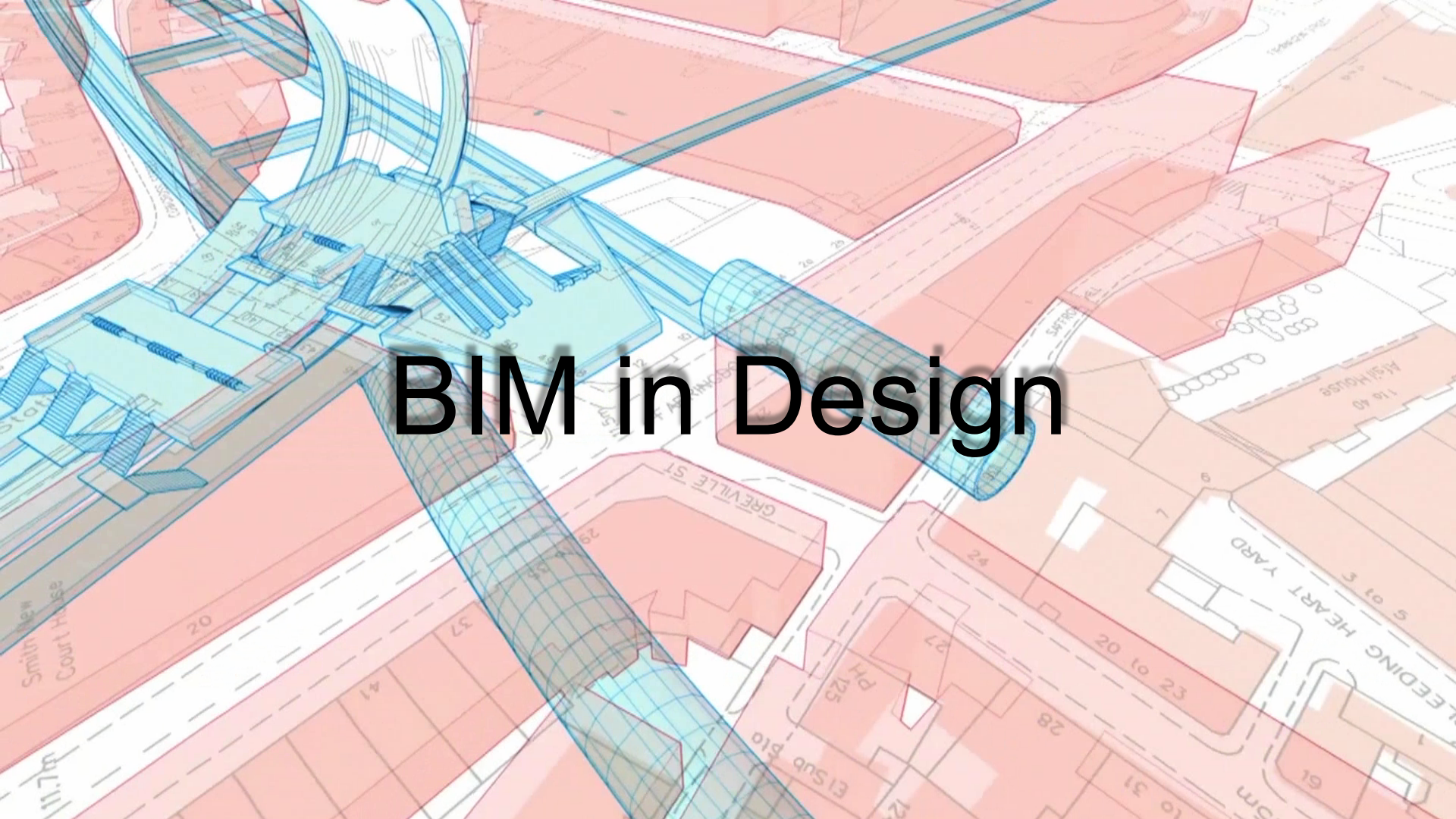
BIM in Planning

BIM in Planning



BIM in Action - Planning



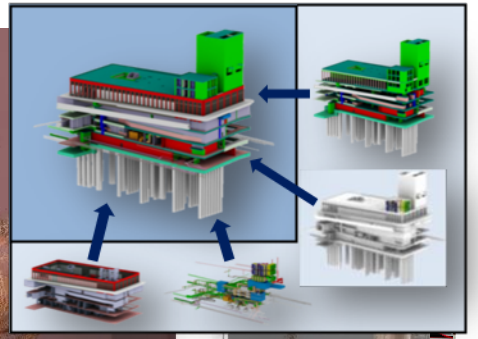

BIM in Design

BIM in Action - Design

- Greater Visibility of Design
- Improved Collective Understanding
- Managed Design & Clash Detection
- Early Conflict Mitigation
- Automated CAD Quality Assurance
- Managing Processes
- Collaborative model use e.g. SMART Boards

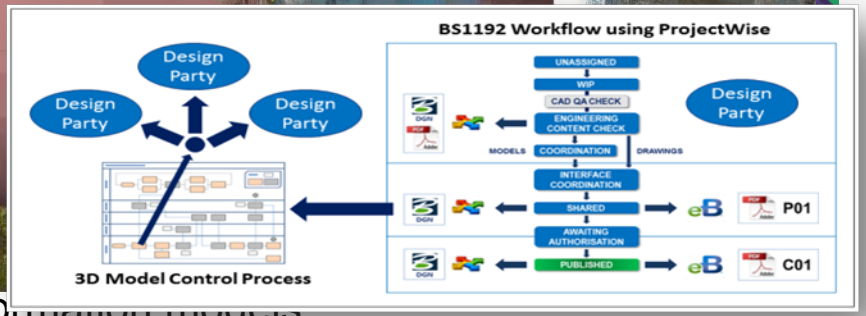
Gate Reviews for design

Implementing 3D Model-based design reviews using SMART boards and involving all parties involved in the design process



Control Processes

Introduced a "3D Model Control" process to support and manage 3D models between multiple design parties

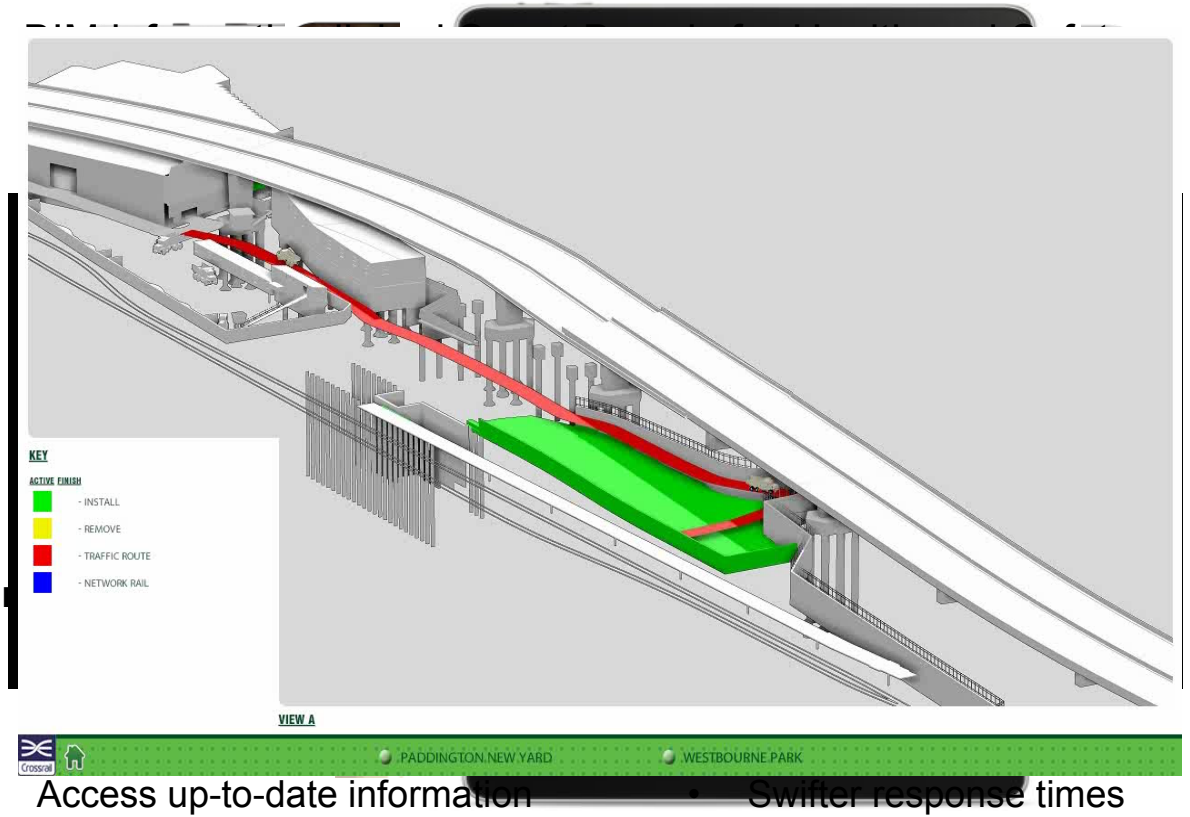


federated information models.


BIM in Construction

BIM in Action - Construction

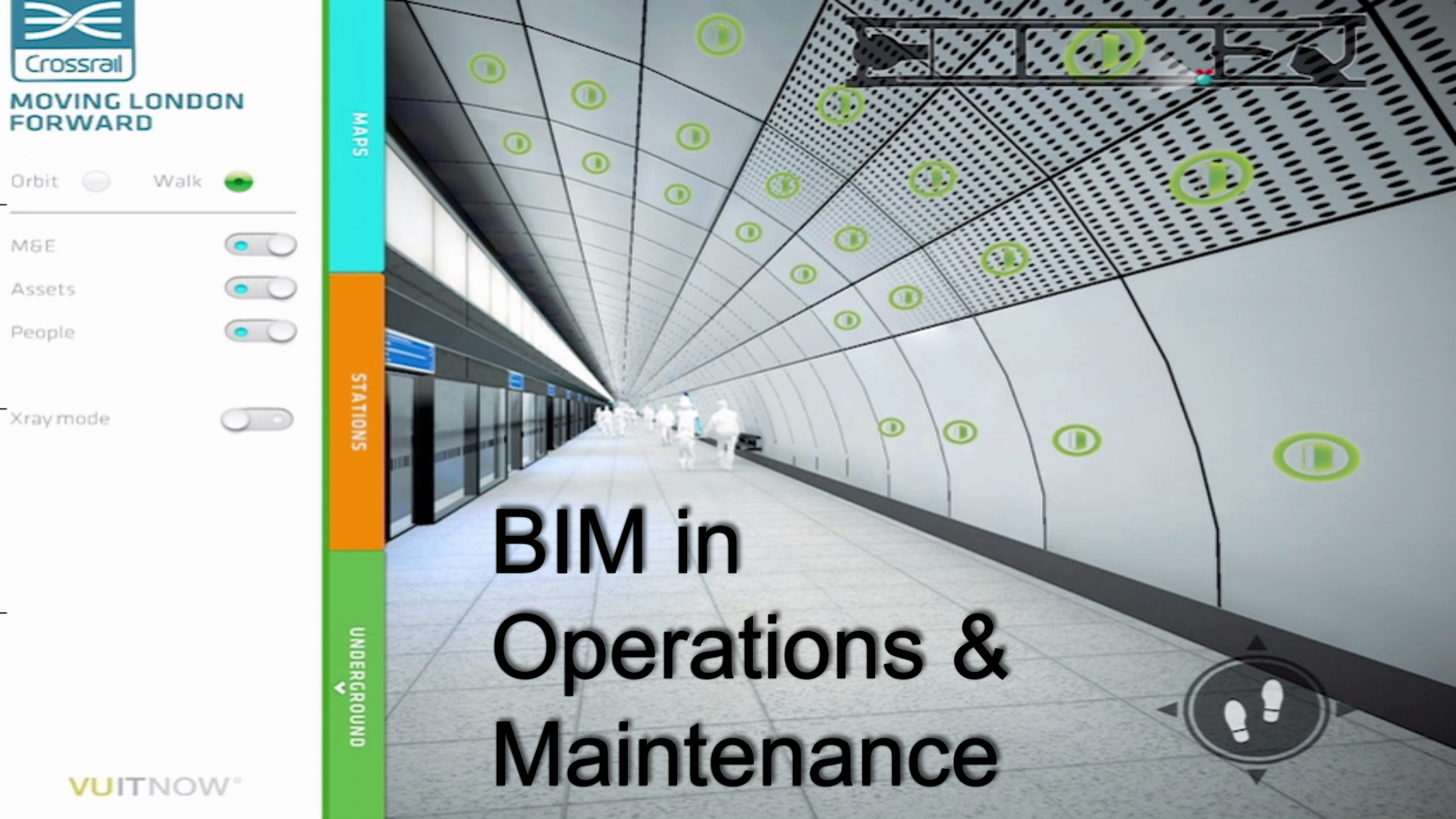
- Improved Understanding
- Demonstrating Readiness to Dig
- Health and Safety
- Improved Interface Management
- Augmented Reality
- Virtual Reality
- On-Site Document Verification
- Field Supervisor - EDMS in the field
- Mobile GIS
- 4D Modelling / Scheduling
- Contract Performance Analysis



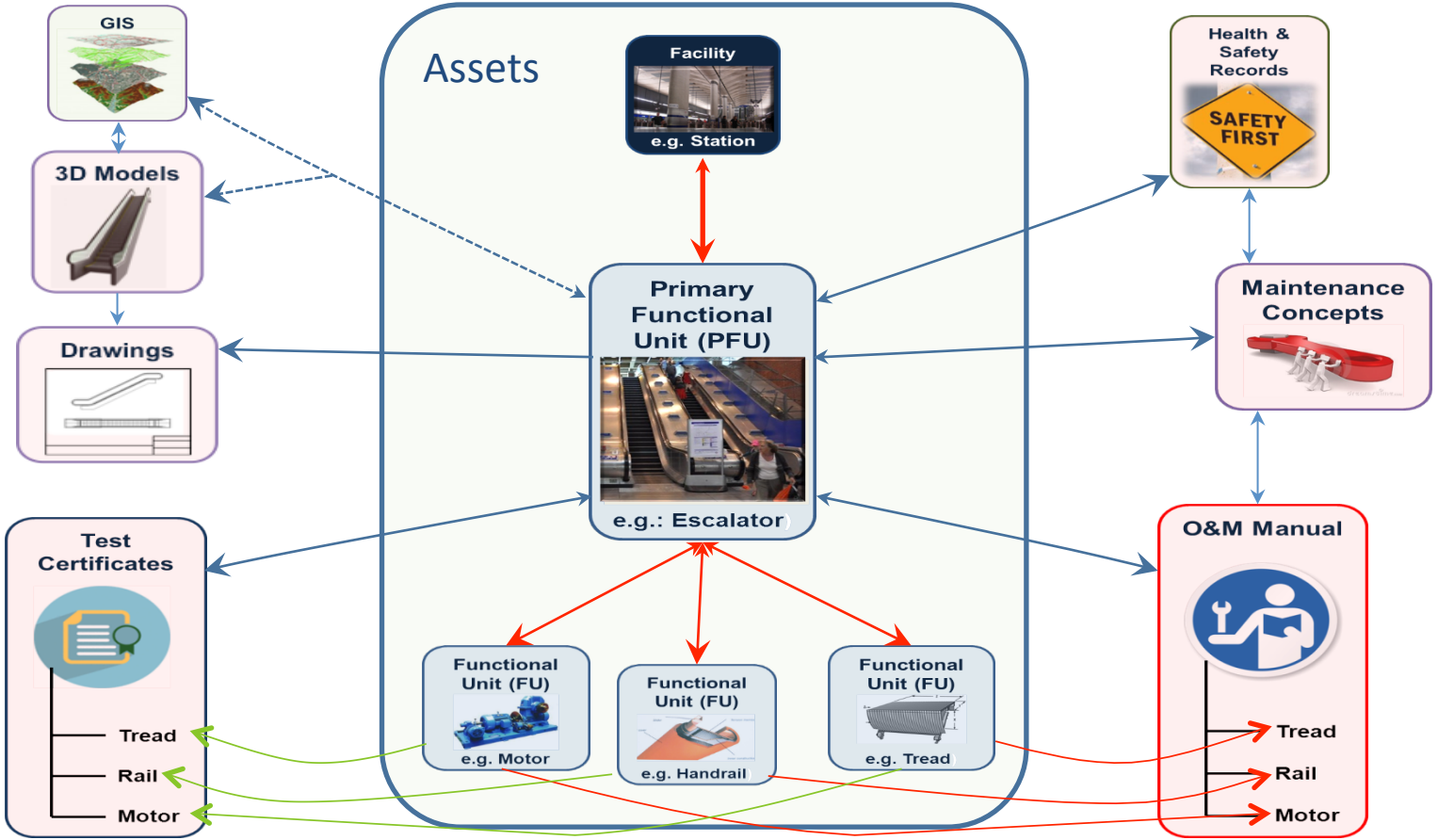
E

- Access up-to-date information
- GIS + models + documentation

- Swifter response times
- Common understanding


Crossrail
MOVING LONDON FORWARD
Orbit
Walk
M&E
Assets
People
Xray mode
MAPS
STATIONS
UNDERGROUND
BIM in Operations & Maintenance
VUITNOW

Structured Information

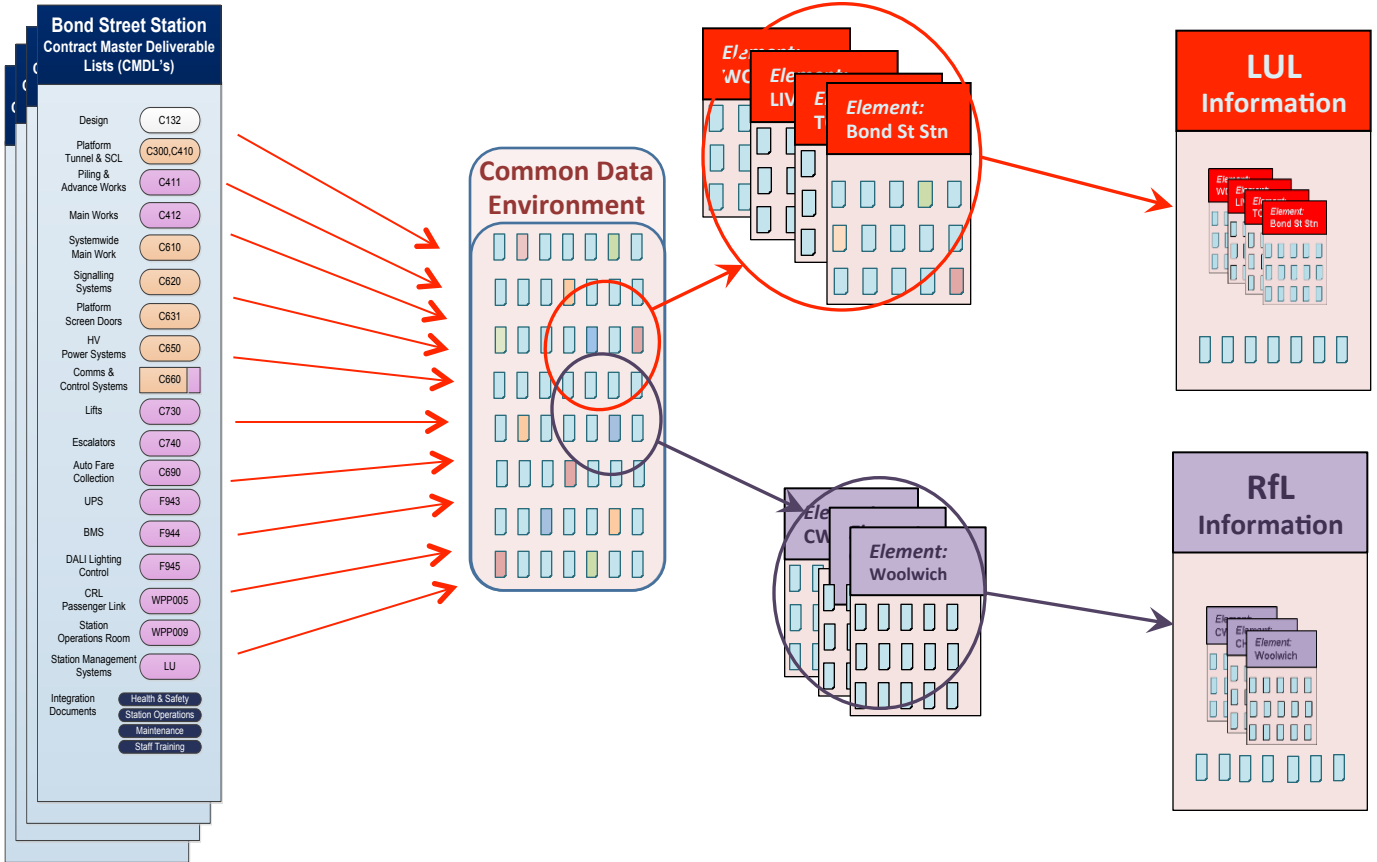


Information Handover Principles

How we are handing over the CDE from Capex into Opex..

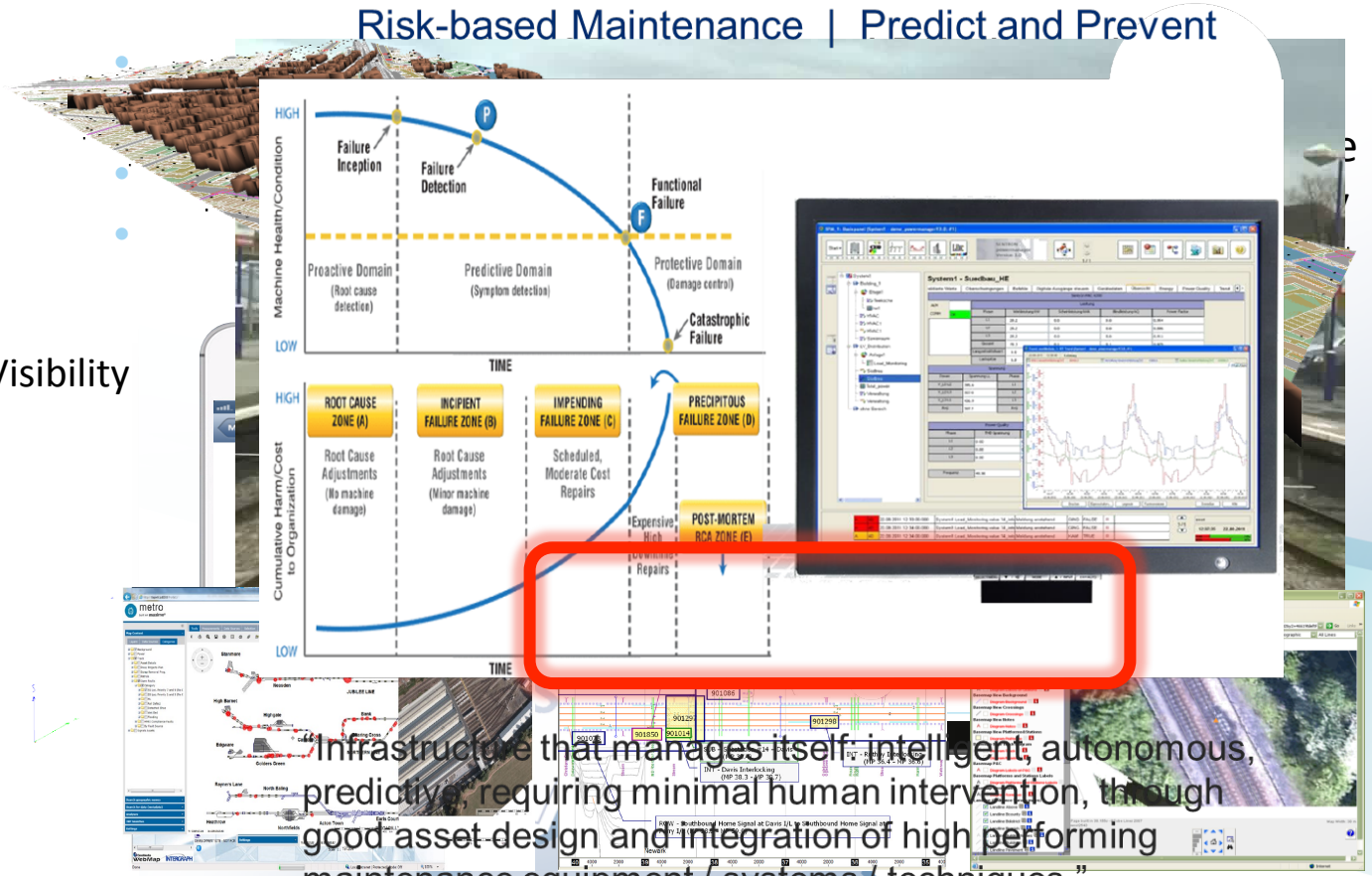
Contract Templates for each facility

Element Handover "Playlists"



BIM in Action – Operations and Maintenance

- Maintenance Concepts
- Augmented Reality
- Virtual Reality
- GIS linked to Maximo
- Digital Processes Drive Visibility
- Digital triage of Faults
- Virtual Maintenance
- CDE underpinning O&M



"Infrastructure that manages itself: intelligent, autonomous, predictive, requiring minimal human intervention, through good asset design and integration of high performing maintenance equipment / systems / techniques."

Return on Investment

Information Engineering: Benefits

- **The direct benefits we have delivered include:**
  - Reduced wastage (minimising clashes)
  - Improved efficiencies (faster collaborative approvals)
  - Reduced information loss (using only the most recent document/ drawings)
  - Improved safety (model visualisations leading to better awareness)
  - Reduced programme risk (through 4D analysis)
  - Improved performance (linking models into GIS mapping)
  - Collaborative model transfer from designer to contractor
  - Innovative asset management (linking models directly to our asset database)

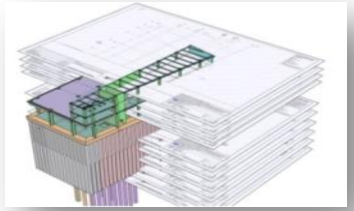
Non-Financial Benefits

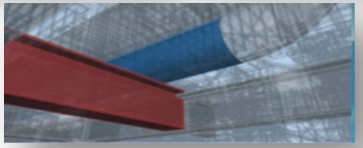
These include:

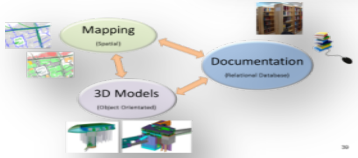
- **Safety**
  Better understanding of construction through visualisations, by combining 2D and 3D

- **Efficiency**
  Reduction in waste through model clash detection

- **Effectiveness**
  Always the most up-to-date information from an integrated single source of truth

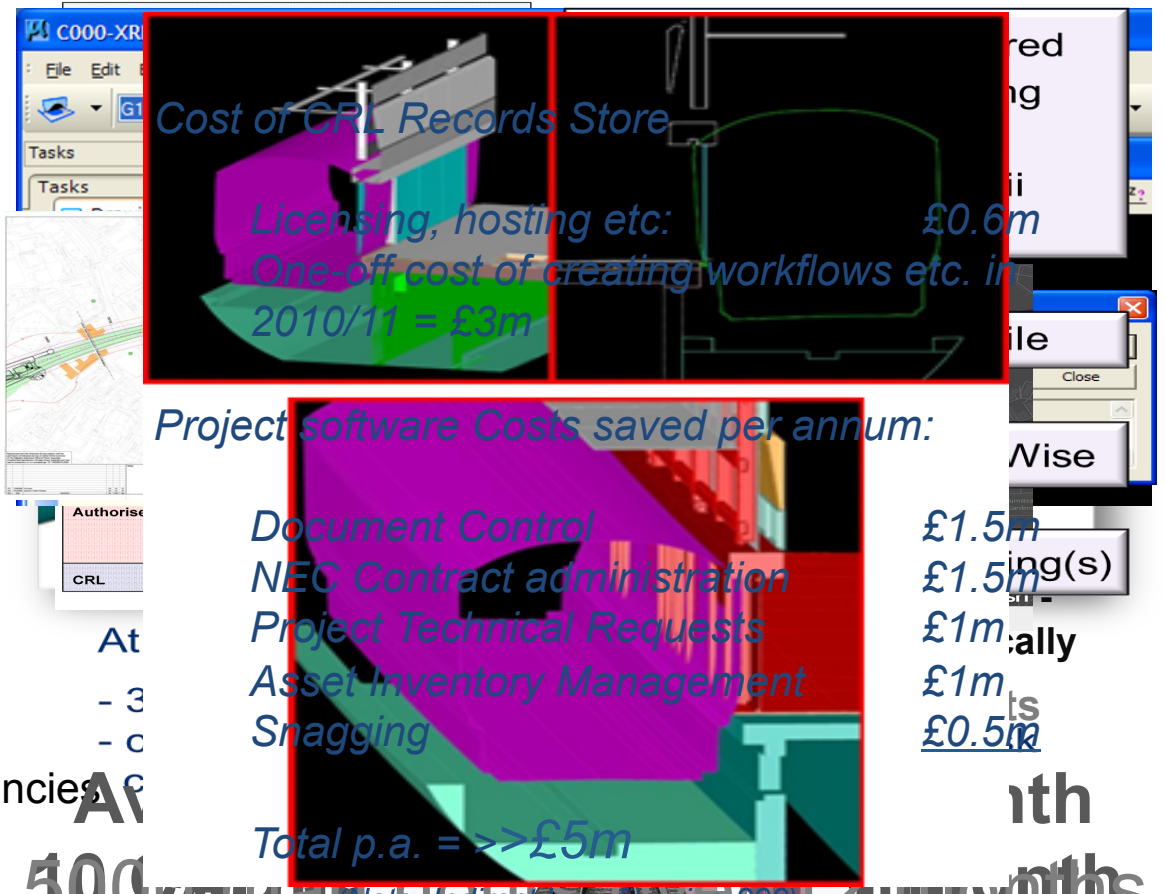






Cost and Time Savings

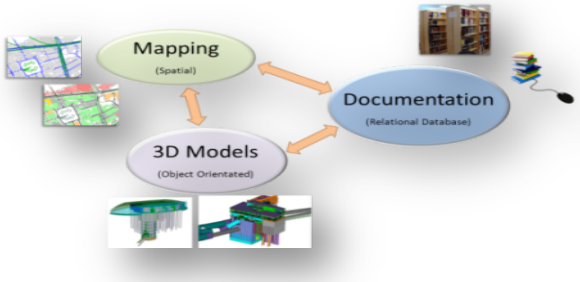
- CAD User Management Tools
- Customised CAD Workflow to BS1192
- CAD QA Customisation
- Smart Design
- Risk Reduction with 4D
- Risk Reduction – Concreting Train
- GIS
- Common Data Environment Efficiencies



Lessons Learned… the hard way!

- Key principles:
  - Treat data as a valuable resource! (owned by the Client)
  - Establish your requirements (at business and project level)
  - Structure data with the end-use in mind
  - Good asset breakdown structure & classification
  - Use relational databases
  - Become data-centric (the CDE)

- Beware (or mindful of):
  - Data interoperability (be prescriptive!)
  - Being led by IT!
  - People don't like change!



Crossrail in Numbers

£14,800,000	Cost
2,054,100	e-Documents stored – so far!
1,000,000	Assets to be Tagged
301,147	Drawings – so far!
8,250	Individual Document users – so far!
650	CAD users – so far!
25	Main Construction contracts
8	Main Design contracts
2	Future Infrastructure maintainers
1	**Crossrail**

It would all be much harder without BIM!


Thank You!