Crossrail: Design, Construction & Operations with Geospatial Data

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Crossrail:…….. our use of geospatial data

Key message:
The importance of BIM and spatial data in creating infrastructure

- Introduction
- Common Data Environment (re-engineering delivery)
- Spatial data in:
  - Design
  - Construction
  - Operational asset management
- Benefits and Lessons Learned

Introduction

Bombardier Automatic Vehicle Inspection (AVI)

- Traction system
- Train control
- Doors
- HVAC
- Power supply
- Engine & gearbox
- Cooling system
- Passenger amenities
- Brake system
- Infrastructure

Crossrail – enabling London to grow

£14.8bn cost

£42bn net benefit

118 km length

40 (10 new**)** stations

24 Trains/hour

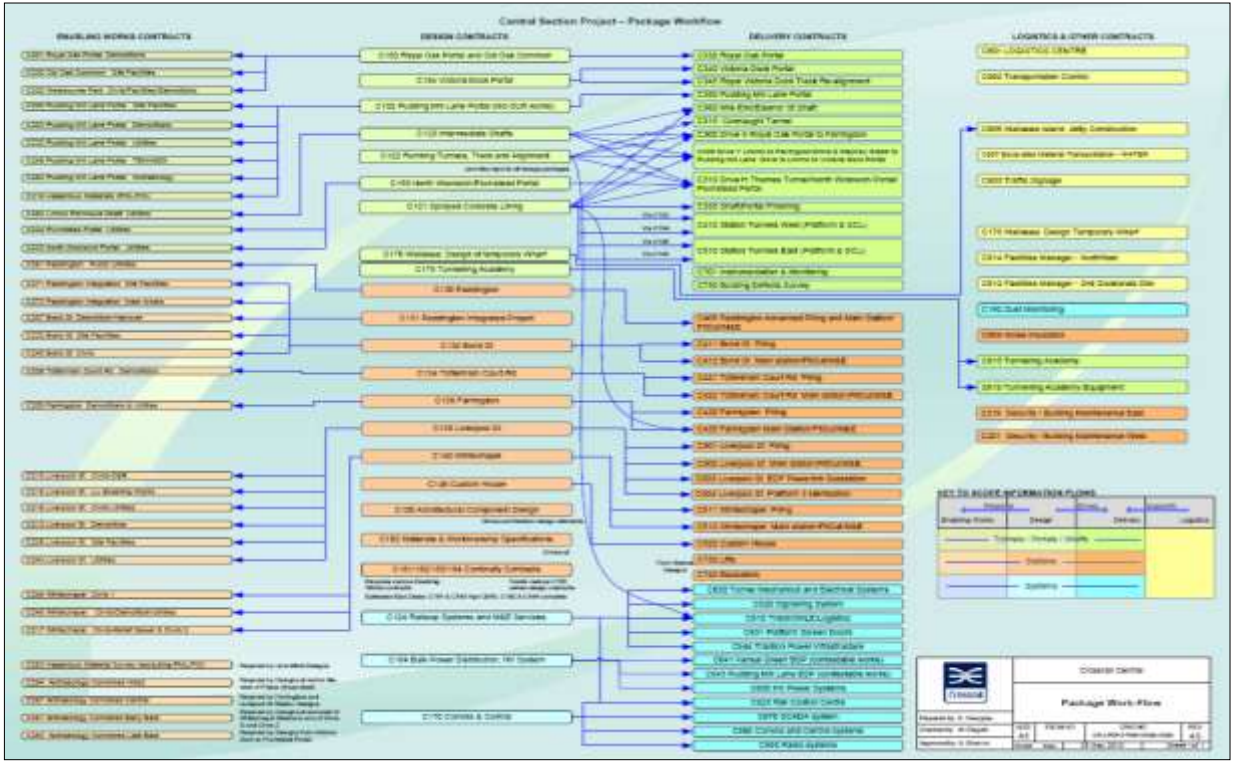
200m journeys pa

Challenges: Contractual

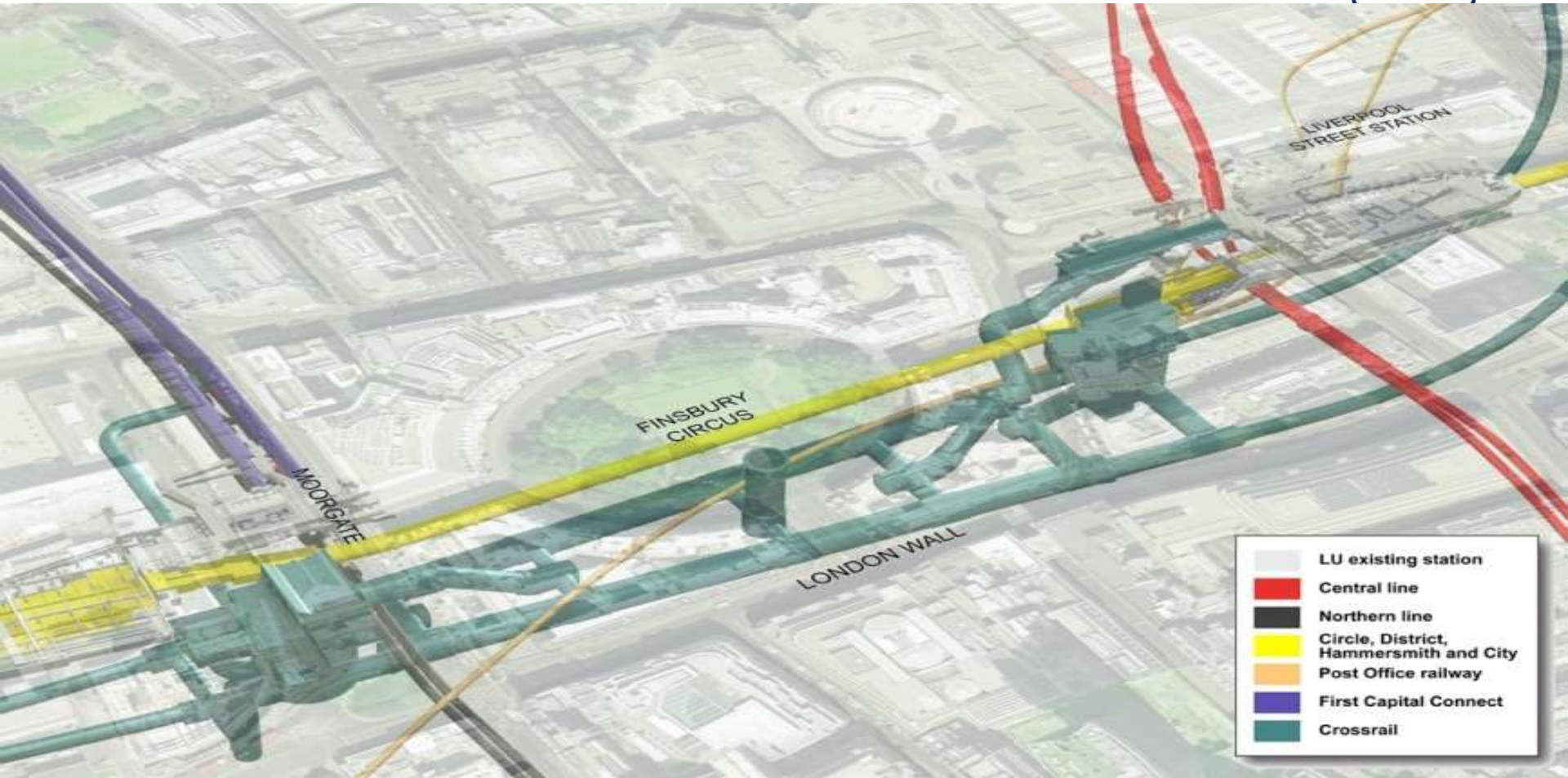
- 34 Enabling Works Contracts
- 23 Design Contracts
- 45 Delivery Contracts
- 14 Others

- They all use information

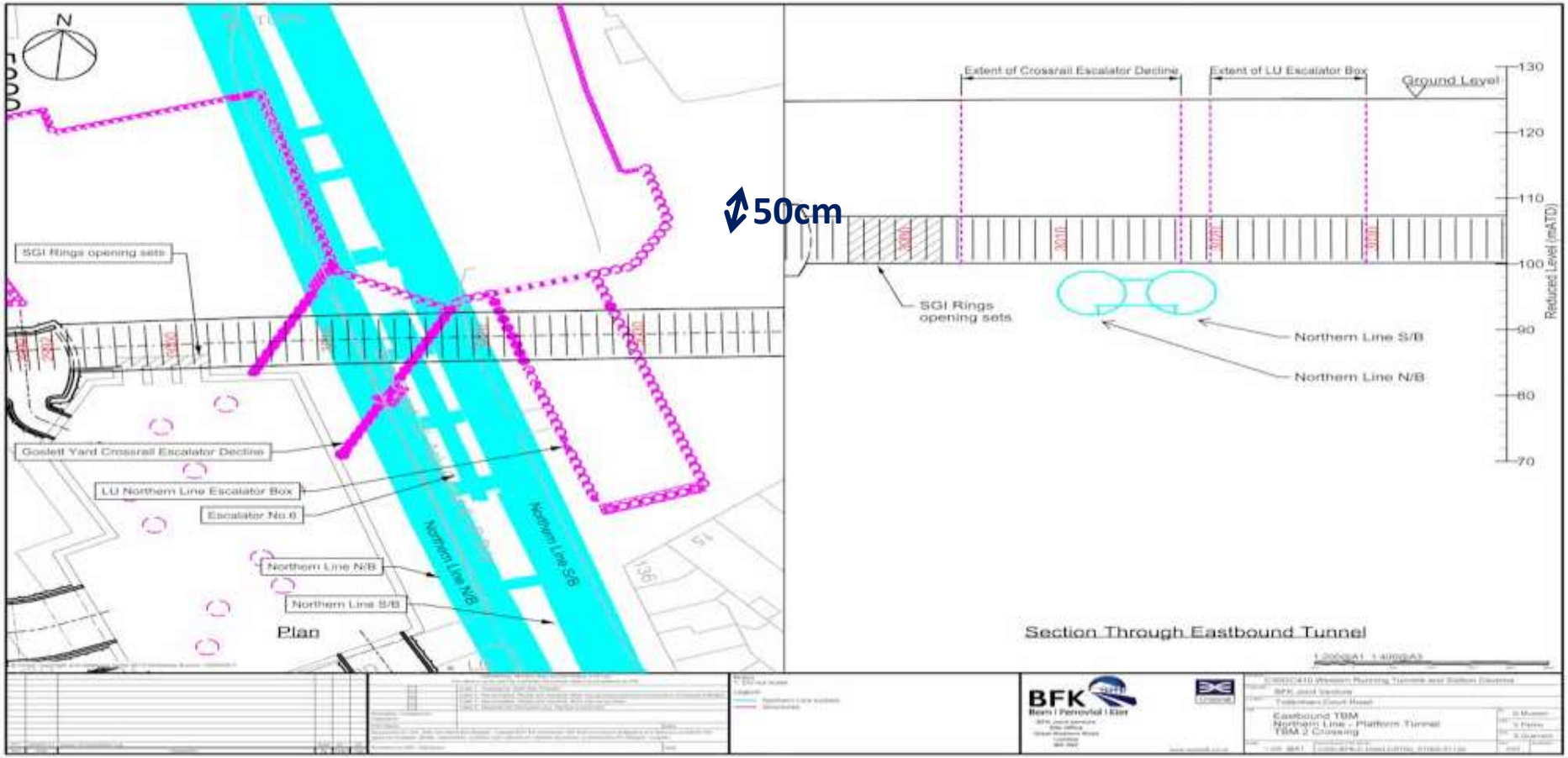
- Need information to collaborate (!)



Challenges: Construction & Environmental

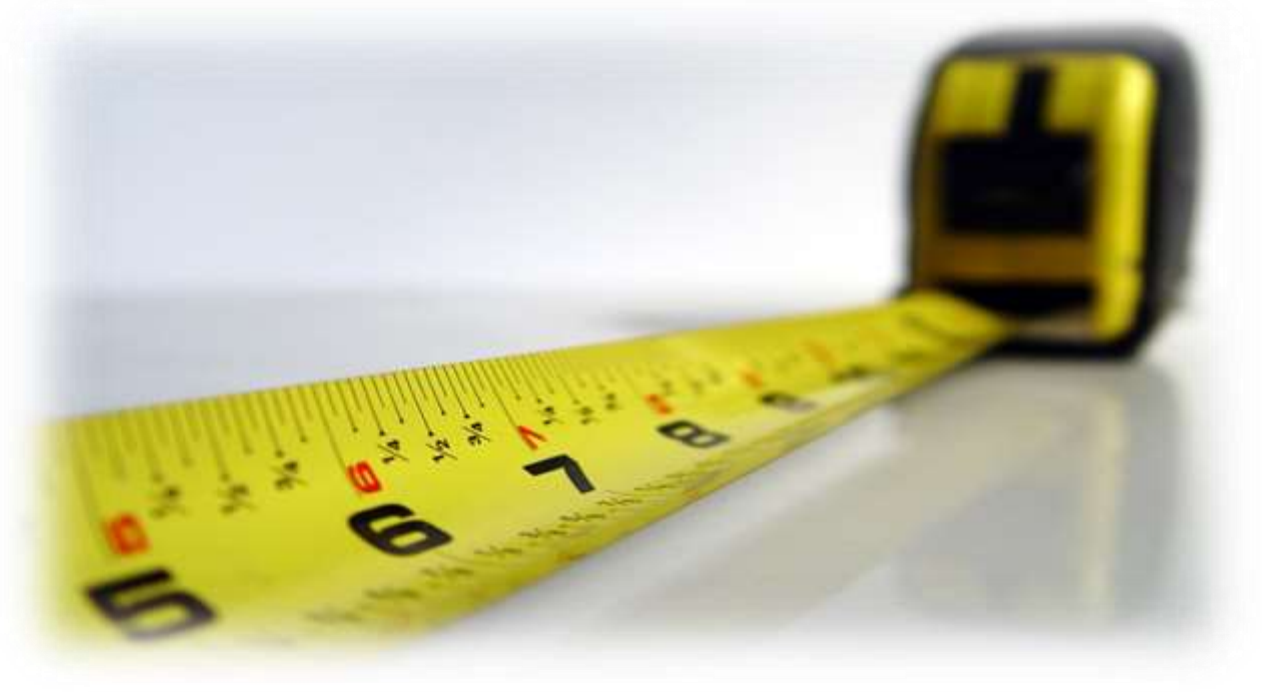


Challenges: Spatial Accuracy



Complexity in Asset Management

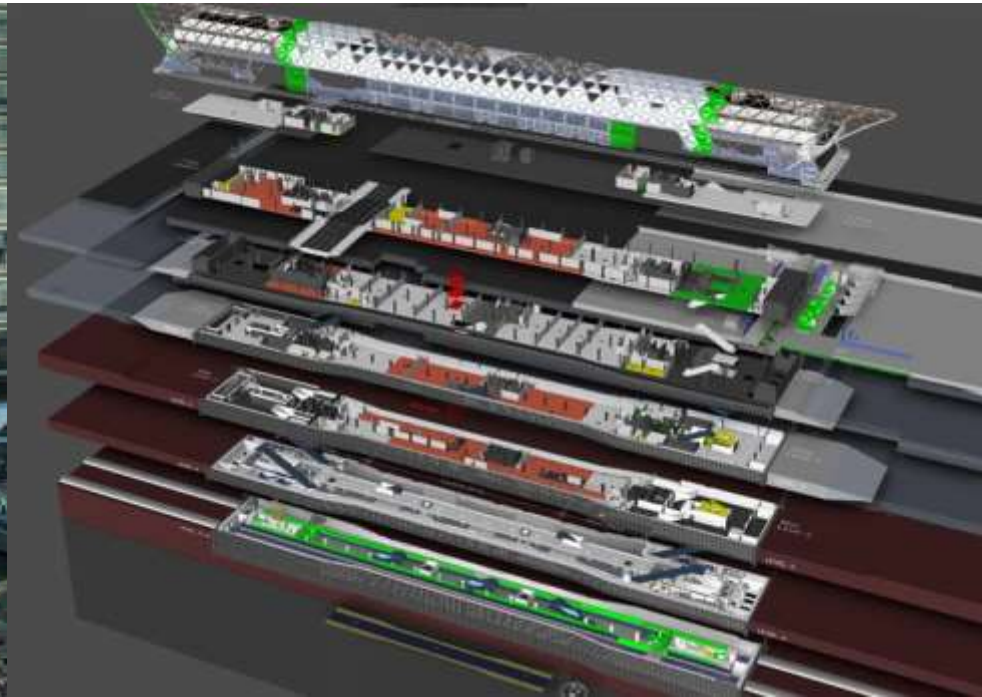
The physical scale of the Crossrail project is replicated by the scale of the Virtual project



Building Two Railways

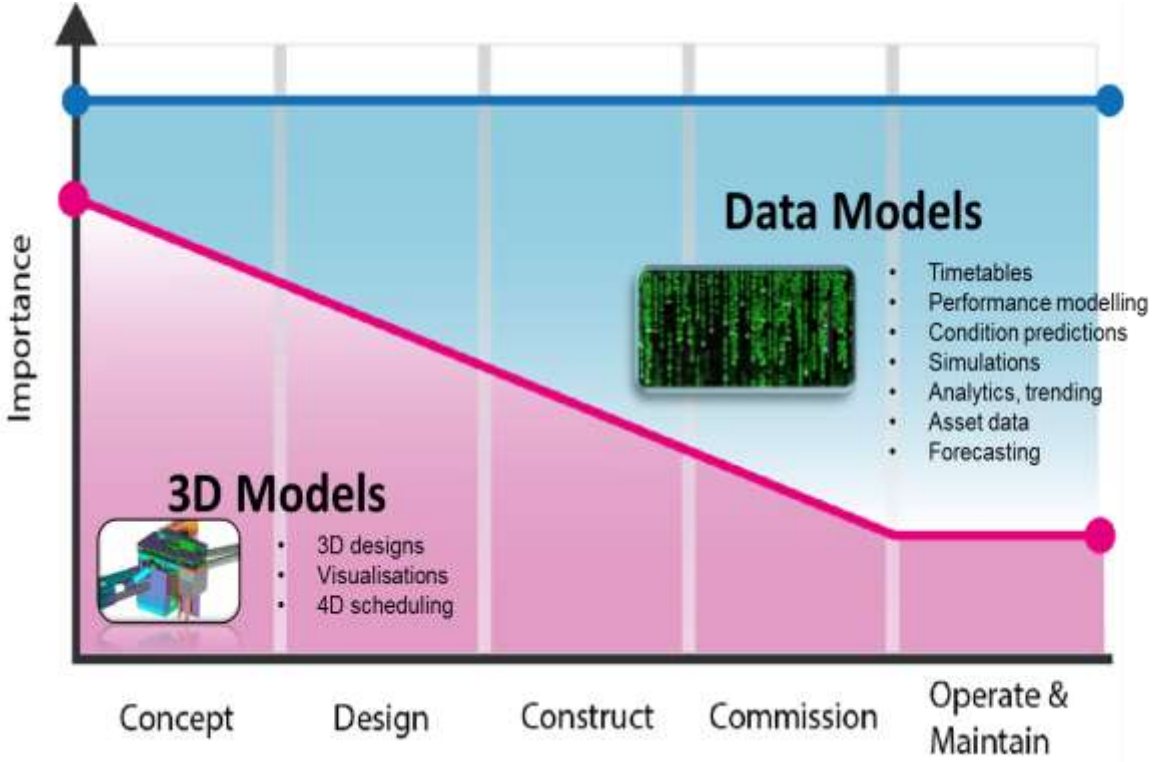
Physical

Digital



The importance of Models (and BIM)

- Information and data…
- Maps and models…
- Making decisions…
  - better
  - quicker



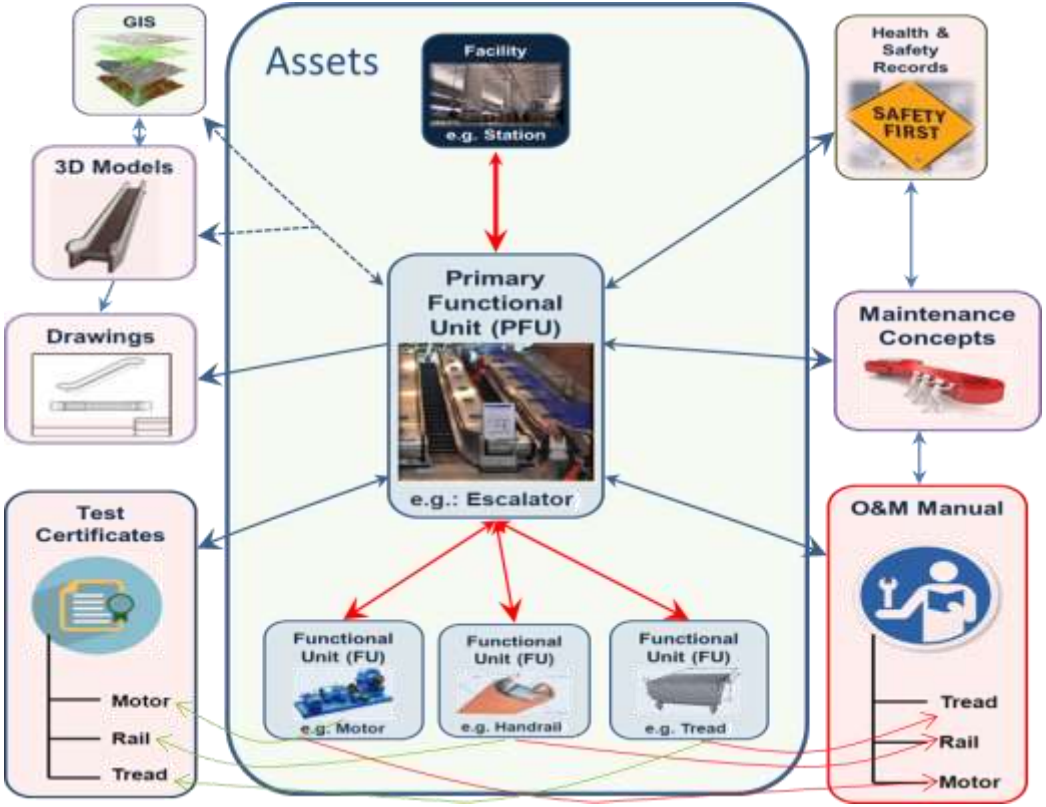
Common Data Environment

- Re-defining Project Information Management
- Re-engineering delivery

Structured Data and the CDE

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
  - Exploiting technologies e.g. databases
- New defined roles and procedures
  - To BS1192
  - Deliverables and processes set out

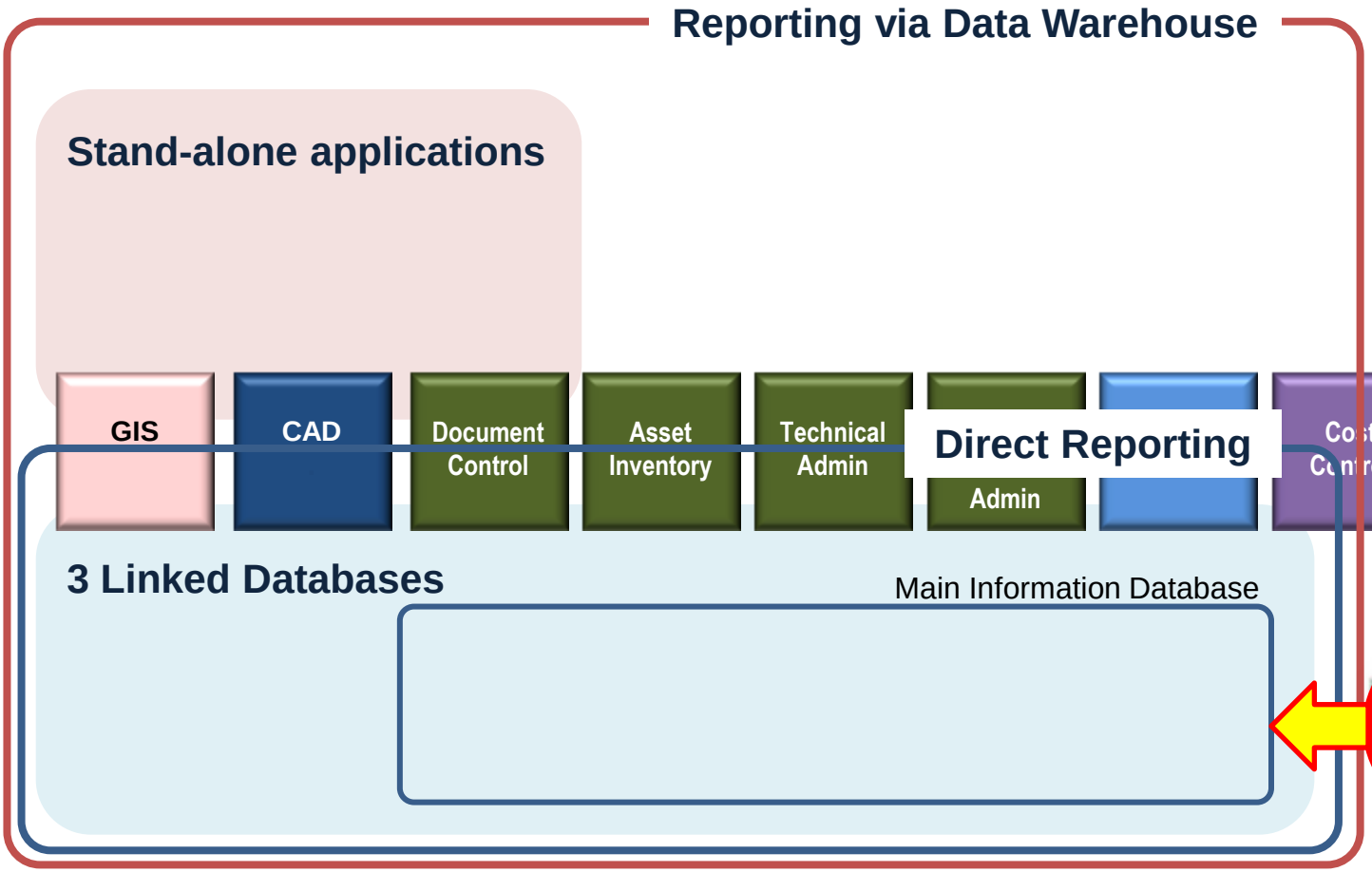


Our Common Data Environment

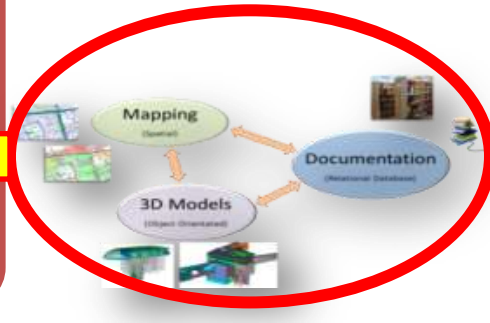
Careful – don't be application-centric!

GIS	CAD	Document Control	Asset Inventory	Technical Admin	Contract Finance & Admin	Schedule	Cost Control	Risk Management	Change Management

Our Common Data Environment



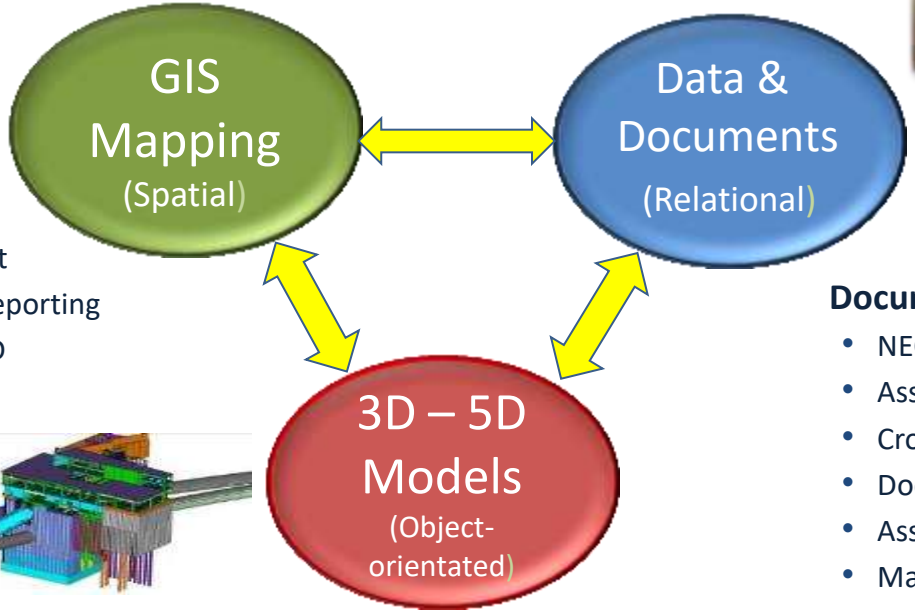
- Single source of data
- CRL owned systems
- Contractual
- Must be used by everyone!



Our CDE workflows

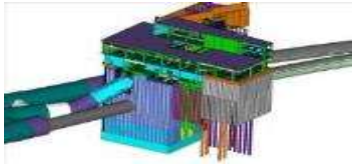
GIS workflows:

- London Survey Grid
- Estates management
- Automated claims reporting
- Integration with CAD



Documentation workflows:

- NEC3Contract Management (£8.3bn)
- Asset Inventory Structure (ABS)
- Crossrail Management System (CMS)
- Document Management System
- Assurance reporting
- Materials compliance system
- Project Technical Requests
- Observation reporting
- Snagging
- Automatic pdf drawings from ProjectWise
- Observation reporting
- Contract deliverables



CAD workflows:

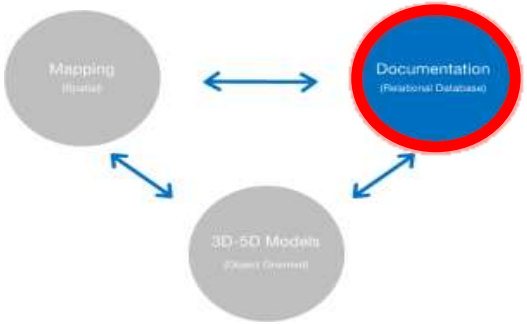
- CAD user tools
- CAD QC/QA
- User Management Tools
- Customised BS1192 Workflow

90% of data in 3 linked databases

Benefits of the CDE

Benefits…..

- Single source of truth
- Avoids duplication
- Encourages collaboration
- Reduces time and cost in producing coordinated data
- Controls change effectively
- Consistent reliable data
- Reduced waste



Cost of the documentation/information database:

Licensing, hosting etc:	*£0.7m p.a.*
One-off cost of creating workflows etc. in 2010/12 =	*£3m*

Typical project software costs saved per annum:

Document Control	*£1.5m*
NEC Contract administration	*£2m*
Project Technical Requests	*£1m*
Asset Inventory Management	*£1m*
Assurance	*£1m*
Snagging	*£0.5m*
Others	*+£1.5m*

Cash benefit ***>>£8m*** *per year for 6 years*

(Plus related data, business agility, less IT support etc.)

Spatial data in:

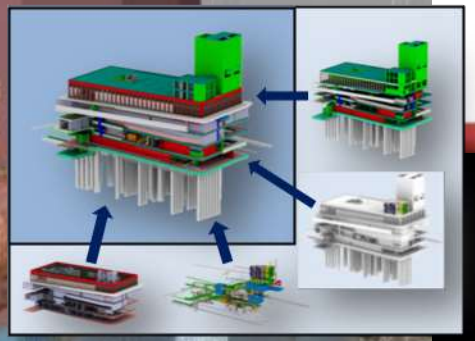
- Design
- Construction
- Operational asset management

Spatial Visualisation - Design

- Greater Visibility of Design
- Improved Collective Understanding
- Managed Design & Clash Detection
- Early Conflict Mitigation
- Automated CAD Quality Assurance
- Managing Processes

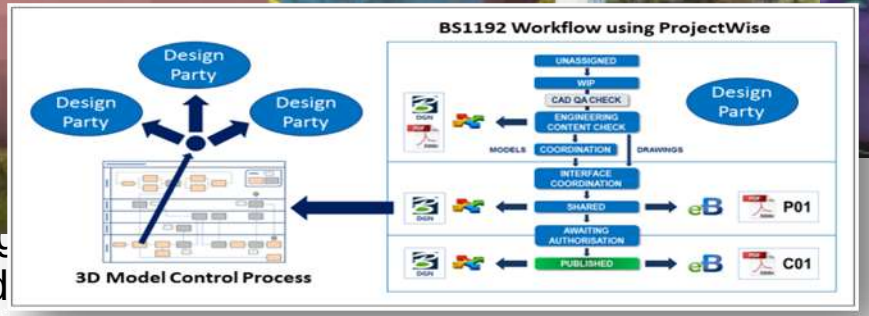
Gate Reviews for design

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



Delivering
federated

Spatial Visualisation - Construction

- Improved Understanding with 4D
- Demonstrating Readiness to Dig
- Health and Safety
- Improved Interface Management
- Augmented Reality
- Virtual Reality
- On-Site Document Verification
- EDMS in the field
- Mobile GIS
- 4D/5D Modelling / Scheduling

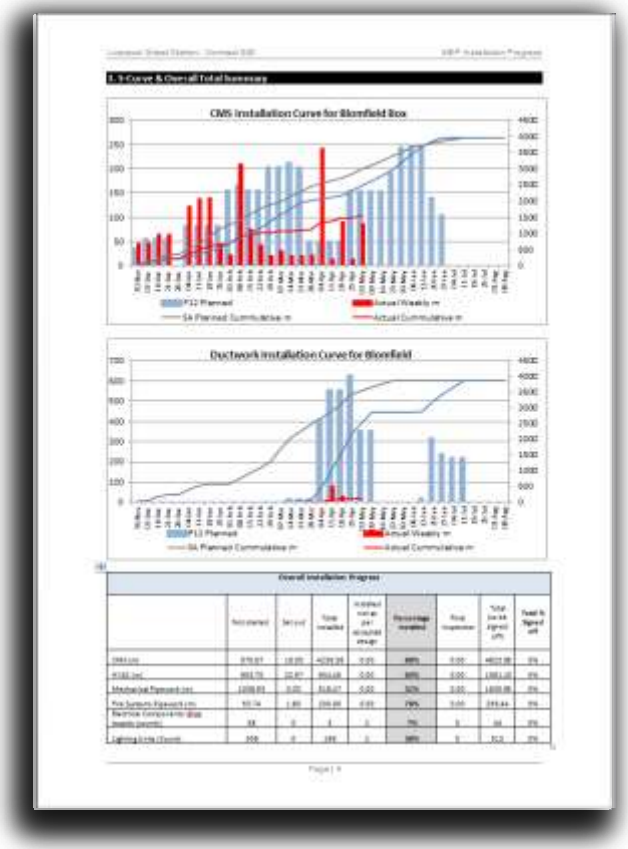
- Access up-to-date information
- GIS + models + documentation
- Swifter response times
- Common understanding

Installation Progress Reports

Benefits:

- Efficiencies
  - Time savings
  - Agreed records
  - Process improvements

- Effectiveness
  - Quality record data
  - Good Assurance data
  - Maintenance benefits



Operations & Maintenance

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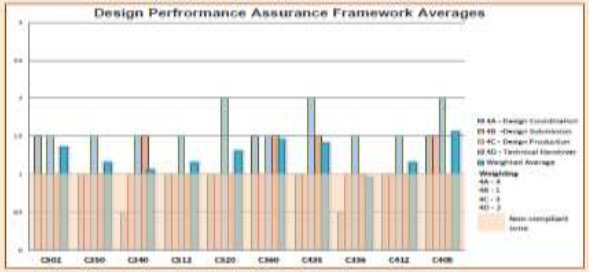
BIM Metrics

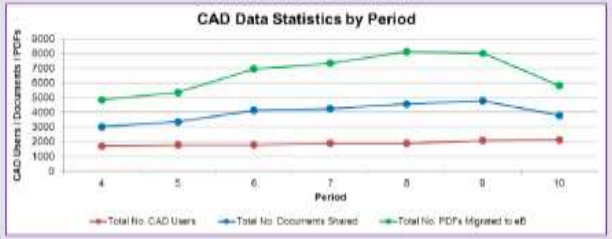
Technical Information Dashboard

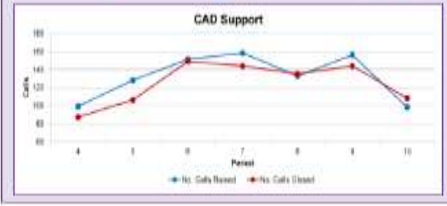
INFORMATION APPLICATIONS



GIS

CAD





Model files in ProjectWise

180,673

+0.00% Period 11

Drawings in ProjectWise

243,545

+0.00% Period 11

DOCUMENT AND DATA CONTROL

Contractor performance (24 contracts)
Contracts scoring over 97%

C298 C315 C340
C350 C501 C510

Total no. of documents (records) in eB

1,545,227

+0.00% Period 11

ASSET INFORMATION

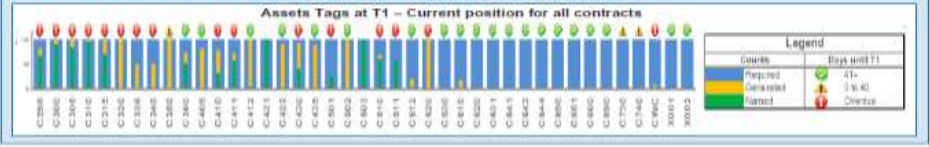
Tagged assets status – January

	Count		
Required (11100)	420,181	-	-
Required (1 Selected)	180,799	-	-
Generated	155,639	145.5%	37.0%
Named	33,140	18.3%	7.9%

Total no. of Asset Tags generated

155,639

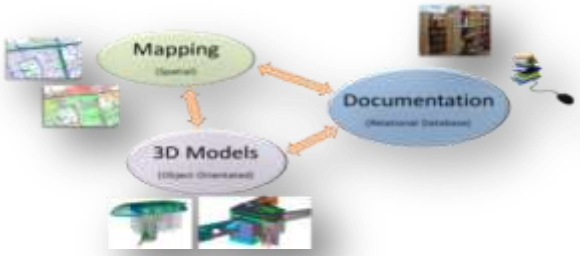
+0.00% Period 11



Benefits & Lessons Learned

Lessons Learned

- 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
- At the start:
  - Good work breakdown structure
  - Good asset breakdown structure & classification
  - Use relational databases
  - Become data-centric (the CDE)
  - Information metrics



http://learninglegacy.crossrail.co.uk/

Crossrail in Numbers

£14,800,000	Cost
2,854,100	e-Documents stored – so far!
1,000,000	Assets to be Tagged
301,147	Model files – so far!
8,250	Individual Information users – so far!
700	GIS mapping layers – so far!
114	Main Construction contracts
23	Main Design contracts
2	Future Infrastructure maintainers
1	**Crossrail**

- It would all be much harder without GIS & BIM!

Thank you!

GEOSPATIAL WORLD FORUM

THEME GEO4IR
Geo-enabling 4th Industrial Revolution
Location | IoT | Bigdata | AI

http://learninglegacy.crossrail.co.uk/