



MOVING LONDON FORWARD

Crossrail: A Case Study in BIM *(Draft 26th July 2013)*

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◀ Crossrail: A Case Study in BIM

Malcolm Taylor

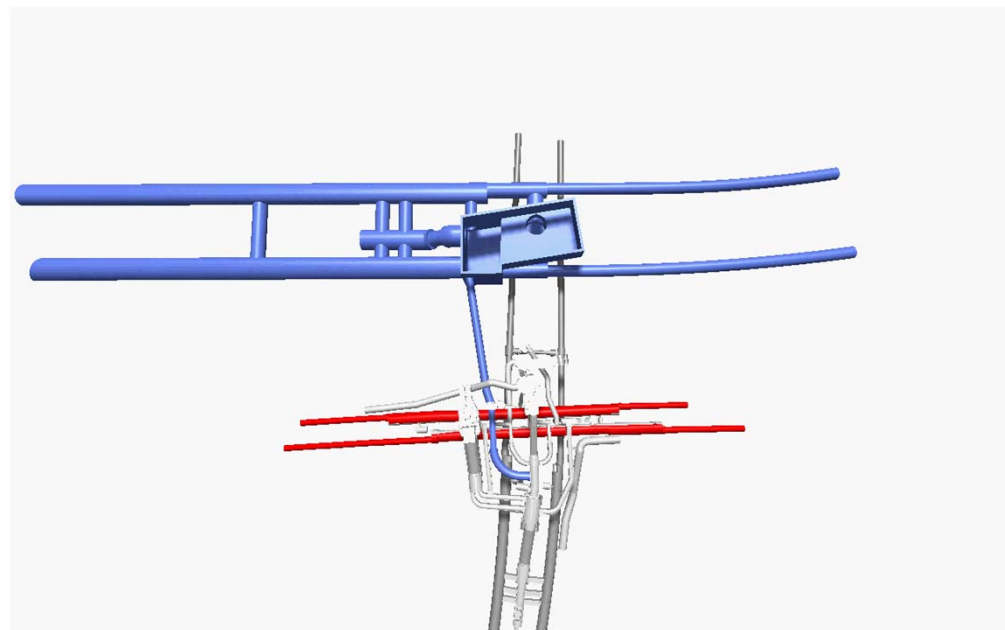
Crossrail Head of Technical Information

29th October 2013

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- ▶ Briefly set the scene...
- ▶ What BIM in Crossrail currently looks like
- ▶ Summary

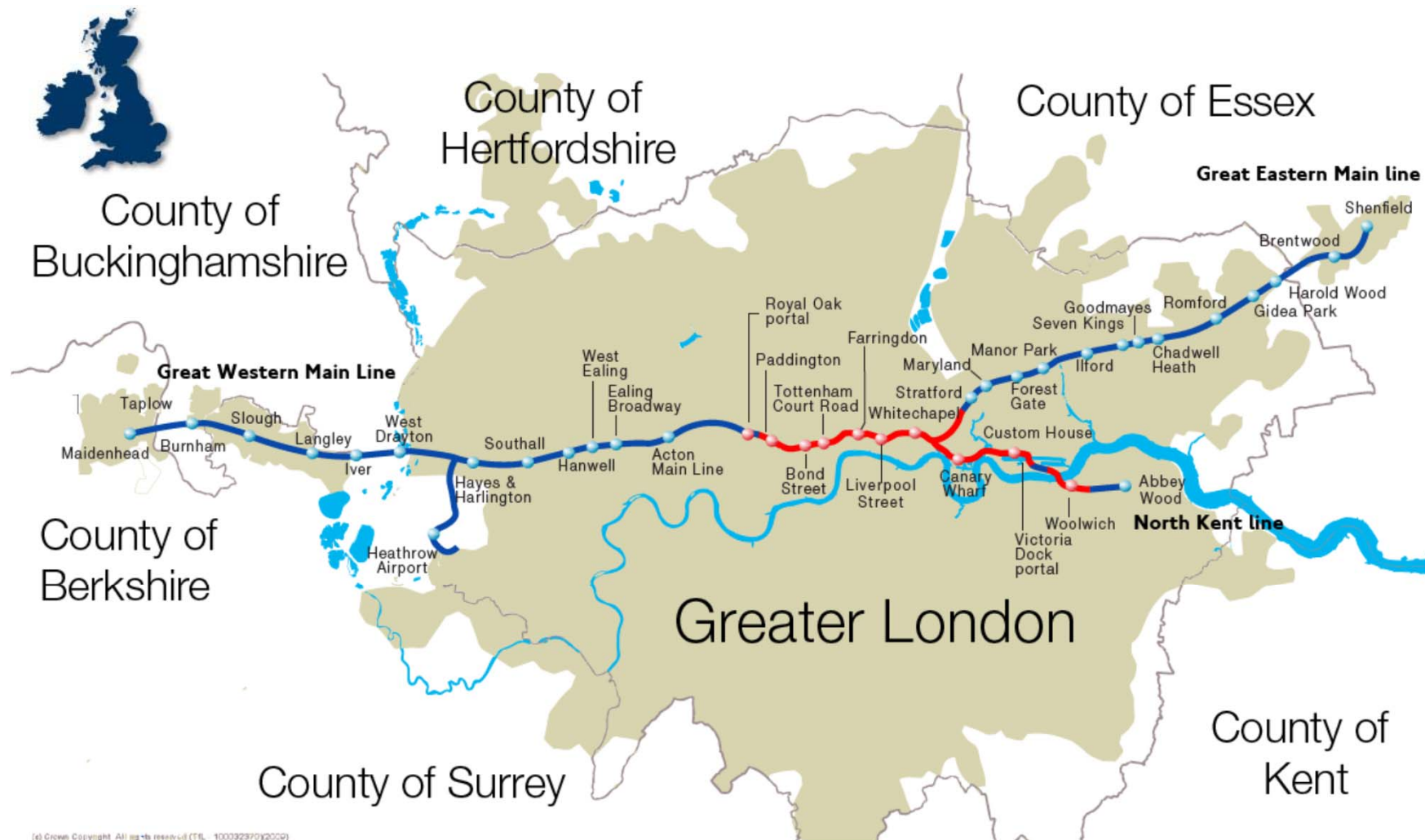




Setting the Scene.....

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◀ Crossrail: Route Across London





Benefits

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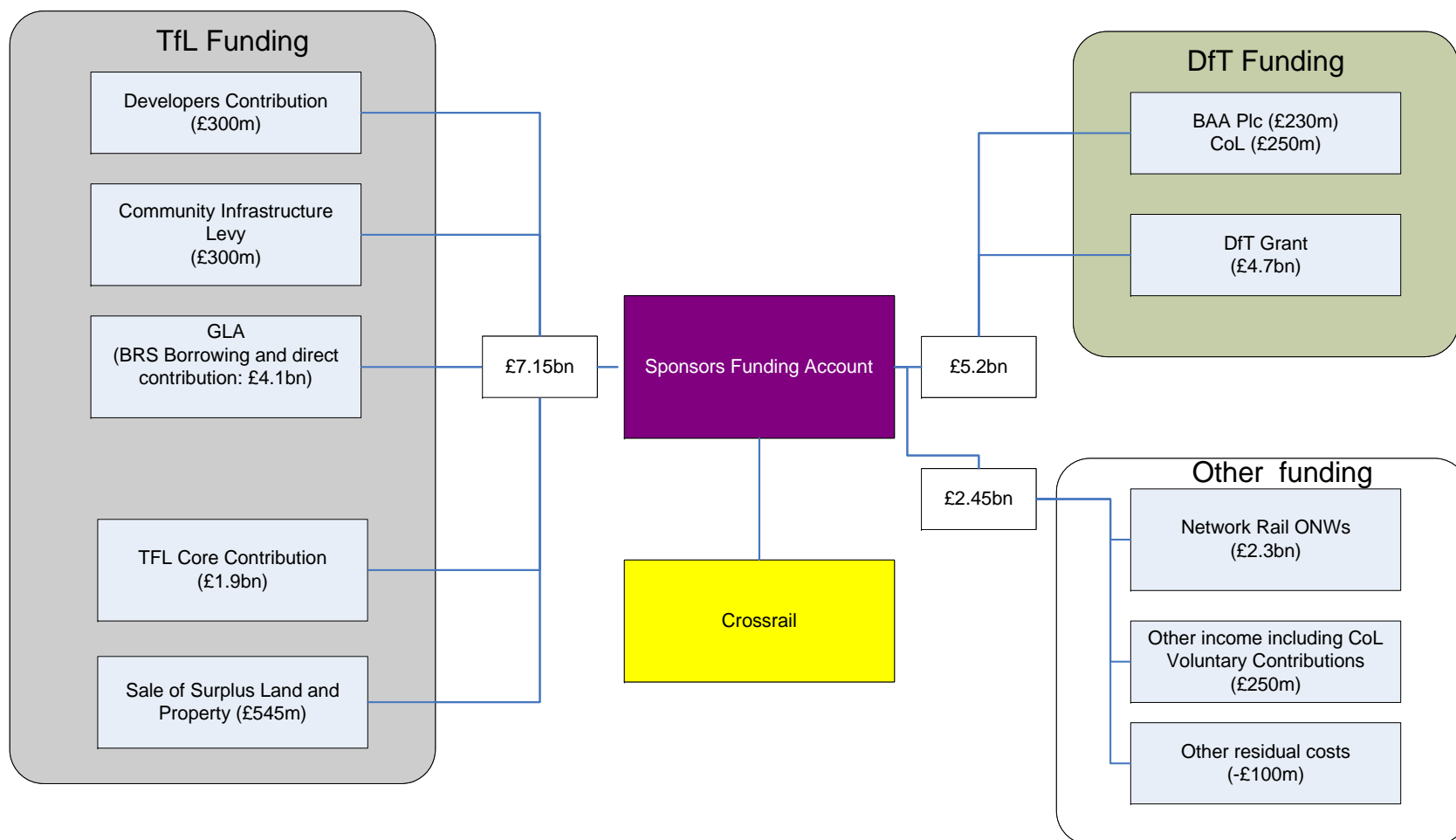
- ▶ £42bn boost to economy
- ▶ Connect Heathrow with the West End, the City and Canary Wharf
- ▶ Support London as a leading world city
- ▶ Generate thousands of jobs



◀ Decreasing journey times

	Current journey time	Crossrail journey time
Slough to Tottenham Court Road	55 minutes	36 minutes
Ilford to Bond Street	35 minutes	22 minutes
Heathrow to Liverpool Street	55 minutes	36 minutes
Liverpool Street to Abbey Wood	40 minutes	22 minutes
Paddington to Canary Wharf	30 minutes	17 minutes

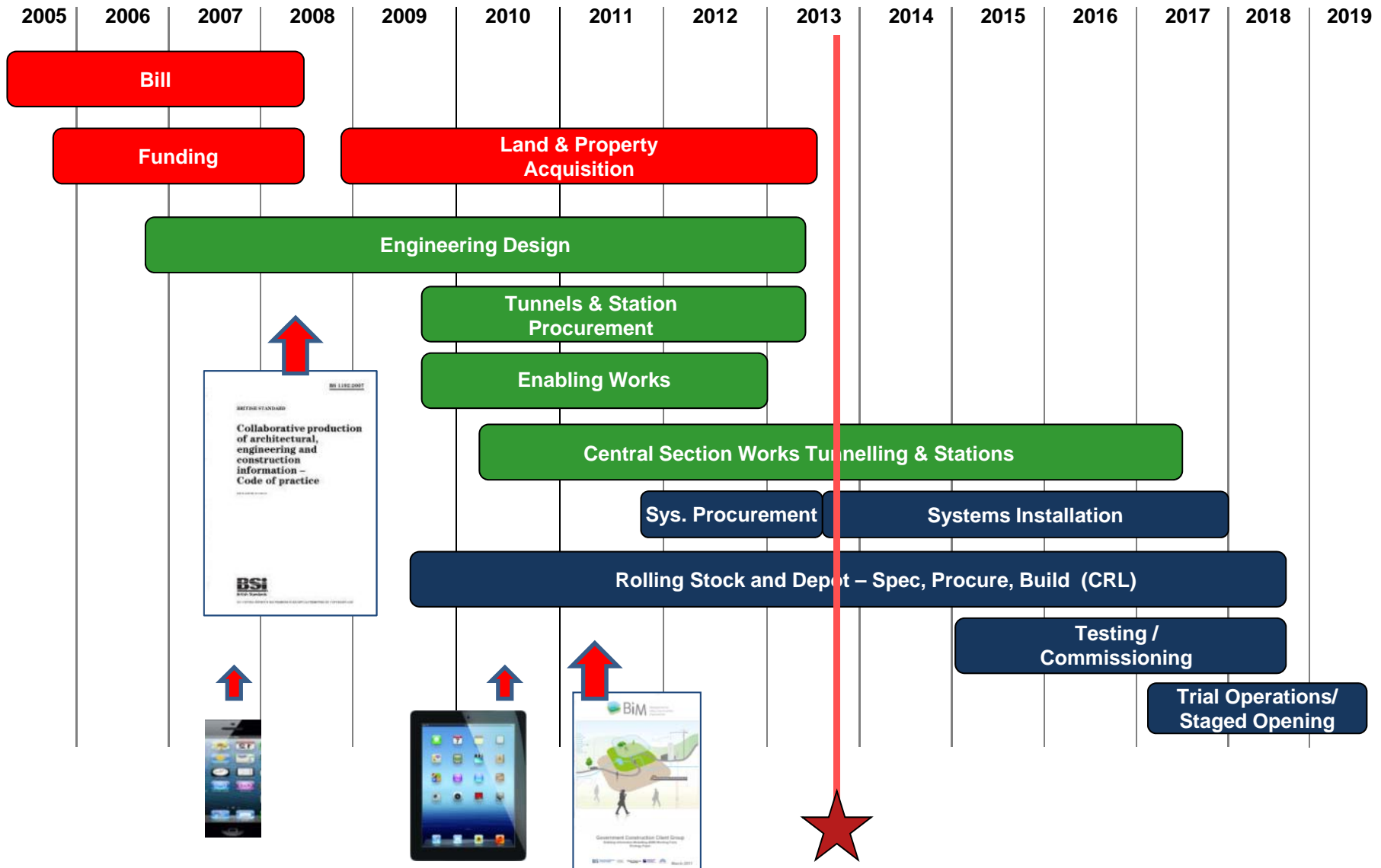
◀ Crossrail Funding - £14.8bn





Programme

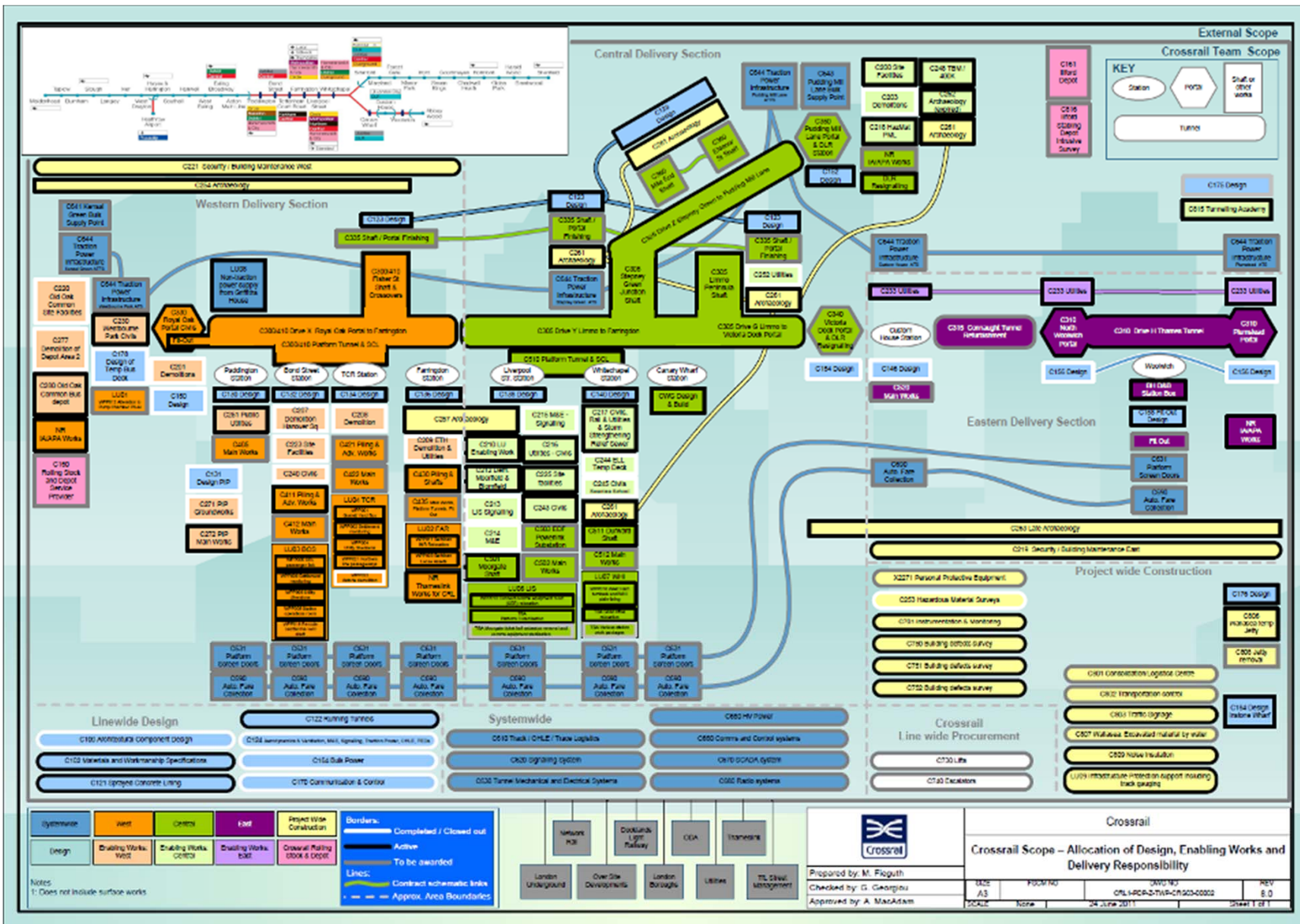
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Contractual Complexity

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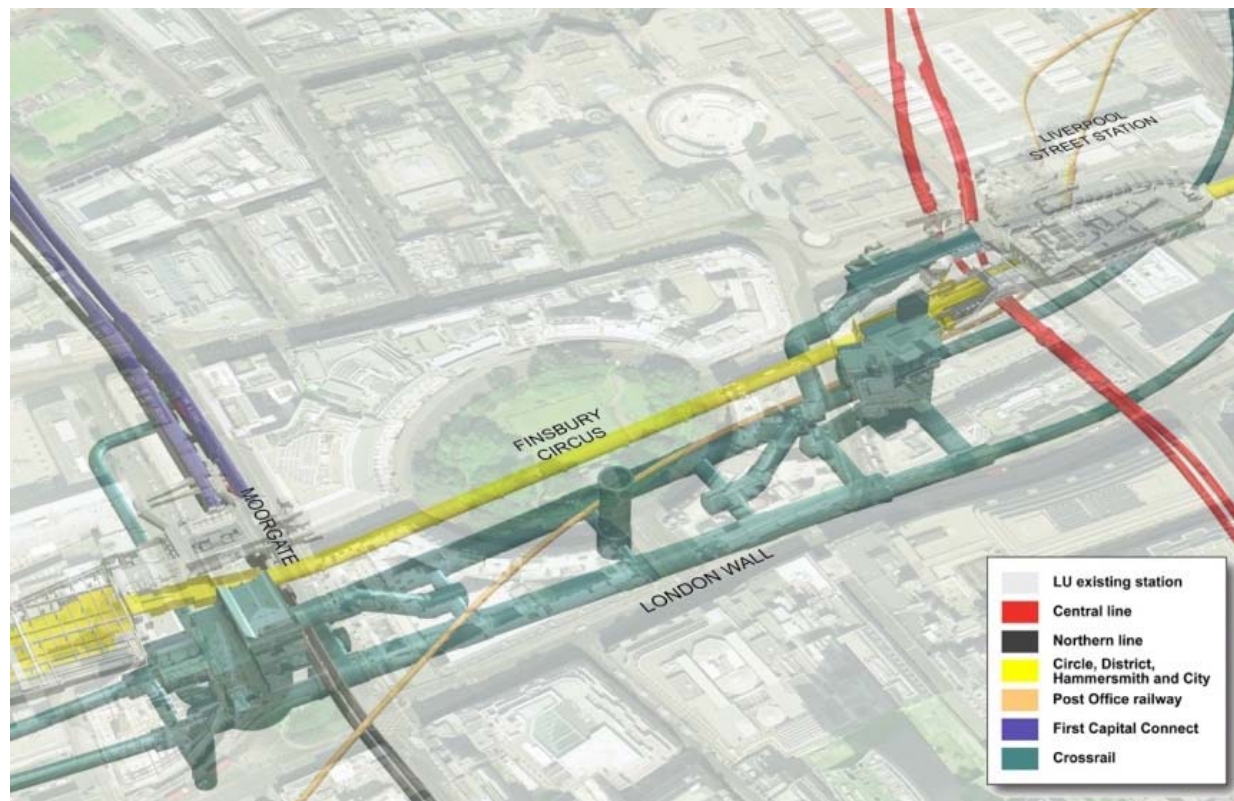


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◀ Crossrail and BIM...

◀ Building Information Modelling:

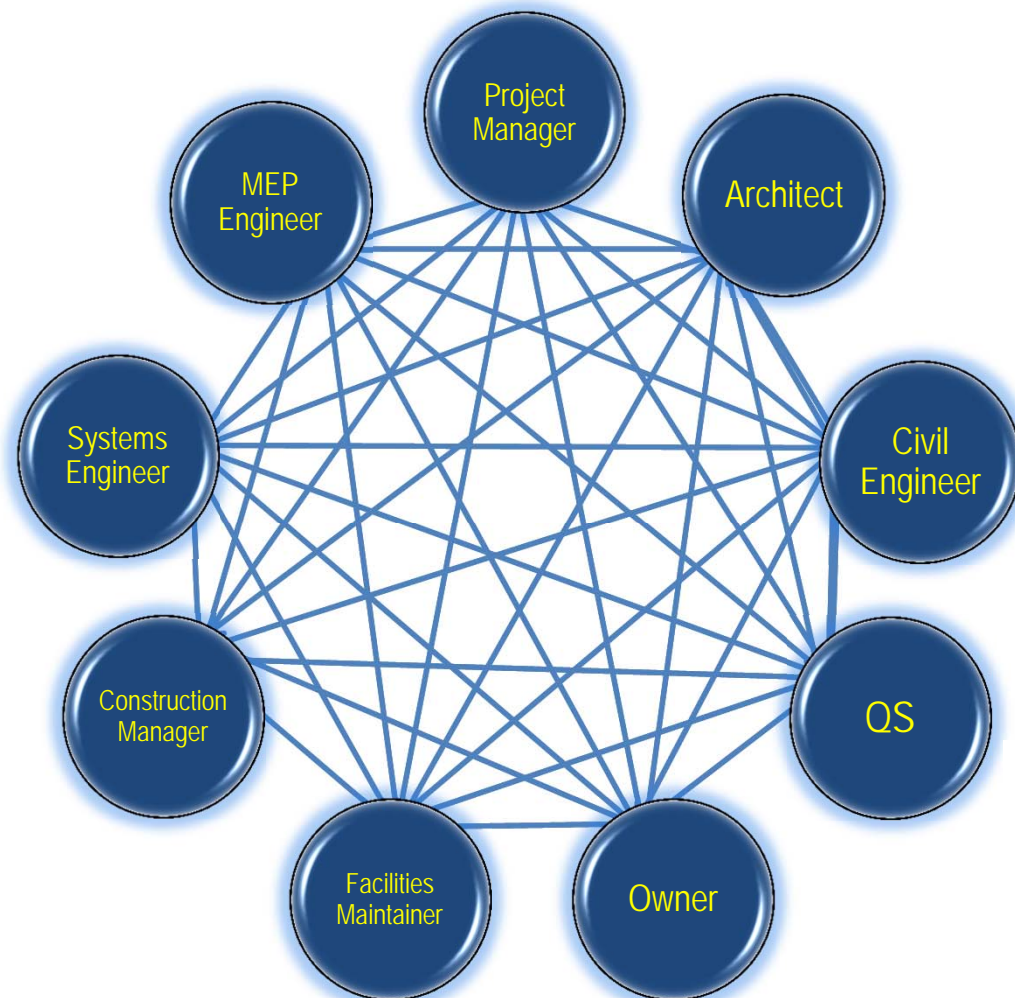
◀ Creating the “virtual” Crossrail





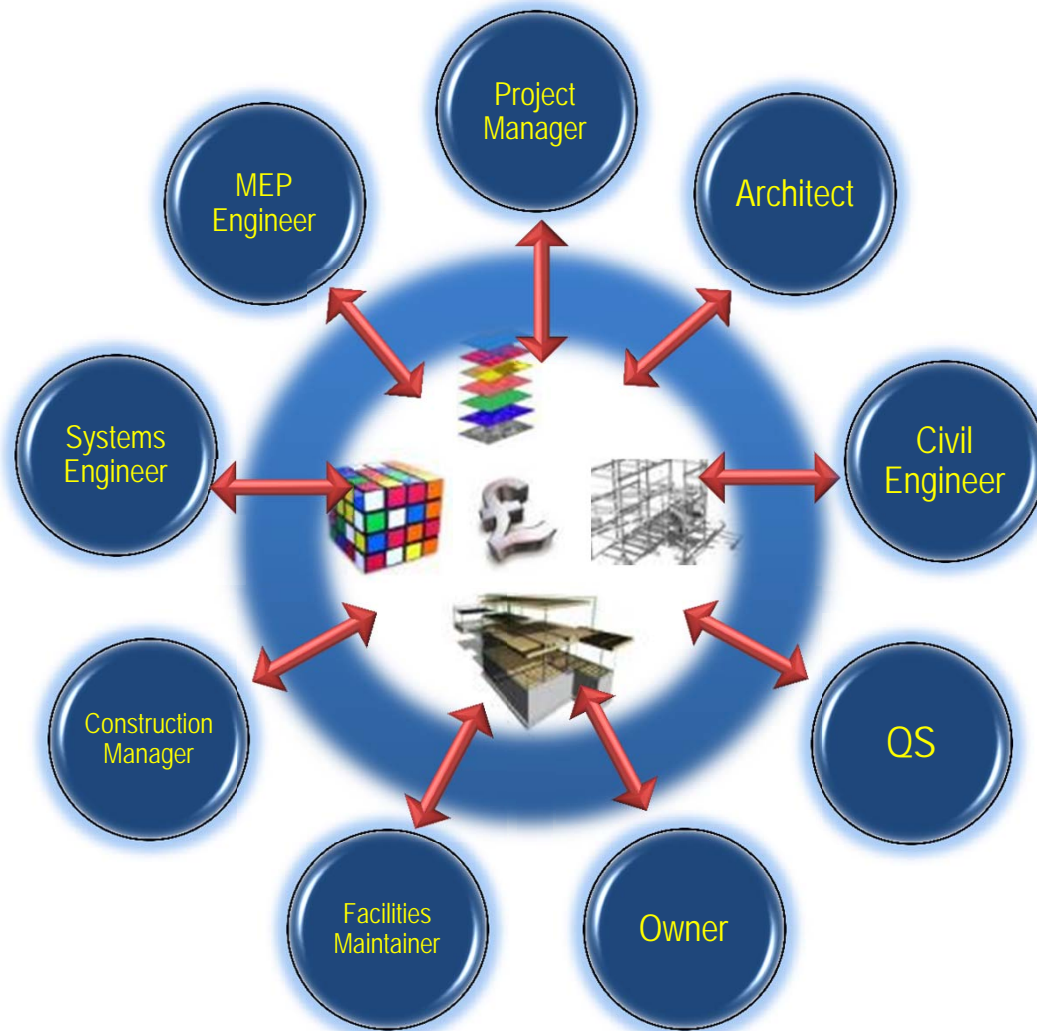
Project Delivery Originally

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**A reminder
of the old
world.....**

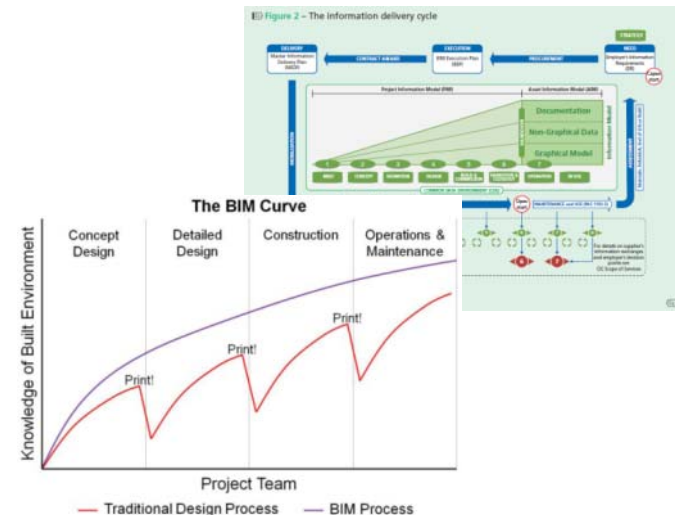
◀ Role of Crossrail – “Enabler” of BIM



Embracing new technologies:

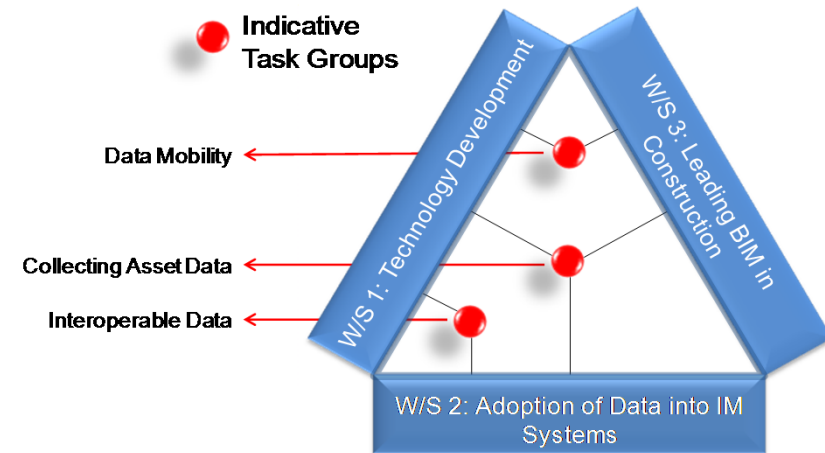
.... the process of generating and managing building information during its life-cycle.

.... model-based technology linked with project information databases.



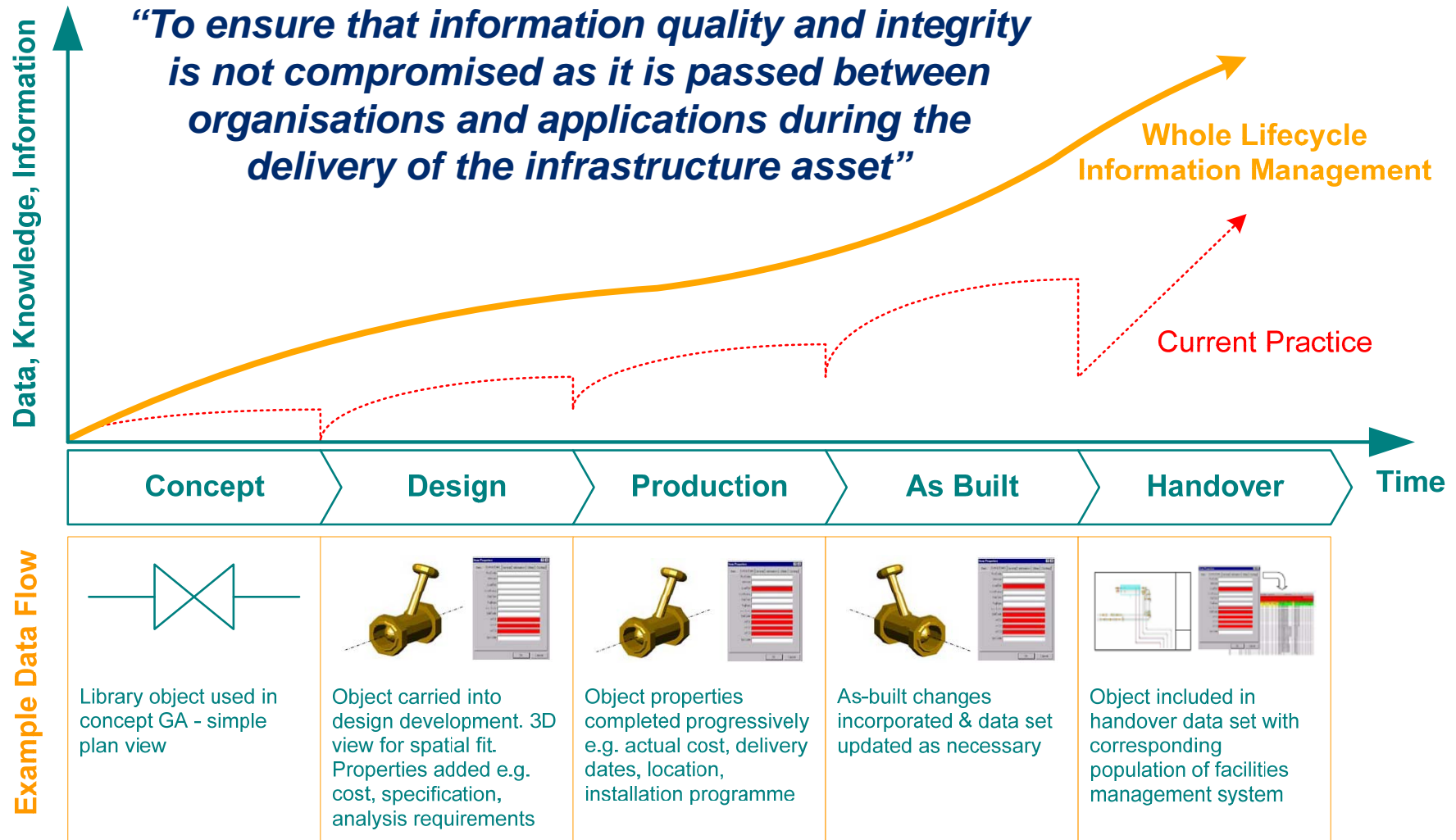
► Reflects

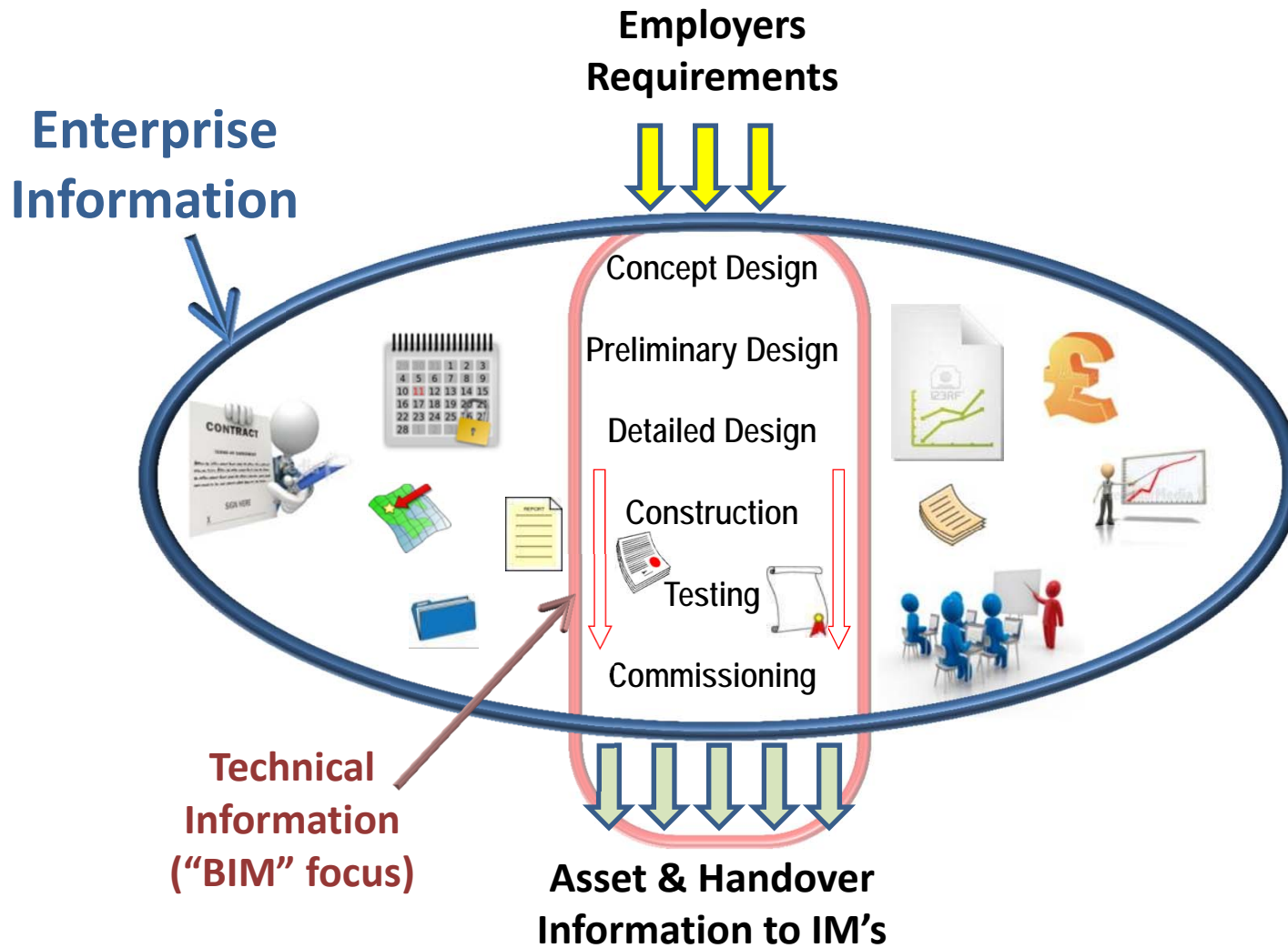
- ◆ The BIM lifecycle status
- ◆ We've been working in a BIM environment for years



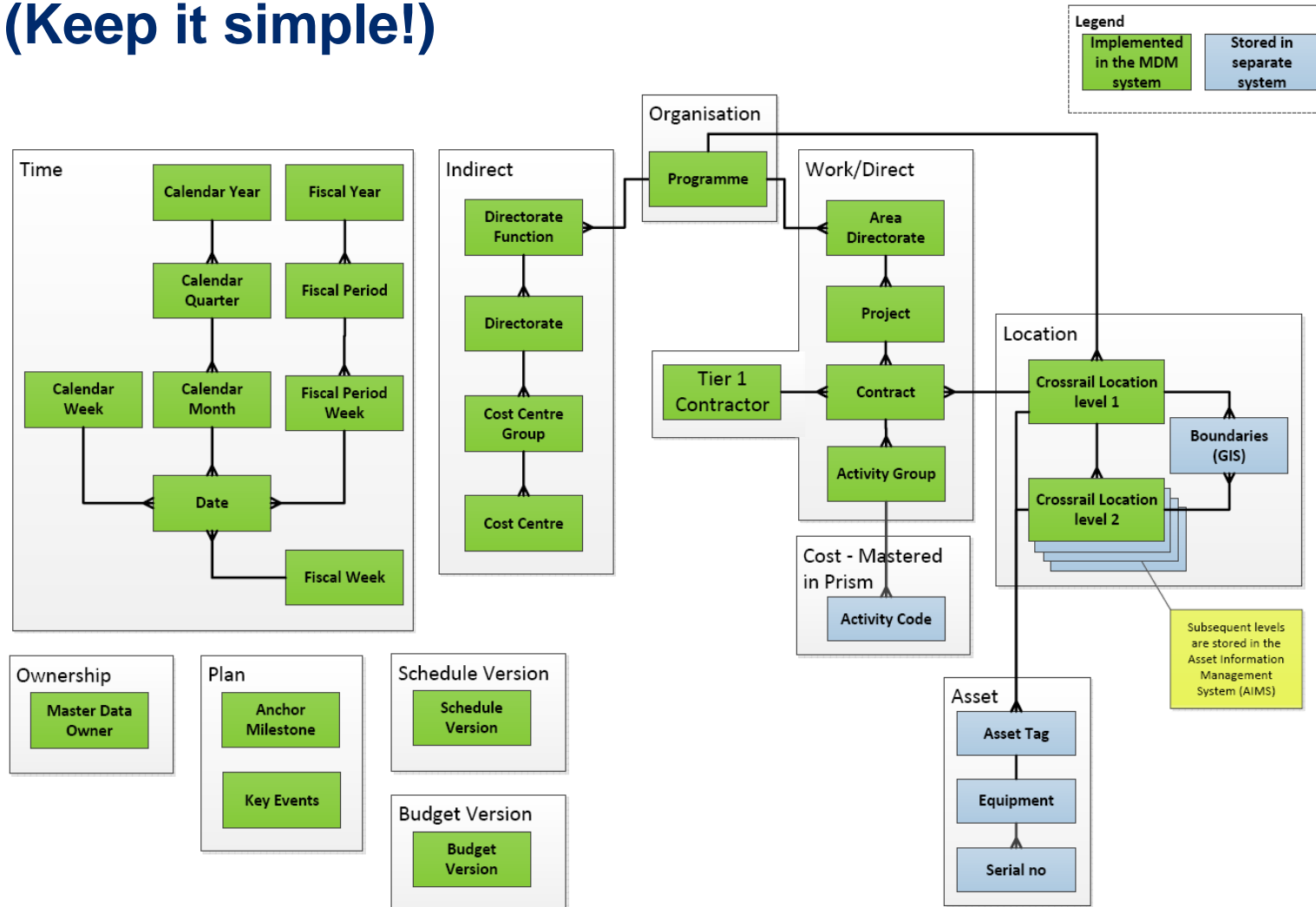
► Comprises 3 elements

Technology Development	Adoption of Data into IM Systems	Leading BIM in Construction
<ul style="list-style-type: none"> <input type="checkbox"/> Technology Partnership with Bentley <input type="checkbox"/> Information Academy <input type="checkbox"/> Industry Expert Panel 	<ul style="list-style-type: none"> <input type="checkbox"/> Vision for TfL asset management <input type="checkbox"/> Harmonisation of LUL/RfL/NR asset classification systems <input type="checkbox"/> Migration strategy 	<ul style="list-style-type: none"> <input type="checkbox"/> Maximising use of data and technology <input type="checkbox"/> Visualisation "Toolbox" <input type="checkbox"/> 4D analyses to mitigate interface risks



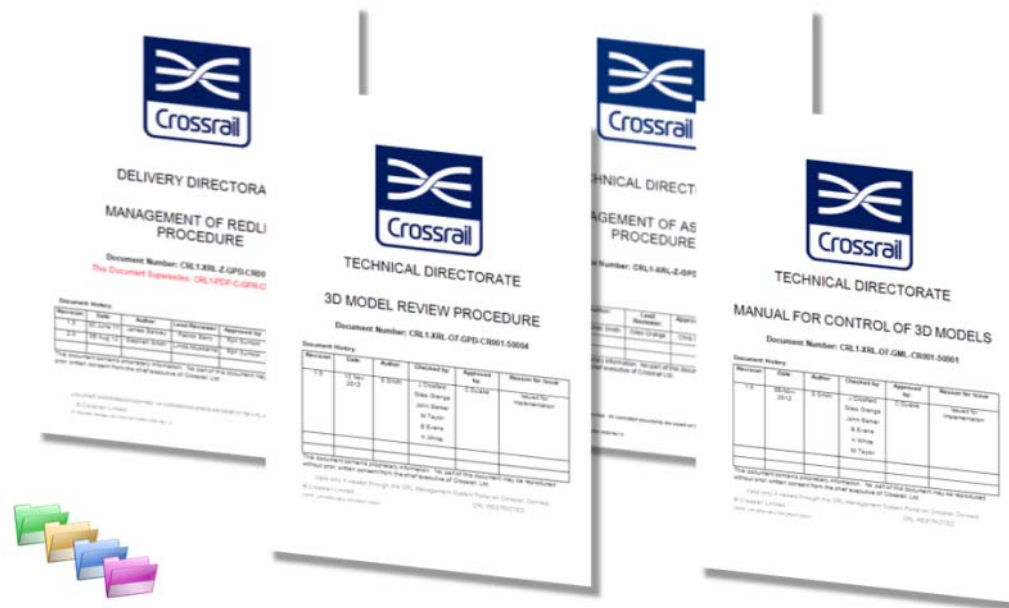


(Keep it simple!)



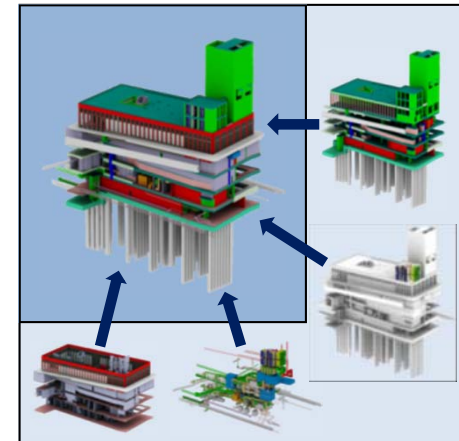
► Specifications and Standards

- ◆ Developed discipline-based 3D Model level-of-development Specifications and Standards – using BS1192
 - ◇ Defines how to collaborate
 - ◇ Defines appropriate levels of detail
 - ◇ Ensures consistency



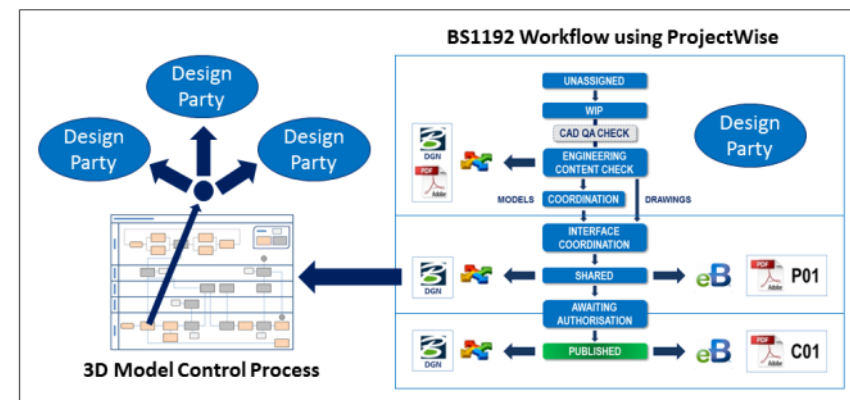
▶ Gate Reviews

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



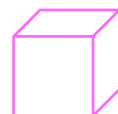
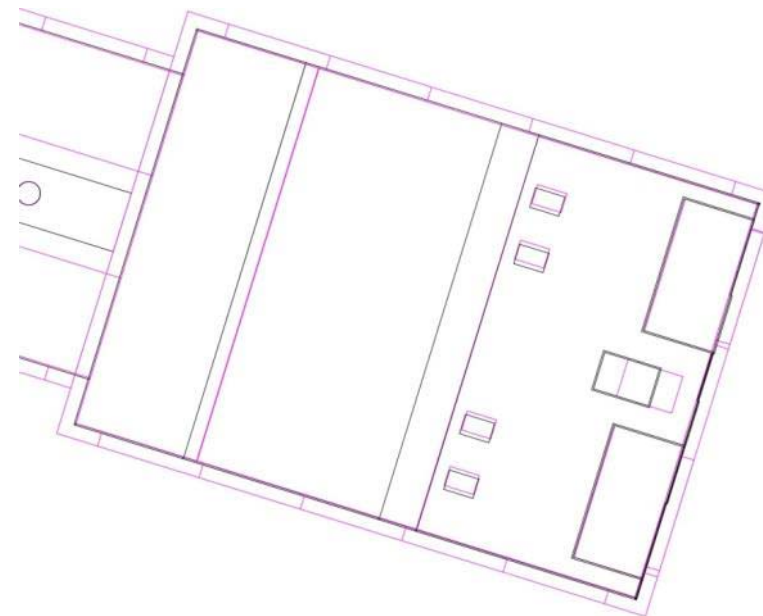
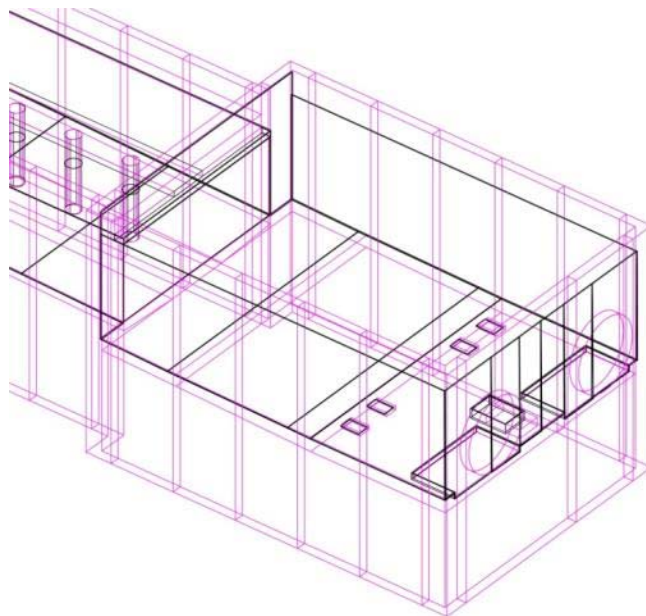
▶ Control Process

- ◆ Introduced a “3D Model Control” process to support and manage 3D models between multiple design parties

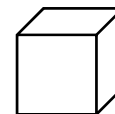


► Laser Scanning

- ◆ Comparing 3D design models to laser scanned data to check and validate the information



3D Design Model



Laser Scan



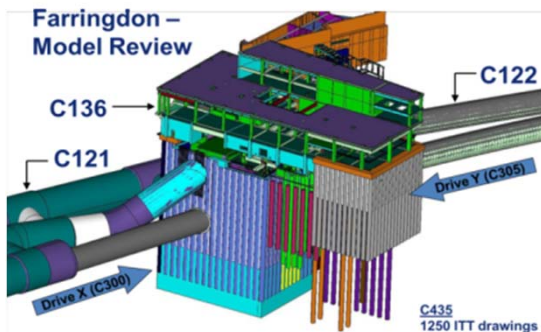
Direct Benefits

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- ▶ **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)

► Cost Savings

- ◆ Finding information – from our “single source of truth”
- ◆ The creation of non-CAD deliverables e.g. reports, lists, mailings, databases
- ◆ The creation of models and drawings



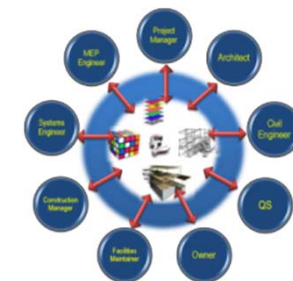
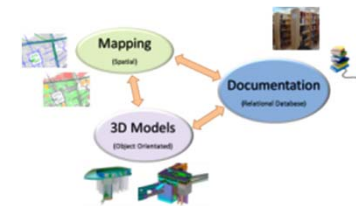
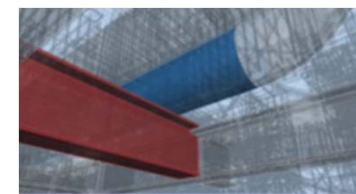
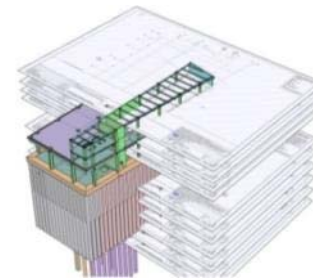
At Farringdon Station

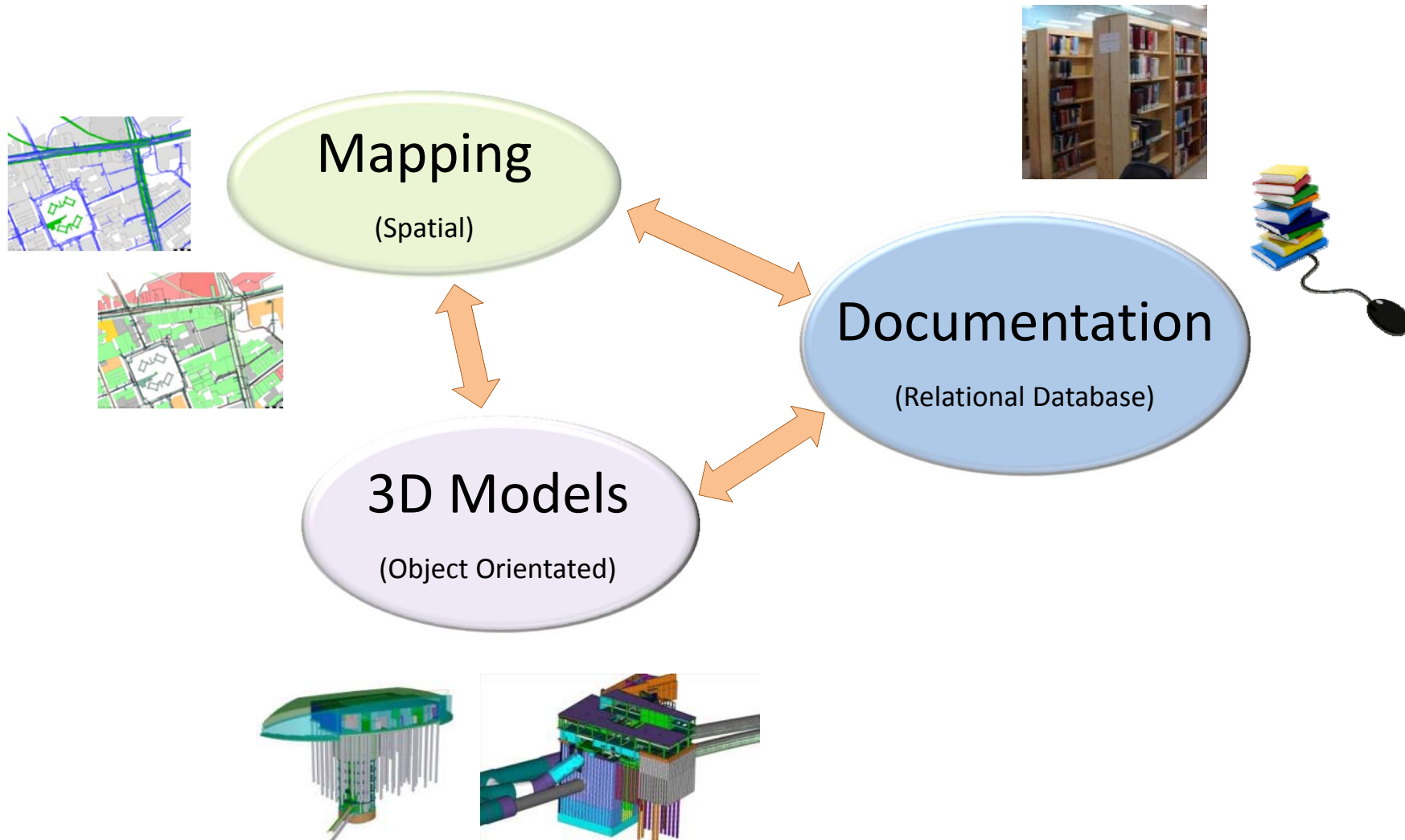
- 3D model linked to the delivery programme
- cost **£120k** but saved over **£8million** from risk . contingency (interfacing complexity)

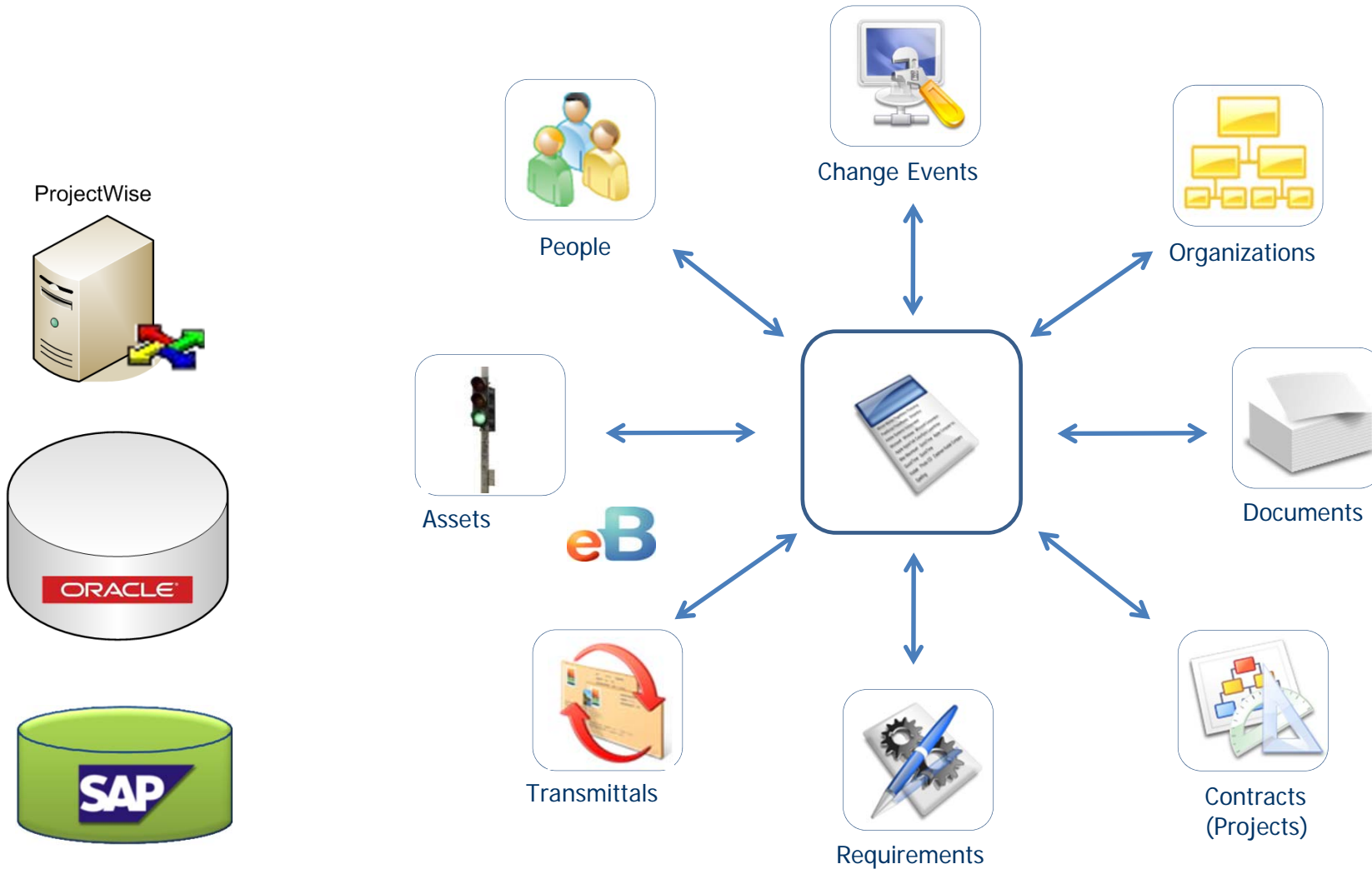
► Non-Financial Benefits

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

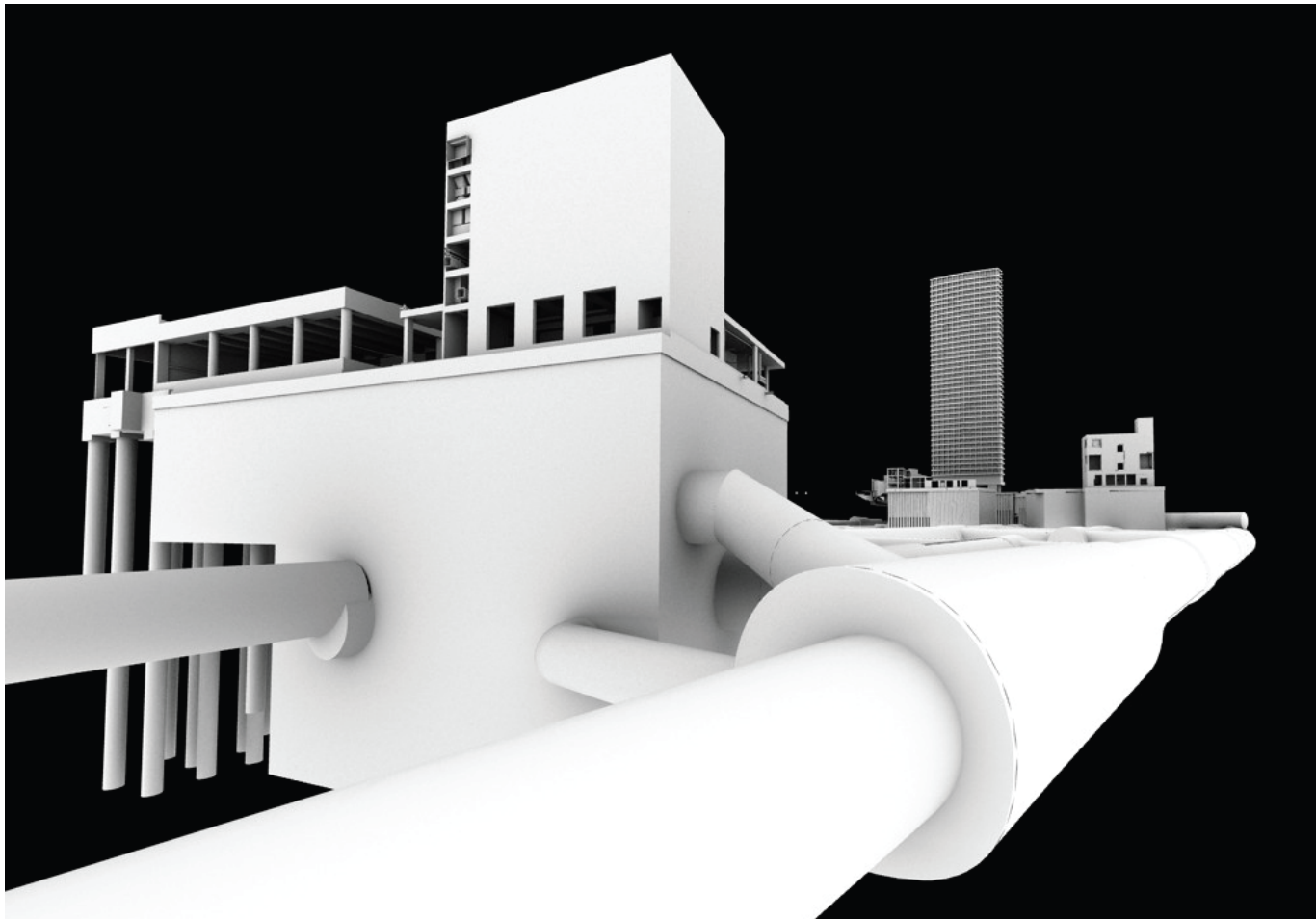






3D Information Models

Tottenham Court Road Station





BIM Making things happen.....

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◀ Station construction is well underway

Bond Street East Ticket Hall



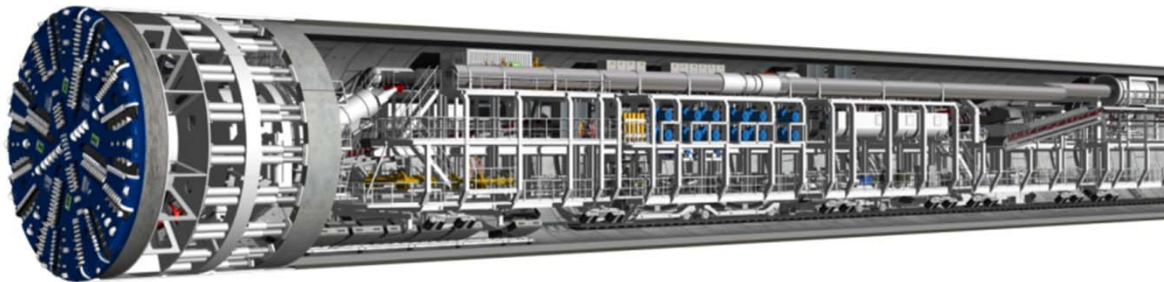
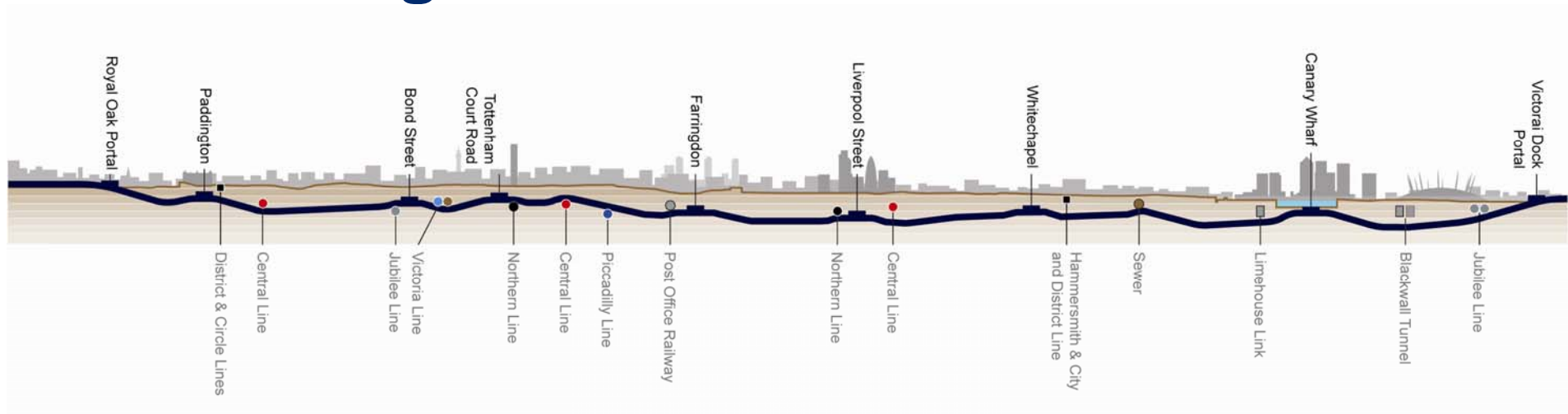
TCR West Ticket Hall



Canary Wharf



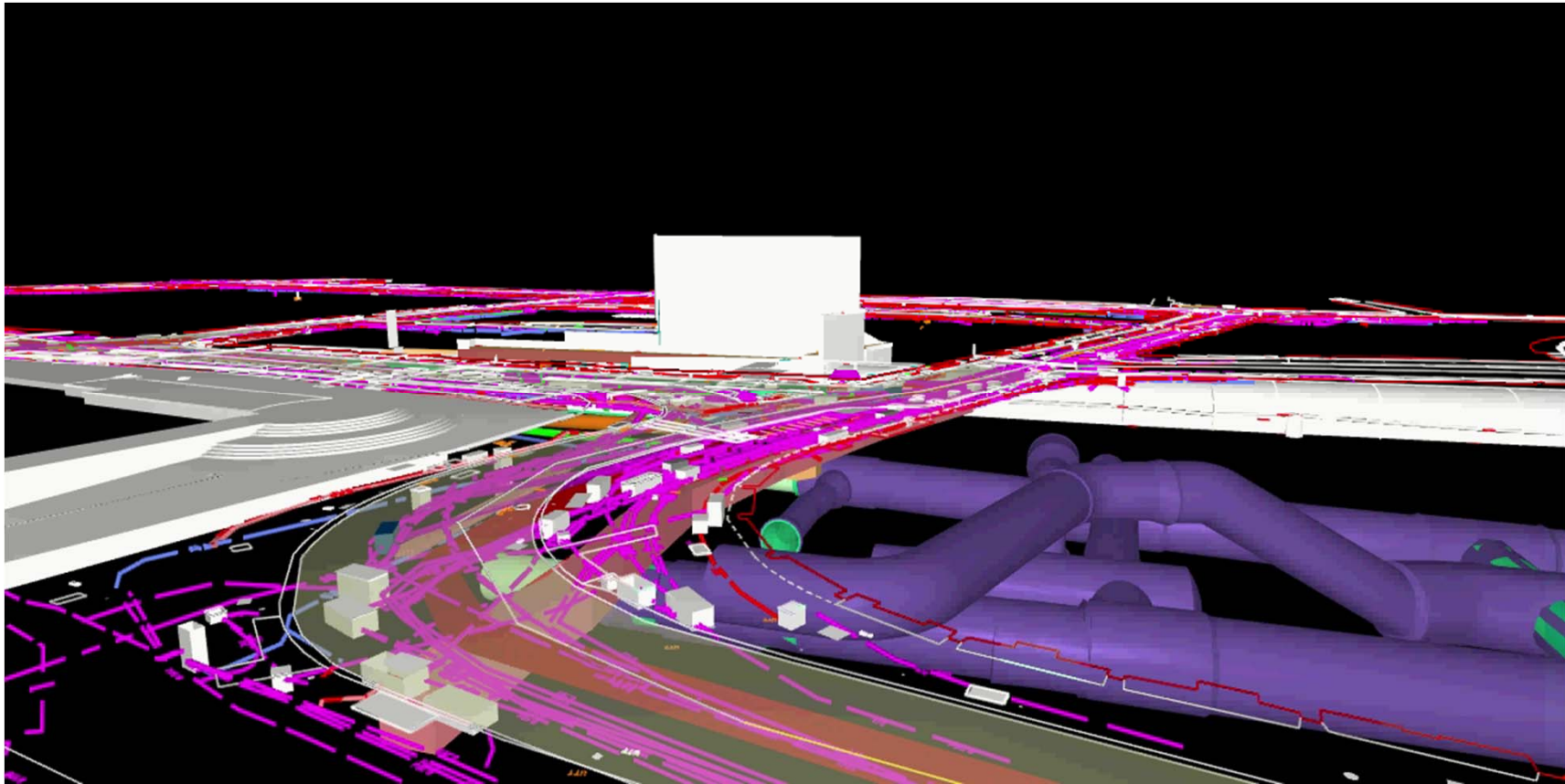
◀ Tunnelling





BIM & Utilities

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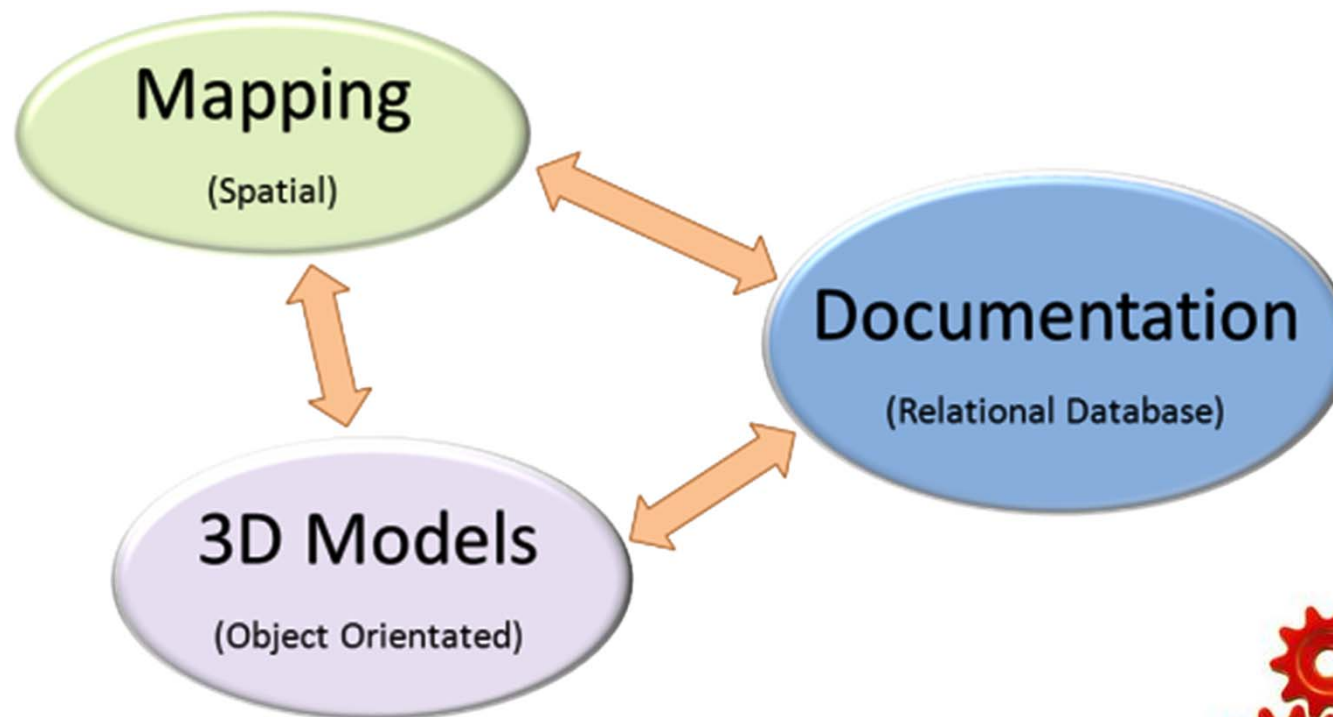


Augmented Reality

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◀ Capturing Asset Information



◀ Asset Data Dictionary

- ▶ Defines the types of assets of interest to Crossrail
- ▶ Asset Data Dictionary Definition Documents (AD4's) define:
 - ◆ Functions and the Classes that relate to them
 - ◆ Classes and the Attributes relevant to them
 - ◆ What an Attribute means e.g. Length



Document Title
Document Number and Rev.

2.1 Example Images





ASSET DATA DICTIONARY DEFINITION DOCUMENT (AD4)
L151 - SHEET PILES

Document Number: XXXX-XXXX-XXX-XXXX-XXXX

Document History:

Revision	Date	Prepared by	Checked by	Authorised by	Reason for Issue	
01	16-02-12	Nick Murray	White	XXXXX	XXXXX	e.g. For Review, Comment B, etc.

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3 Attributes

Generic Attributes plus the following:

Attribute	Units	Description
Length	Metre	The total horizontal length of the sheet piling asset
Height	Metre	The total vertical height of the sheet pile asset (where height varies use average height)
Depth	Metre	The depth below ground level (where Depth varies use average depth)
Weight per metre	Kg	The weight per metre of a single pile
Area	Metre ²	The total area of the sheet piling
Grade of steel	BS 970	Grade of steel used for the pile

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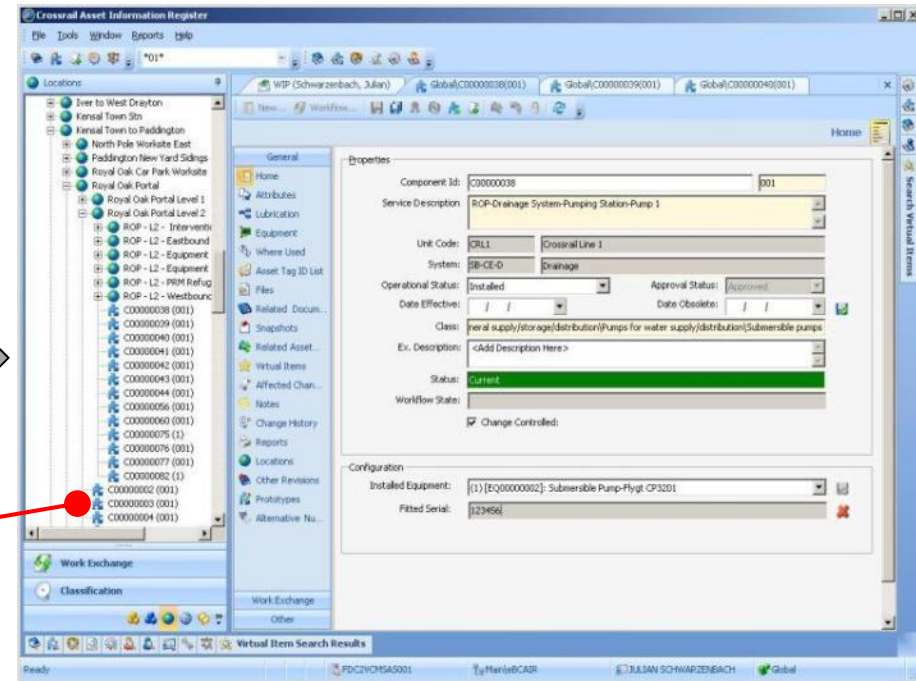
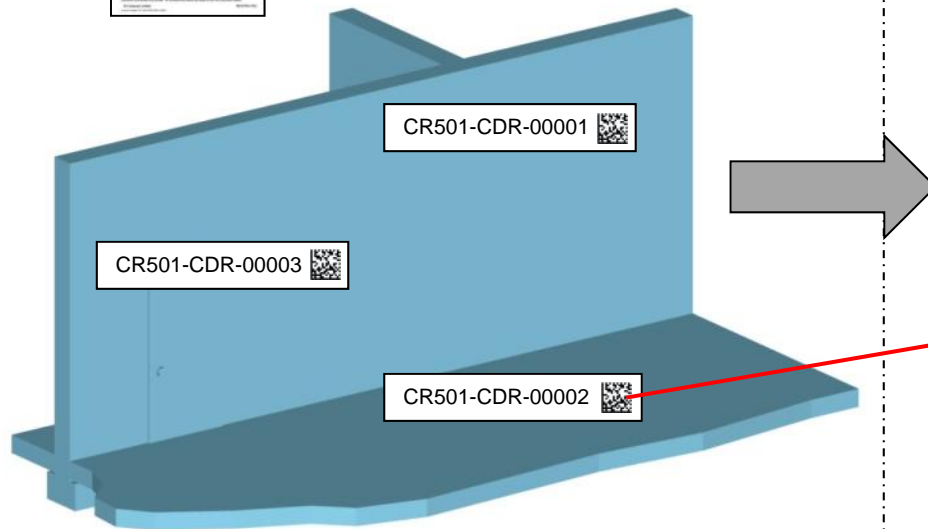
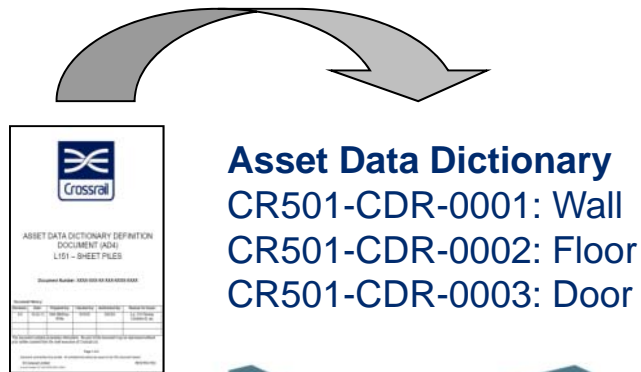


Asset Model

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Asset Model

Asset Database

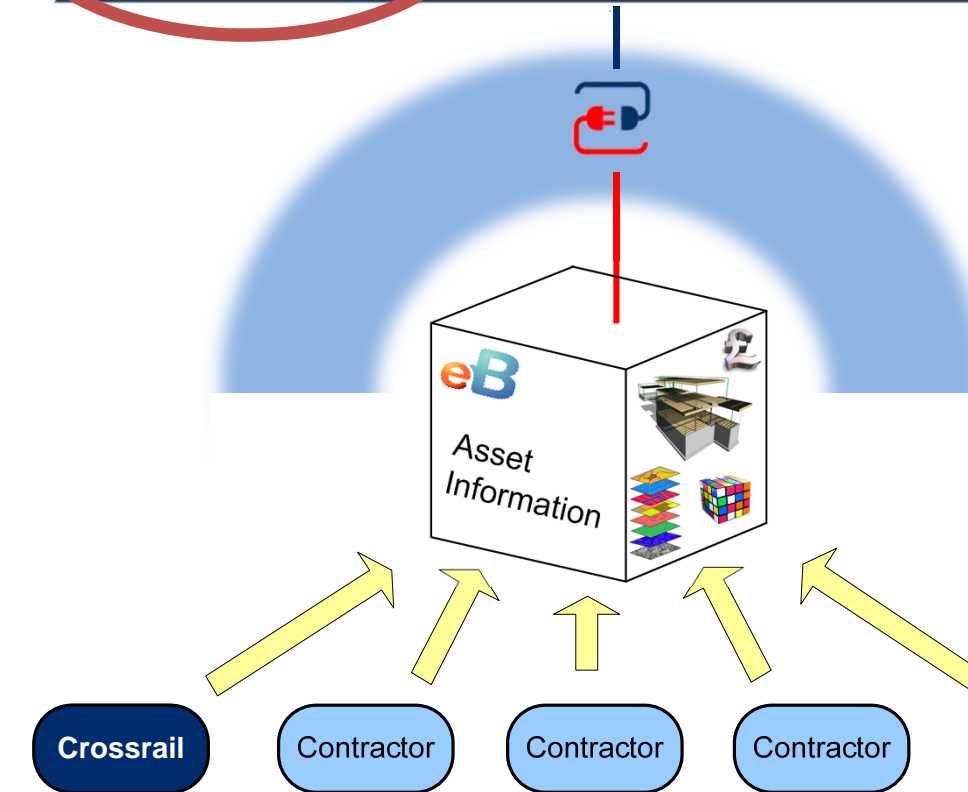


Using "As-constructed" data

Third Party
Asset Management Systems

Crossrail Asset Datastore

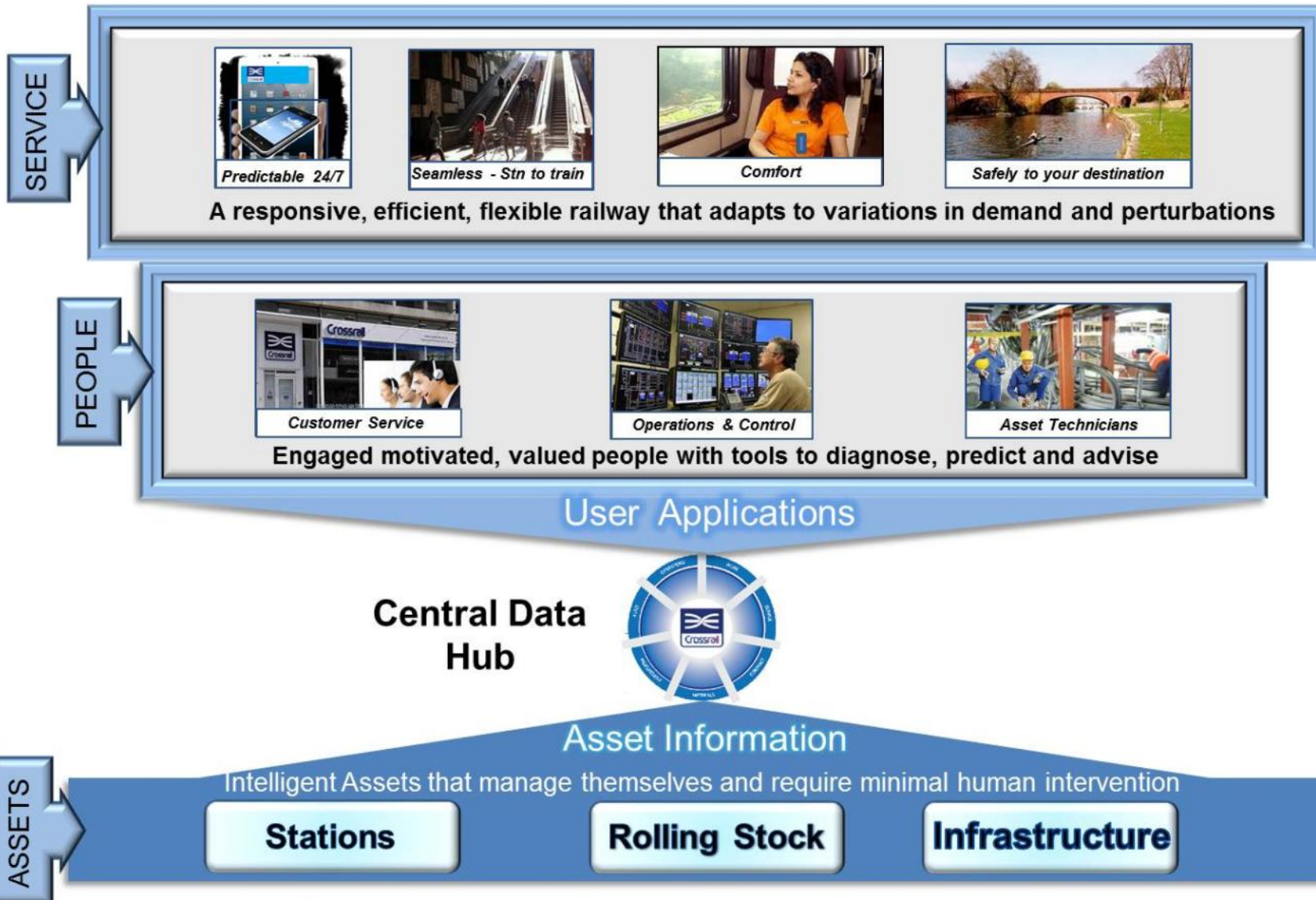
Data Sources





Crossrail BIM Vision

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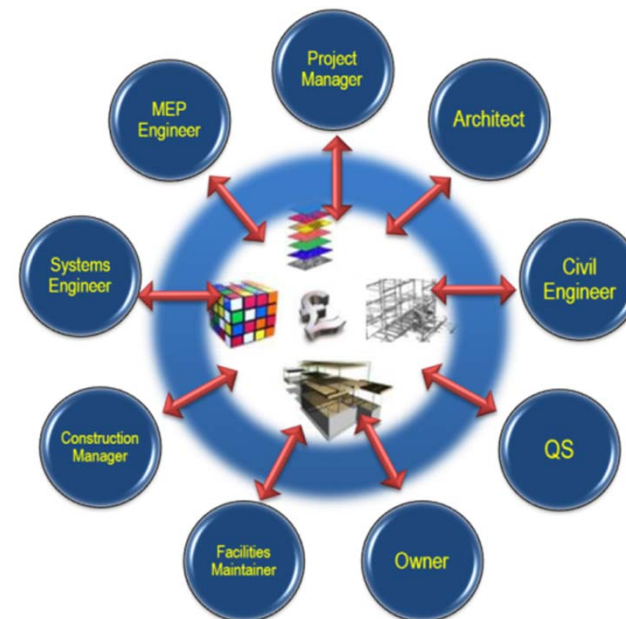


Interactive Data

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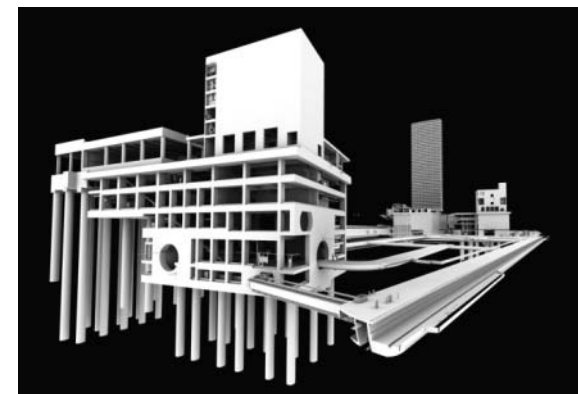
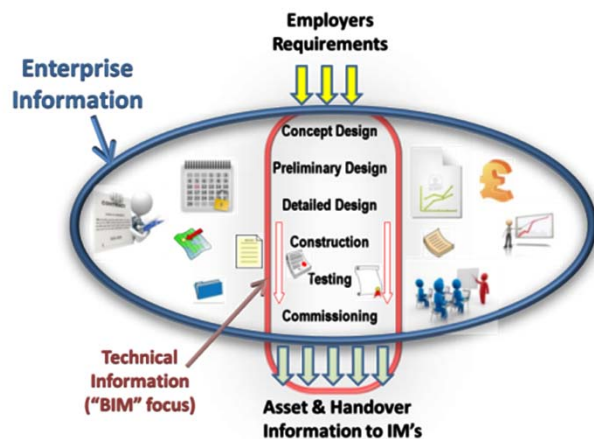
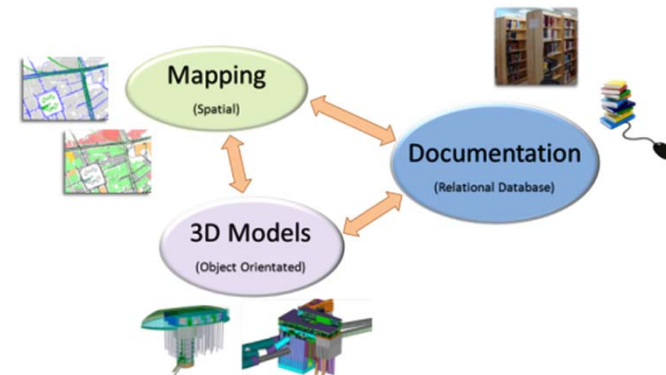


◀ And to Conclude.....

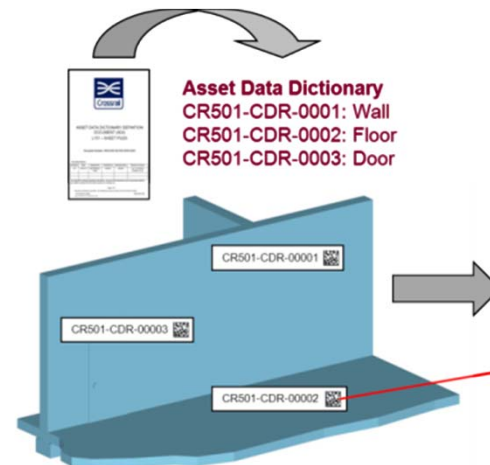
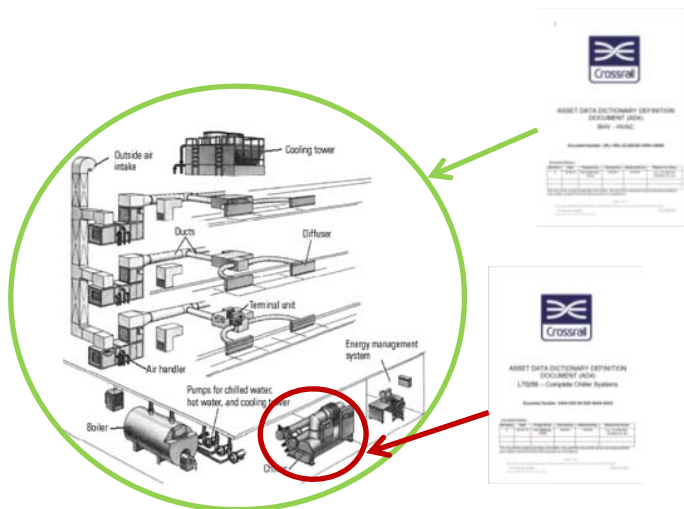
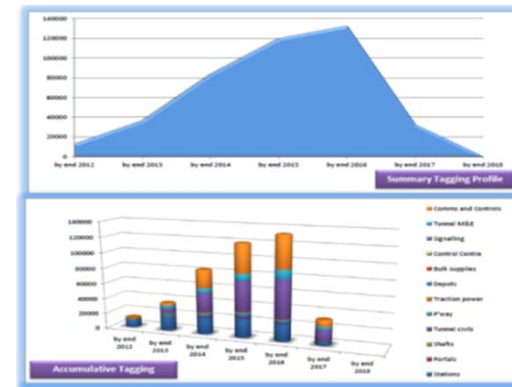
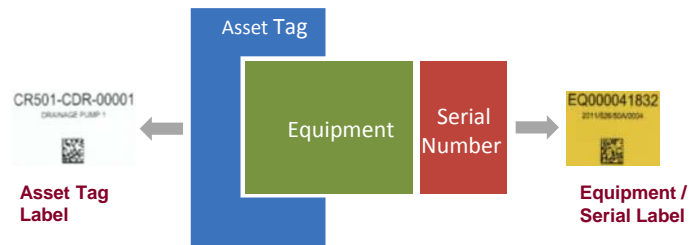


◀ Seen what BIM currently looks like

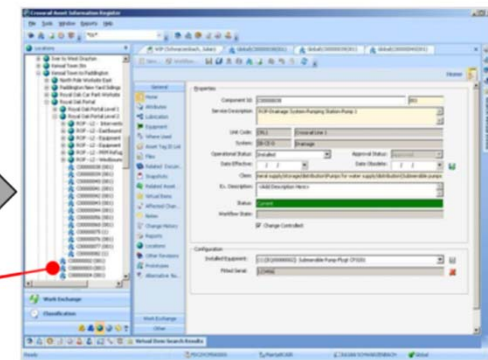
- ▶ Creating a virtual world as well as a physical one
- ▶ Embracing new technology
- ▶ Demonstrating efficiencies



◀ Capturing Asset Information



Asset Data Dictionary
CR501-CDR-0001: Wall
CR501-CDR-0002: Floor
CR501-CDR-0003: Door





Conclusion

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£14,800,000,000	Cost
1,275,000	CAD Model files – so far!
830,000	e-Documents stored – so far!
650,000	Assets to be tagged
8,250	Individual Document users – so far!
650	Individual CAD users – so far!
61	Main Construction Contracts
25	Main Design Contracts
8	Main Central Interchanges
2	Future Infrastructure Maintainers
1	Crossrail

It would all be much harder without BIM!

◀ *Thank you!*





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