

# Expanding Alliances Facing the challenges ahead



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AECOM Global BIM/IM Consultancy Director  
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Chair SFT BIM Working Group

FICE, FCIQB, FRICS, FInstCES

*BIM for Local  
Highway  
Authorities*



**CabinetOffice** **BIS** | Department for  
Business Innovation & Skills

# BIM vs Digital Engineering

**BIM:**  
**Information Management**



**Digital Engineering:**  
**Information Management**



*“BIM in its various guises is becoming a metaphor for industry change – it is helping set a compelling vision of what a digitised sector would look like using computer-readable data”*



# Key Drivers For BIM Adoption

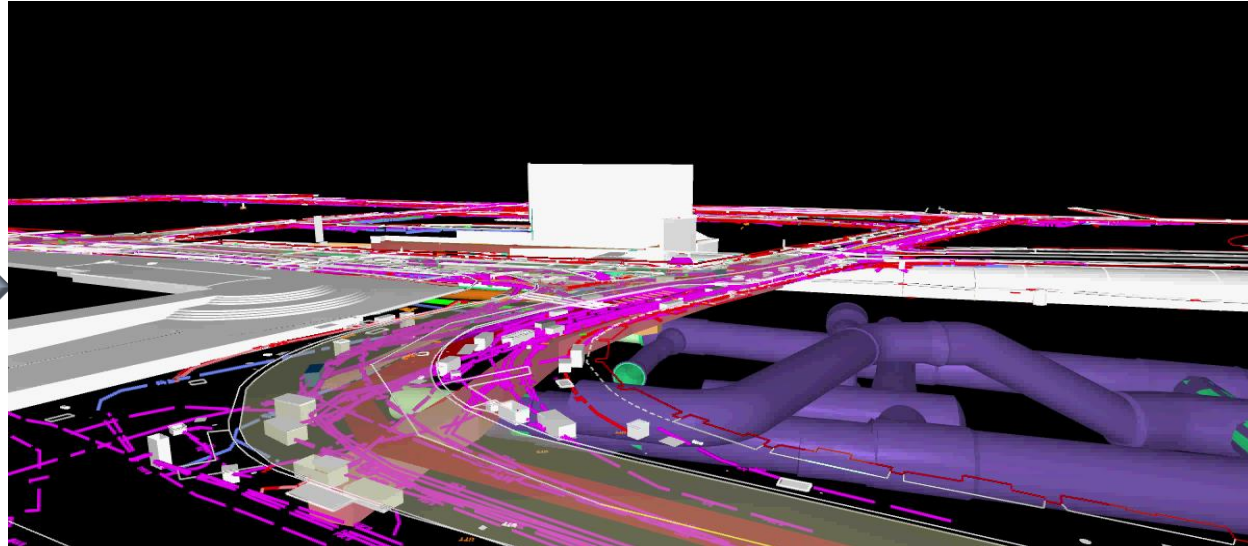
- To ensure that data is bought only once and that these needs are clearly and consistently defined in the contract documents as early as possible
- Availability of validated useful information to improve the efficiency
- Better user engagement – clear, easier understanding through data rich environment
- Elimination of waste from the design, construction and commissioning process
- Use 3D models to inform and optimise the Highways planning process
- Improve operational excellence through well informed decision making
- Encourage collaborative working including early engagement of FM and Operation
- Visualisation & Lifecycle solution testing & preconstruction stage
- Accurate and complete data improving quality of bids, reducing risk allowances in target prices and lump sum bids
- 3D model input into the assessment of the impact changes at all stages in a project lifecycle
- Input of a populated asset data set into Computer Assisted Facilities Management (CAFM) systems – saving time and avoid duplication



# Virtual Asset Lifecycle Modelling:

Allows the virtual production, analysis, evaluation and optimal development of a highway in a digital environment that mimics the understanding and behaviour of the solution to the realization of that solution in reality.

Digital Briefing  
& Digital  
Procurement



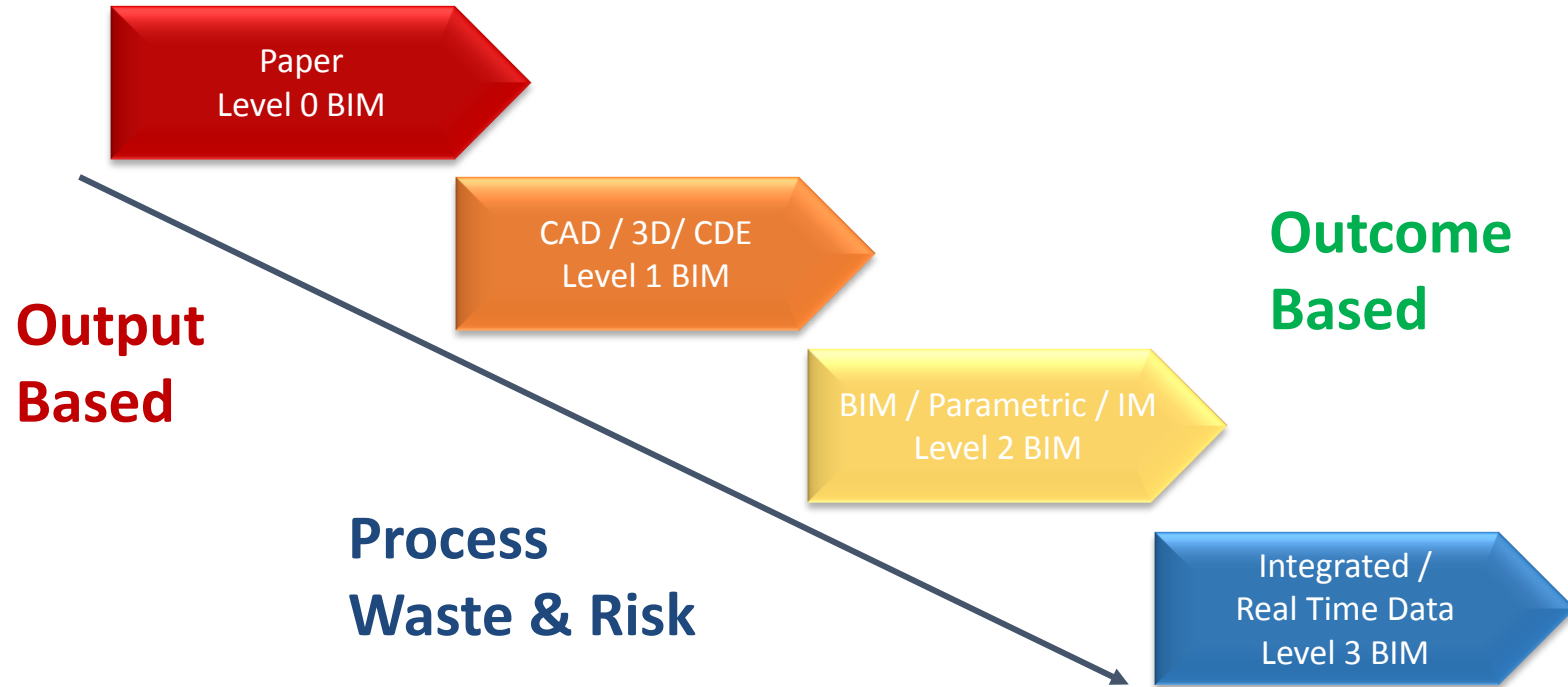
Optimised  
Operation

**Build Better Before Built & Operated**

**AECOM**

# Building Two Highways

## Construction Transition



## Physical



## Digital

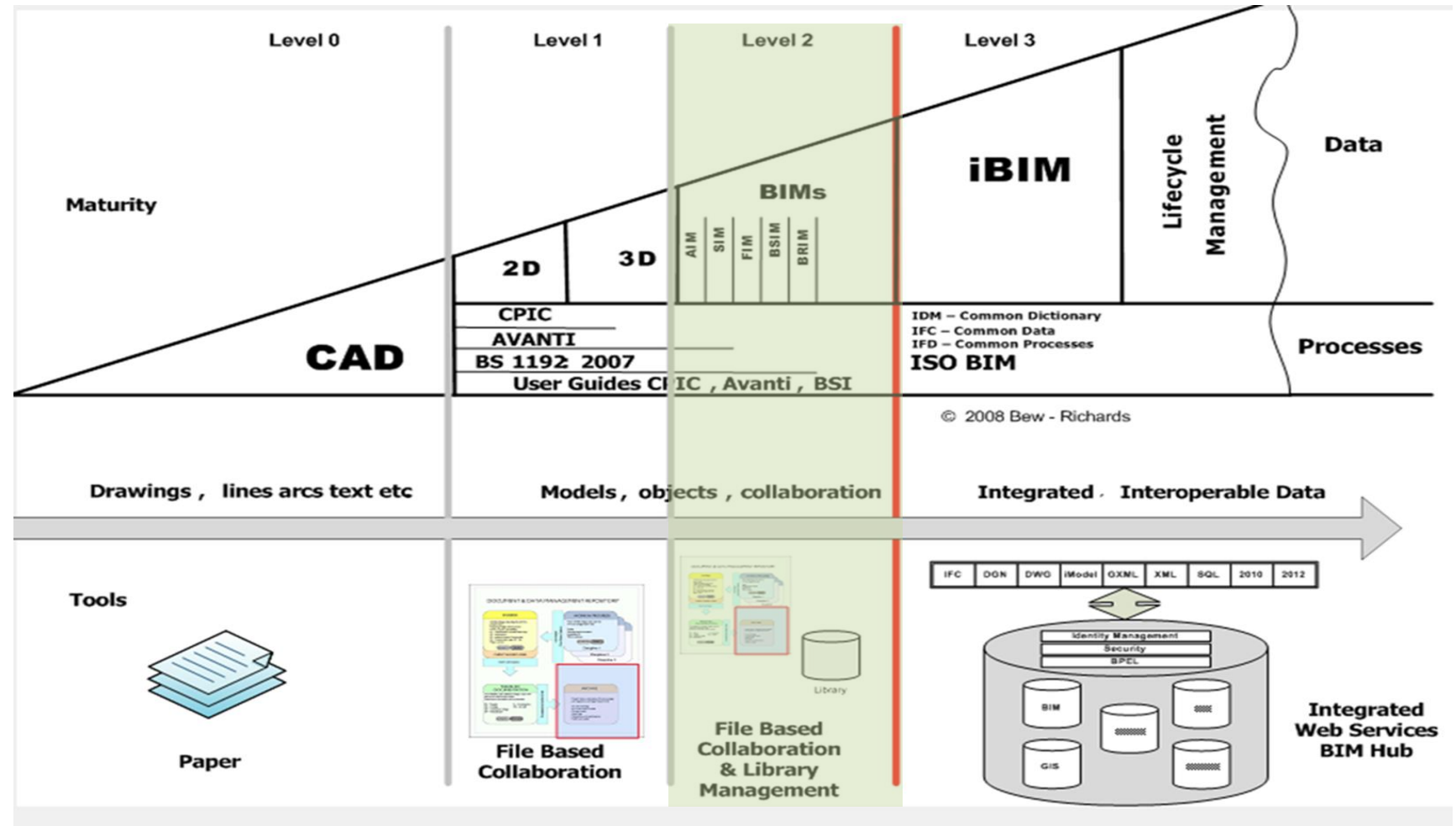
## Analogue

## Digitised



# Level 2 BIM: a minimum standard

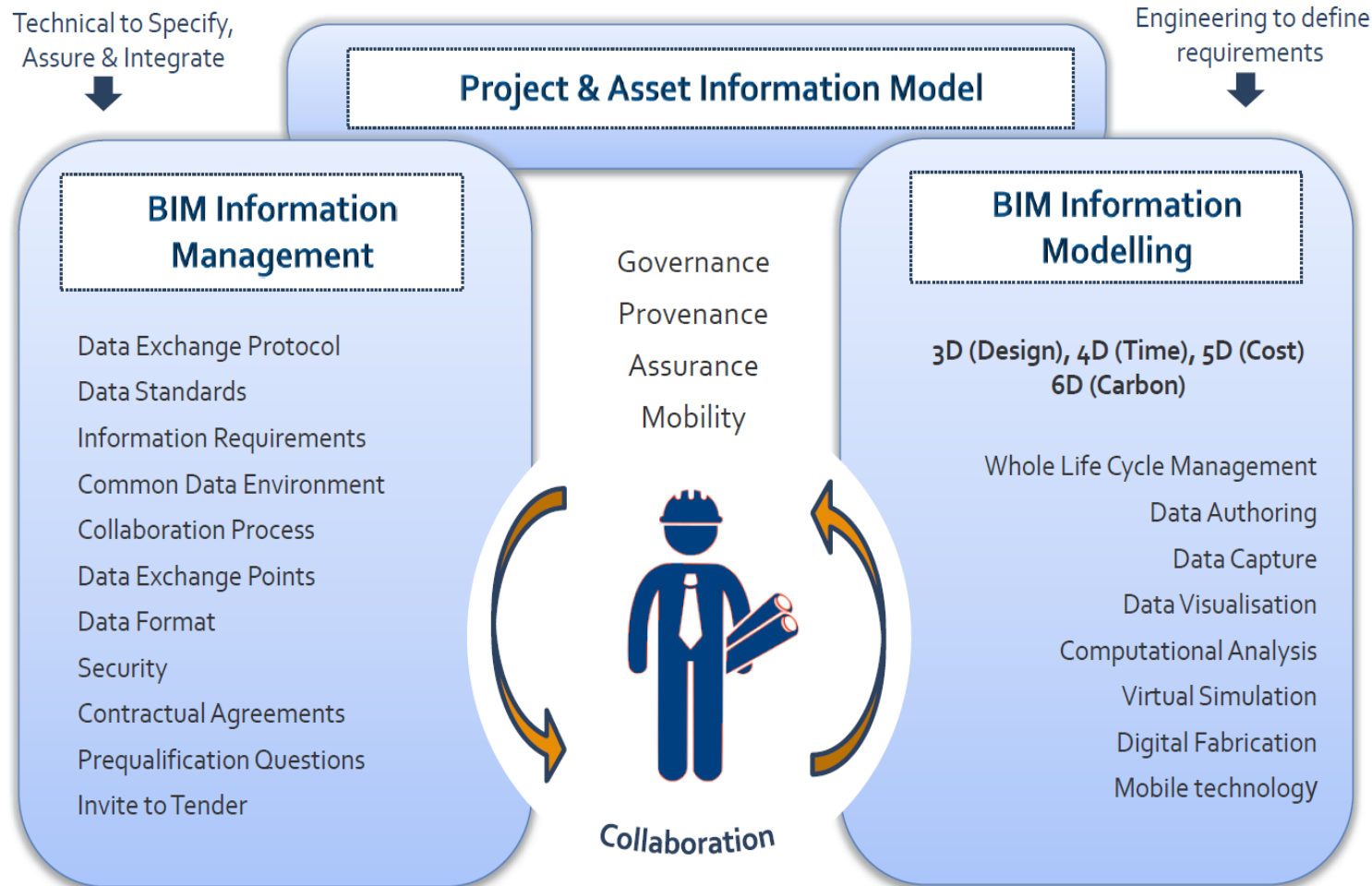
- **Level 0** - Unmanaged CAD typically 2D, with paper (or 'electronic ink') exchanged between participants.
- **Level 1** - Managed CAD in 2D or 3D using BS 1192:2007 with a common data environment, but standalone commercial data management
- **Level 2** - Managed 3D environment using separate discipline "BIM" tools with attached data and integrating commercial data
- **Level 3** - iBIM or integrated BIM potentially accessing all available data forms, adding value in operation and supported by open standards.



# What does BIM mean for HS2?

'Information is the building blocks of our Future'

**AECOM**



# OPPORTUNITY

Realise real value from our digital assets

**"BIM is our lifeblood ... our central nervous system"**

Prof. Andrew McNaughton, Technical Director, HS2

**Inception | Design | Build | Operation & Maintenance | Decommission**

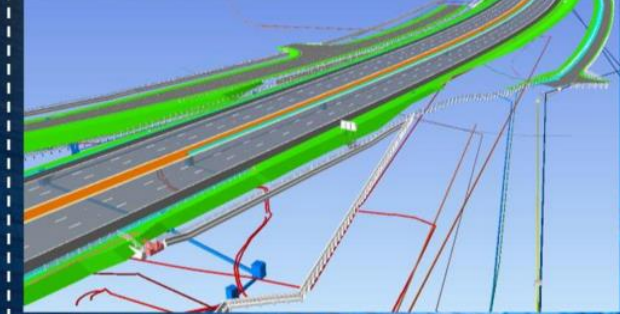
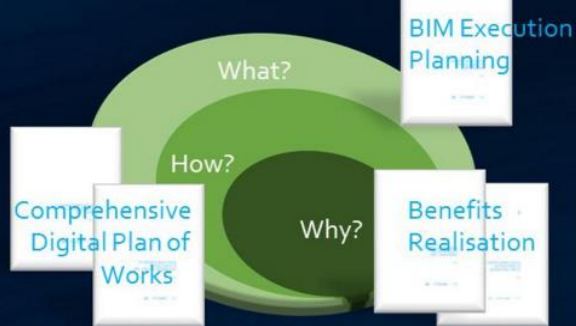
**BIM**



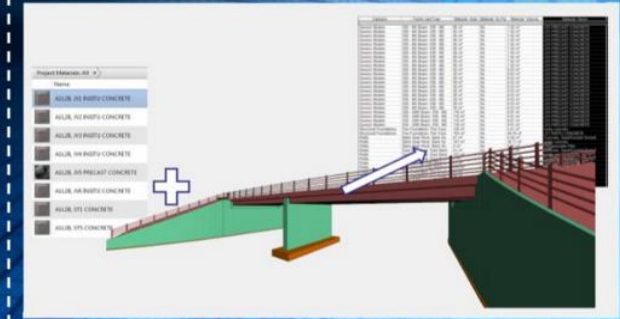
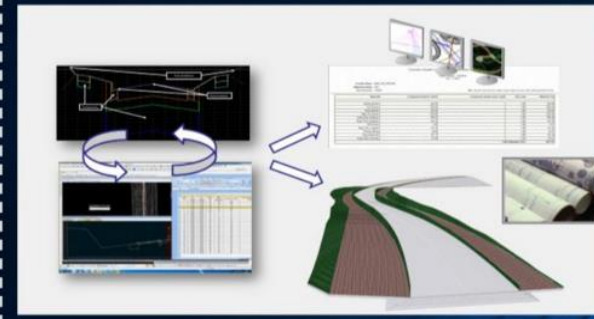
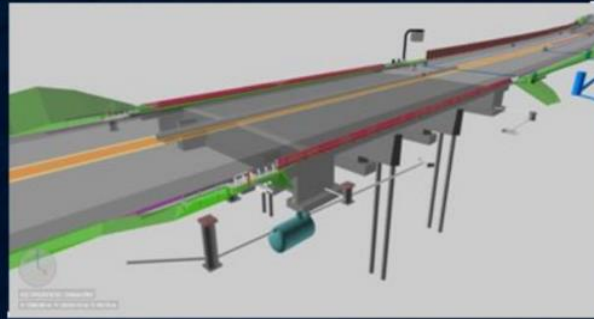
# Pioneering BIM for Roads

LIFE CYCLE APPROACH | EXISTING CONDITIONS | PARAMETRIC DESIGN | DIGITAL CONSTRUCTION | ASSET PERFORMANCE

Early Process Criteria

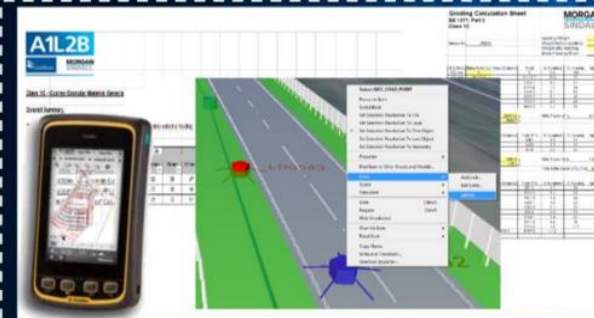
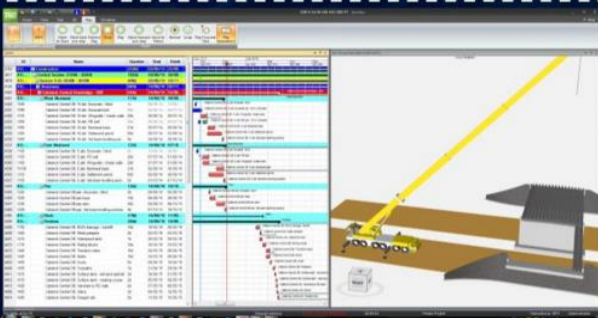


Existing Conditions



Proposed Above and Below Works

Embracing Parametric Driven Design

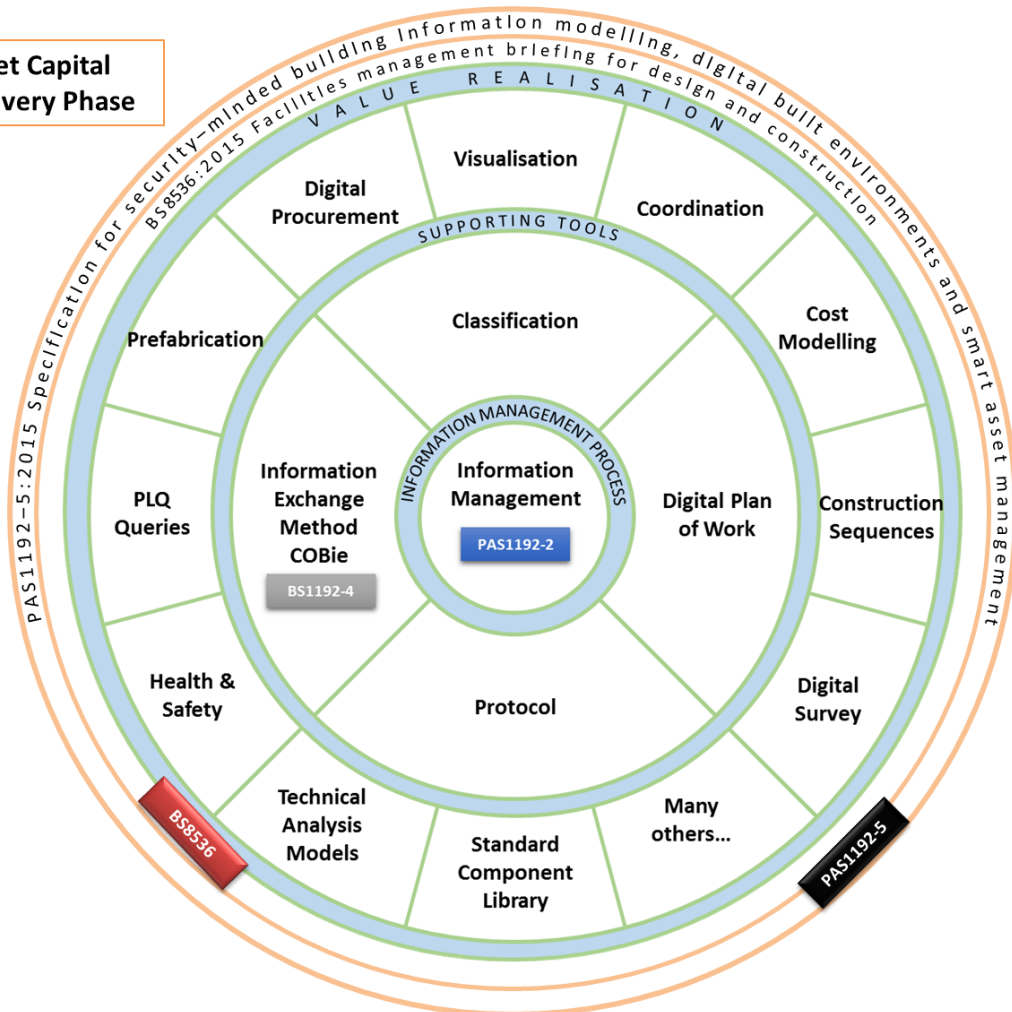


Digital Construction

Mobile Field Activities



## Asset Capital Delivery Phase



**PAS 1192-5:2015**  
Specification for security-minded building information modelling, digital built environments and smart asset management

PAS 1192-5 specifies requirements for security-minded management of BIM and digital built environments. It outlines the cyber-security vulnerabilities to hostile attack when using BIM and provides an assessment process to determine the levels of cyber-security for BIM collaboration which should be applied during all phases of the site and building lifecycle.

PAS 1192-5 is of relevance to any organization working with building information modelling, digital built environments and smart asset management. The approach outlined in this PAS is applicable not only to projects employing BIM and the implementation and use of smart asset management, but to any built asset where asset information is created, stored, processed and viewed in digital form. It is also applicable to the capture of digital survey data as part of the day-to-day asset management processes or in anticipation of a future project.

The PAS addresses the steps required to create and cultivate an appropriate security mindset and secure culture within an organization, including the need to monitor and audit compliance.

**BS 1192:2007 + A2:2016 (BIM Level 1)**  
Collaborative production of architectural, engineering and construction information. Code of practice

BS 1192 provides a 'best-practice' method for the development, organization and management of production information for the construction industry, using a disciplined process for collaboration and a specified naming policy.

It provides the template for common naming conventions and approaches to collaborative working for use in architecture, engineering and construction. It also facilitates efficient data use in facilities management.

The principles for information sharing and common modelling outlined in this standard underpin the BIM Level 2 standards and are equally applicable to building and civil projects.

**PAS 1192-2:2013**  
Specification for information management for the capital/delivery phase of construction projects using building information modelling

The requirements within PAS 1192-2 build on the existing code of practice for the collaborative production of architectural, engineering and construction information, defined within BS 1192:2007 + A1:2015.

PAS 1192-2 focuses specifically on project delivery, where the majority of graphical data, non-graphical data and documents, known collectively as the project information model (PIM), are accumulated from design and construction activities.

The intended audience for this PAS includes organizations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings and infrastructure assets. Where possible, generic language has been used, but where necessary, specific definitions are included.

**PAS 1192-3:2014**  
Specification for information management for the operational phase of assets using building information modelling (BIM)

PAS 1192-3 provides guidance to Asset Managers on how to integrate the management of information across the longer term activity of asset management with the shorter term activity of asset construction for a portfolio of assets.

PAS 1192-3 is a partner to PAS 1192-2. PAS 1192-2 specifies an information management process to support BIM Level 2 in the capital/delivery phase of projects. In contrast, PAS 1192-3 focuses on the operational phase of assets irrespective of whether these were commissioned through direct capital works, acquired through transfer of ownership or already existed in an asset portfolio. However, like PAS 1192-2, PAS 1192-3 applies to both building and infrastructure assets and is based on the existing code of practice for the collaborative production of architectural, engineering and construction information that is defined within BS 1192:2007 + A1:2015. It is envisaged that cost savings of 33% can be achieved across the CAPEX and OPEX phases through implementation of the processes outlined in PAS 1192-2 and PAS 1192-3.

PAS 1192-3 has been developed in recognition of the fact that the cost of operating and maintaining buildings and facilities can represent up to 85% of the whole-life cost, and savings can pay back any upfront premium in construction expenses in a few years.

**BS 1192-4:2014**  
Collaborative production of information. Fulfilling employer's information exchange requirements using COBie. Code of practice

BS 1192 4 outlines the UK usage of COBie, an internationally agreed information exchange scheme for exchanging facility information between the employer and the supply chain.

This code of practice defines expectations for the exchange of information throughout the lifecycle of a Facility. The COBie (Construction Operations Building information exchange) provides a common structure for the exchange of information about new and existing Facilities, including both buildings and infrastructure. The use of COBie ensures that information can be prepared and used without the need for knowledge of sending and receiving applications or databases. It ensures that the information exchange can be reviewed and validated for compliance, continuity and completeness.

**BS 8536-1:2015**  
Briefing for design and construction. Code of practice for facilities management (Buildings infrastructure)

BS 8536-1:2015 gives recommendations for briefing for design and construction, to ensure that designers consider the expected performance of a building in use. The standard applies to all new buildings projects and major refurbishments.

BS 8536-1 aims to:

- Involve the operator, the operations team and their supply chain from the outset
- Extend the involvement of the supply chain for the project's delivery through to operations and defined periods of aftercare

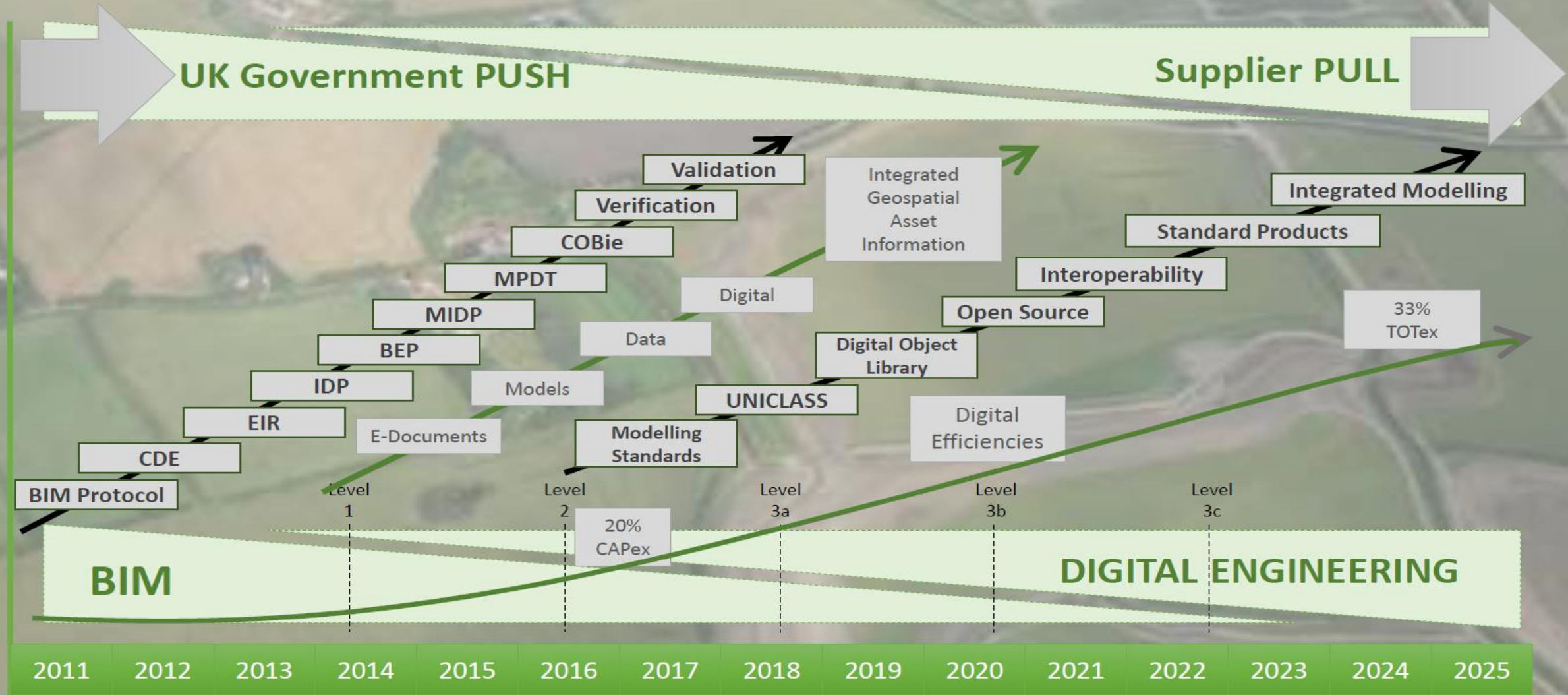
The scope of the revised BS 8536-1 has been expanded to include briefing requirements for soft landings, building information modelling (BIM) and post occupancy evaluation (POE).

Mark Bew, Chairman of the UK Government BIM Implementation Group says that 'The Government has a vision to reduce whole life costs of assets by 33% by 2025, and the revision of BS 8536 incorporating the principles of GSI (Government Soft Landings) will ensure that it will become one of the key guidance documents, alongside PAS 1192-2, PAS 1192-3, PAS 1192-5 and BS 1192-4 to achieve this aim in both the private and public sectors'.

# STANDARDS HELP CONSISTENCY AND ADOPTION

# AECOM

# The BIM journey



Dates & relationships are approximate

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# Information Delivery Assurance

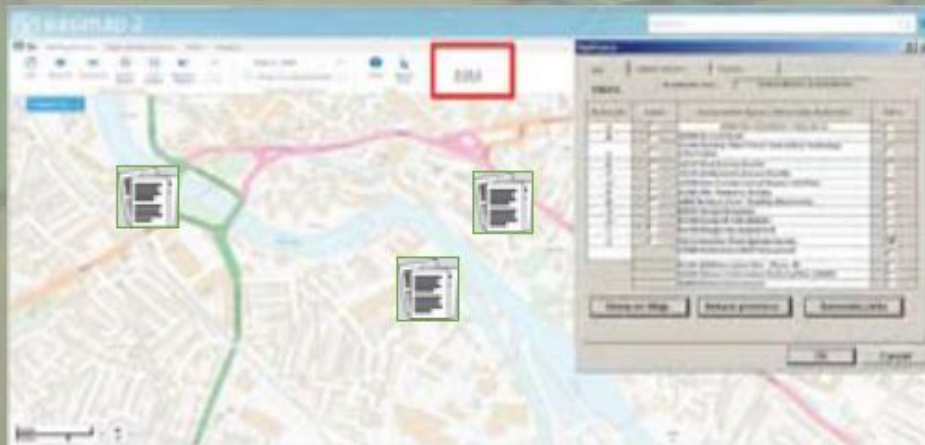
PROJECT  
CONTEXT



Task	Start	End	Status
Emergency IDP Preparation	2017-01-01	2017-12-31	Completed
Emergency IDP Preparation	2018-01-01	2018-12-31	In Progress
Emergency IDP Preparation	2019-01-01	2019-12-31	Planned
Emergency IDP Preparation	2020-01-01	2020-12-31	Planned

**Contractual Information Delivery Plan**  
*Assured indexed file & data delivery*

OPERATION  
CONTEXT



**GIS Portfolio BIM Model View**  
*Visual query based file & data access*

**Information Assurance:**

**Shared State:** *without provenance we CANT RELY on it*

**Published State :** *with provenance, we CAN RELY on it*

WHOLE LIFE  
CONTEXT



Name	Type	Function	Location	State
Asset 1	Building	Residential	City Center	Shared
Asset 2	Building	Commercial	City Center	Published
Asset 3	Building	Industrial	City Center	Published

**Whole Life Client Side AIM CDE**  
*Shared & Published Information*

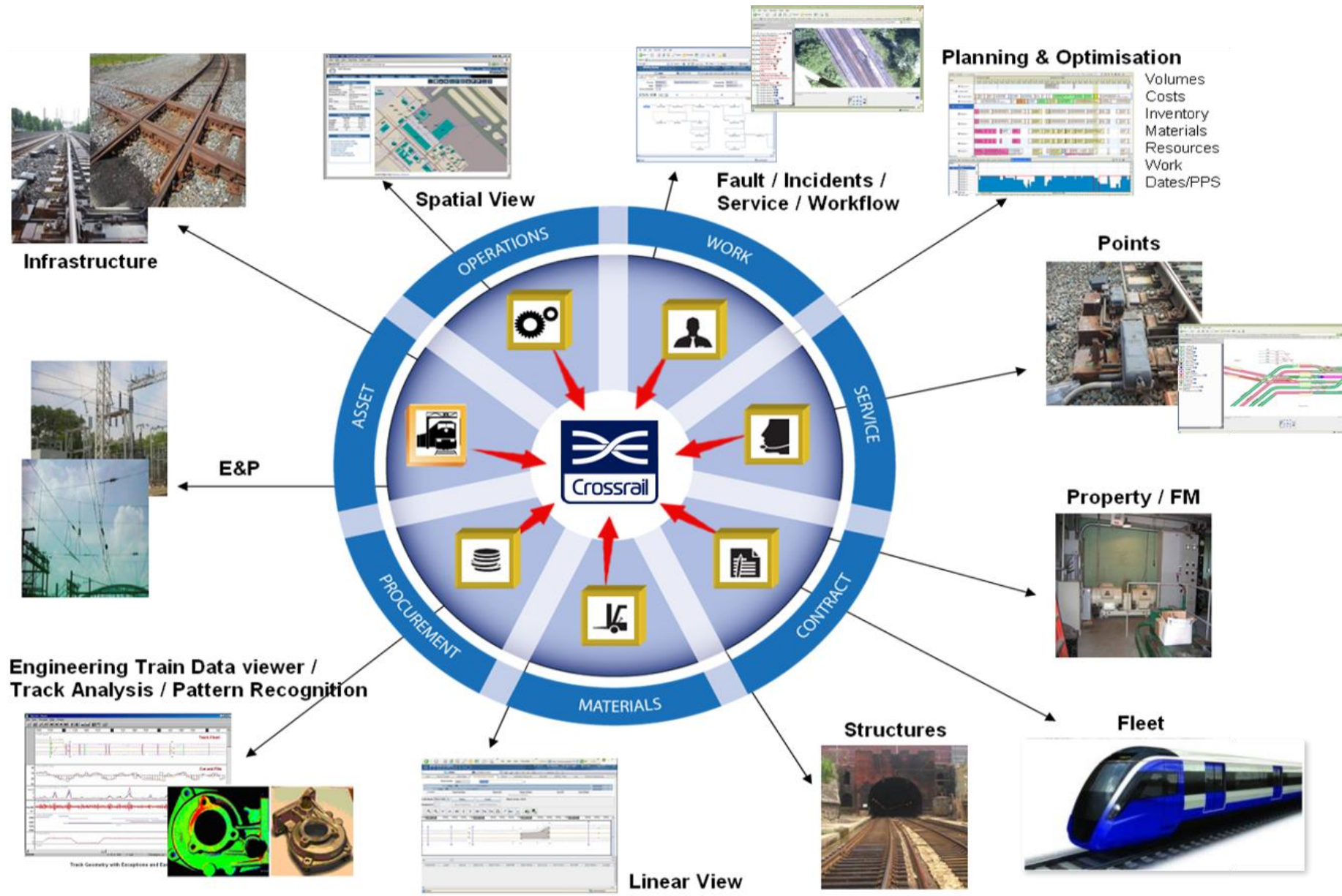
*The concept of a project has little value after handover.*

*The context is by asset, type, function, location & state*

*Think Whole Life for the Asset Information Model*



# Digital Transportation – Information Centered





# 3 key requirements

- ▶ **Common Data Environment & Master Data Management**
- ▶ **Structured data** - Asset definitions, Deliverable templates, Information metrics
- ▶ **Processes & Procedures**
  - Spec's and standards
  - Gate Reviews
  - Control processes

## Asset Information

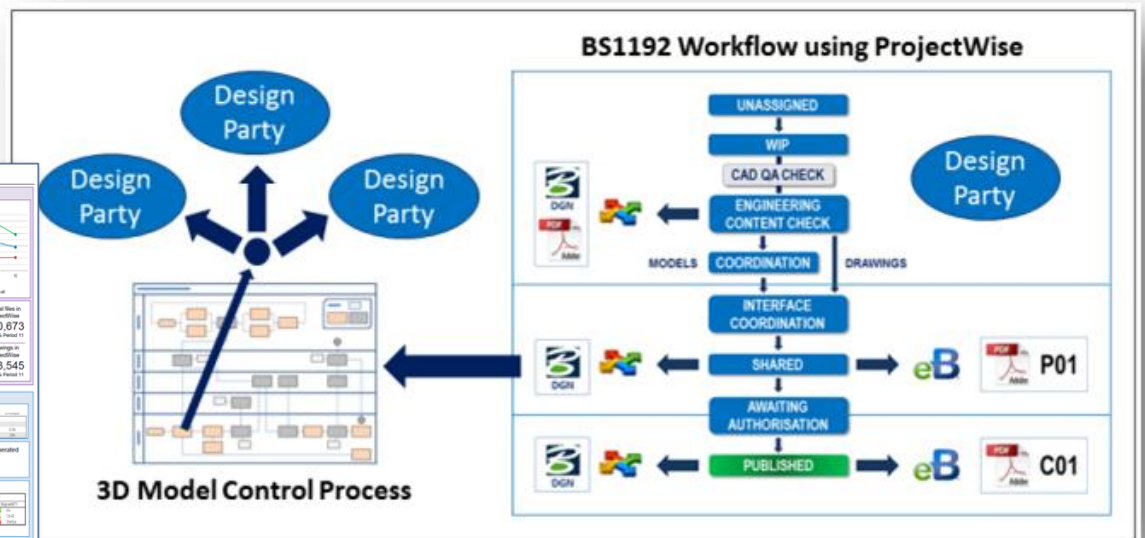
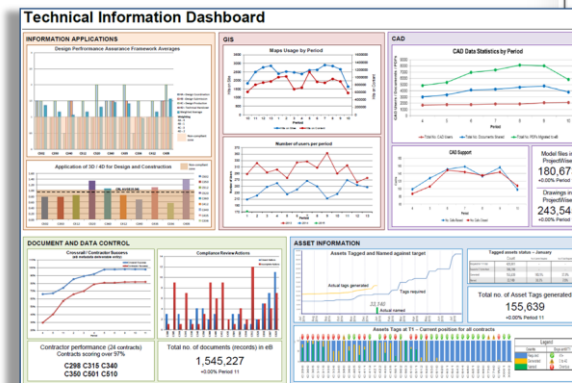
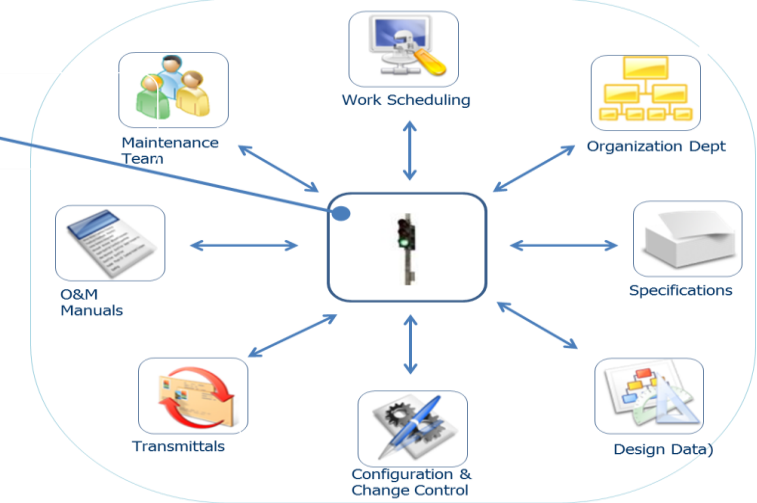
### Metadata Attributes:

- Location
- Length
- Breadth
- Width
- Material
- Install date
- Etc, etc.

### Database Workflows:

- Document Control
- Contract Administration
- RFI's, Snagging,
- Asset inventory
- etc

eB



PAS1192:2 Specification  
for information  
management for the  
capital/delivery phase of  
construction projects  
using Building  
Information Modelling

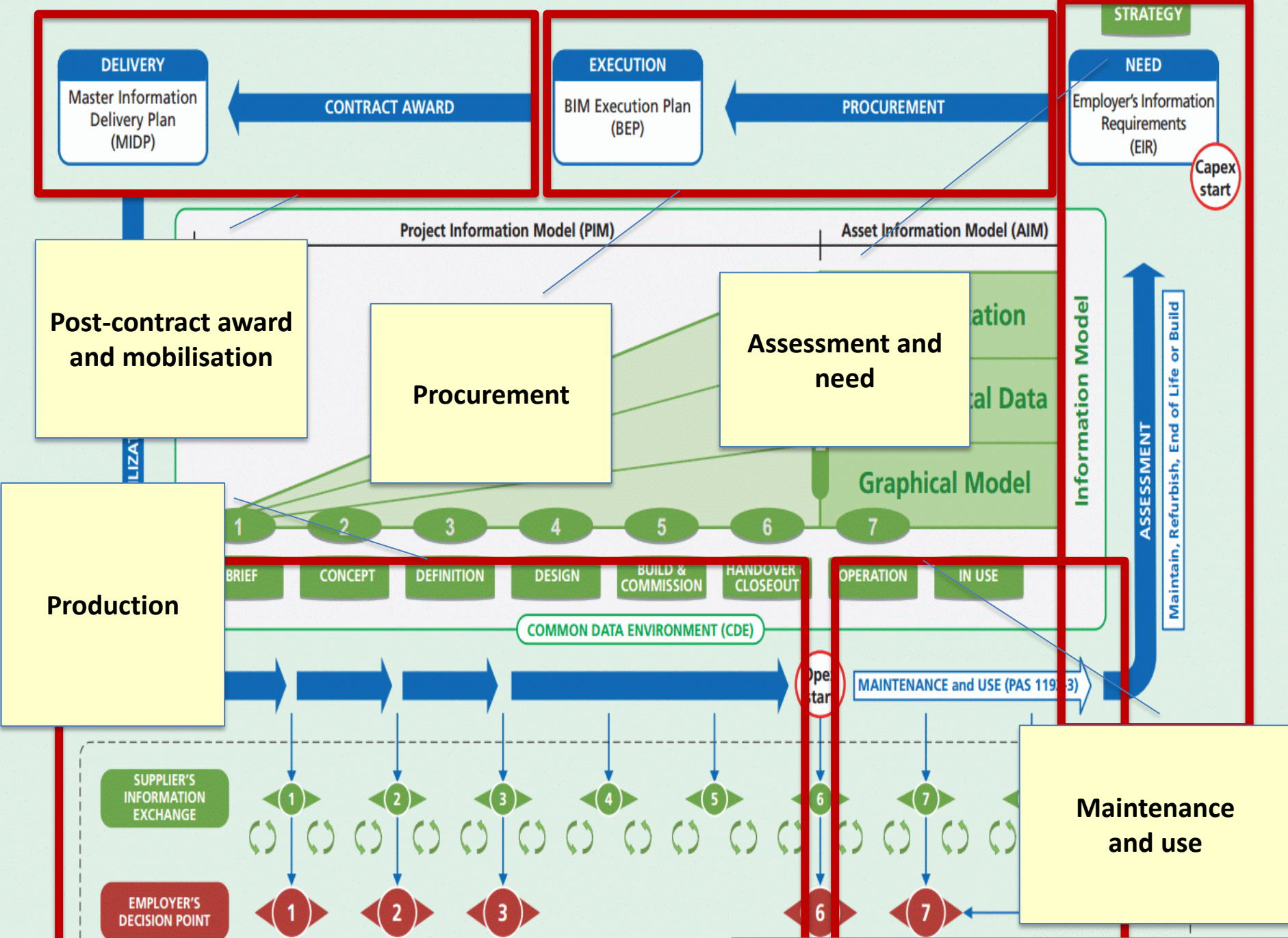
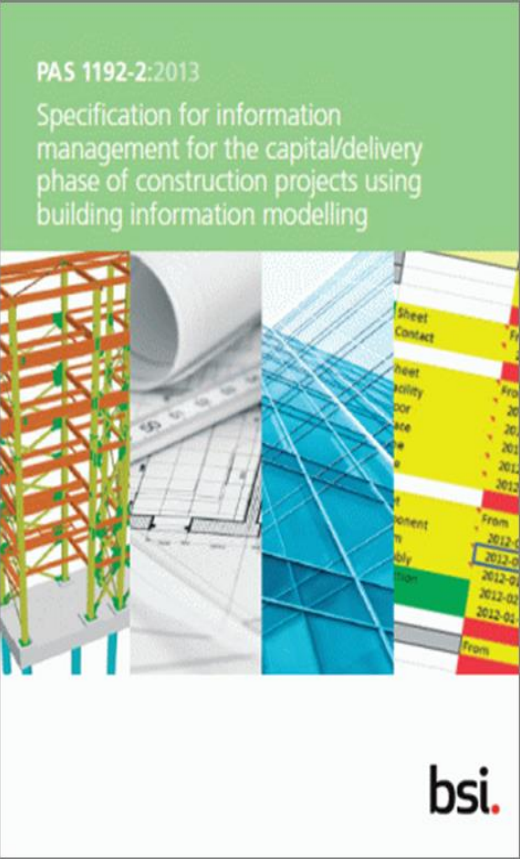
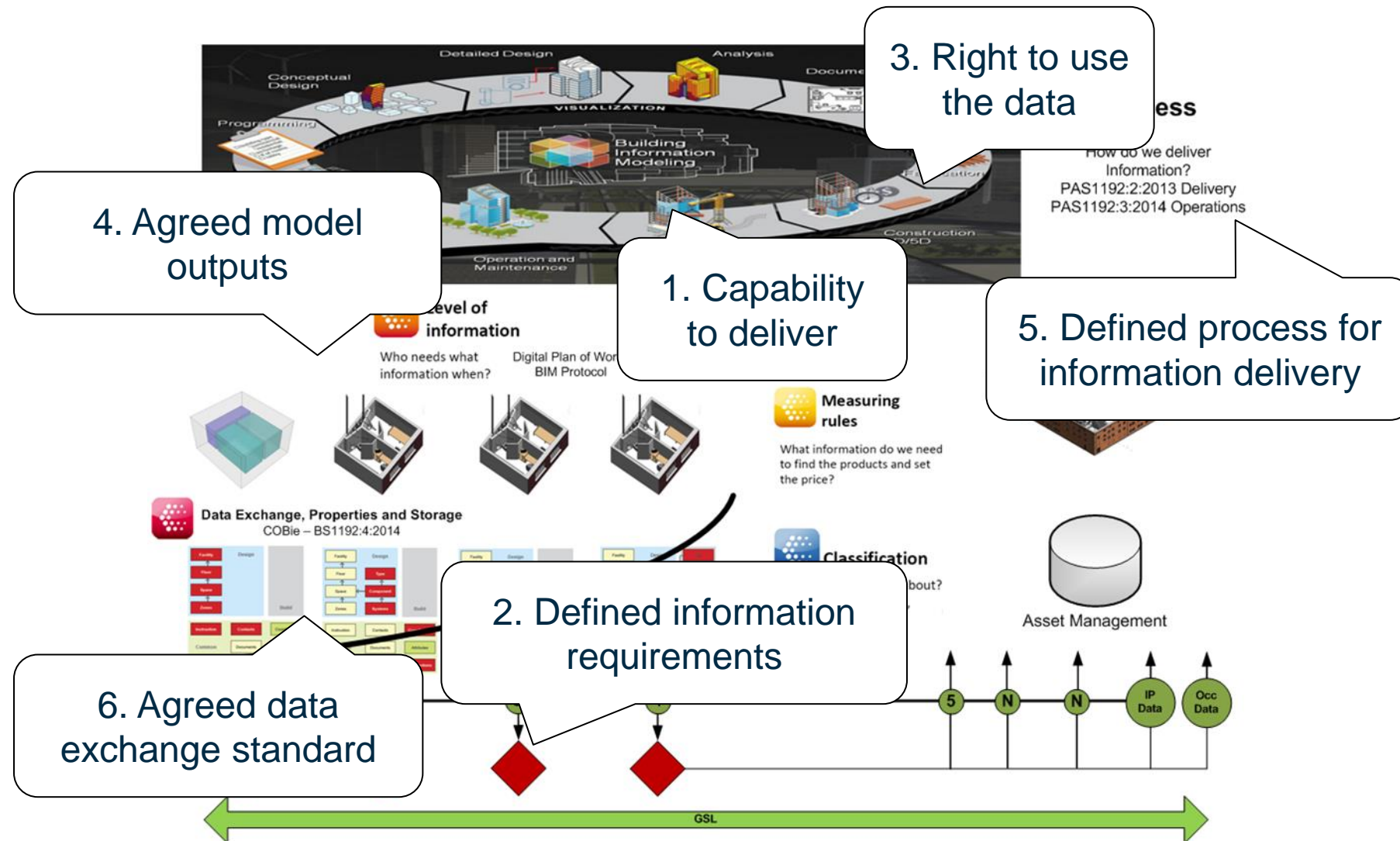


Figure taken from [PAS1192-2:2013](#) – Copyright Mervyn Richards



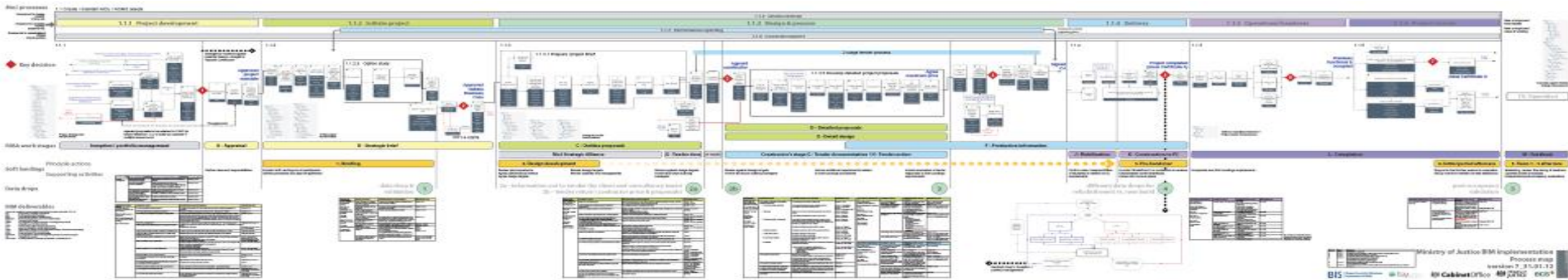
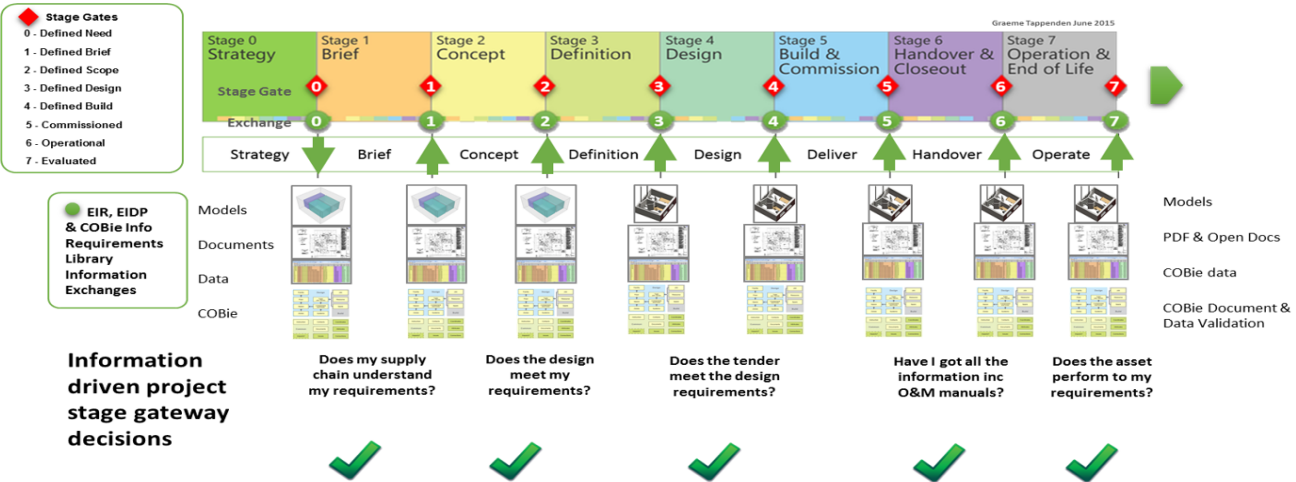
# Clients need to become good at buying their digital data



UNDERSTAND WHAT YOUR ALIM LOOKS LIKE. IDENTIFY THE PROBLEM AREAS

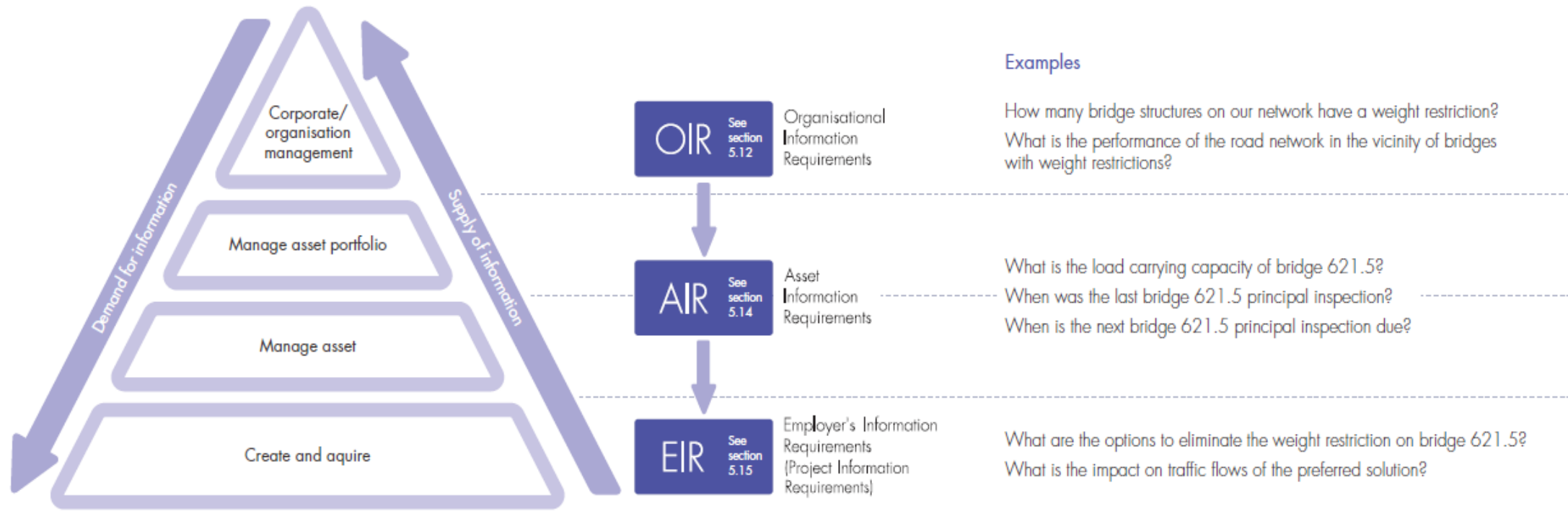


Defining, Packaging & Validating information exchanges across the project lifecycle with COBie transmittal validation





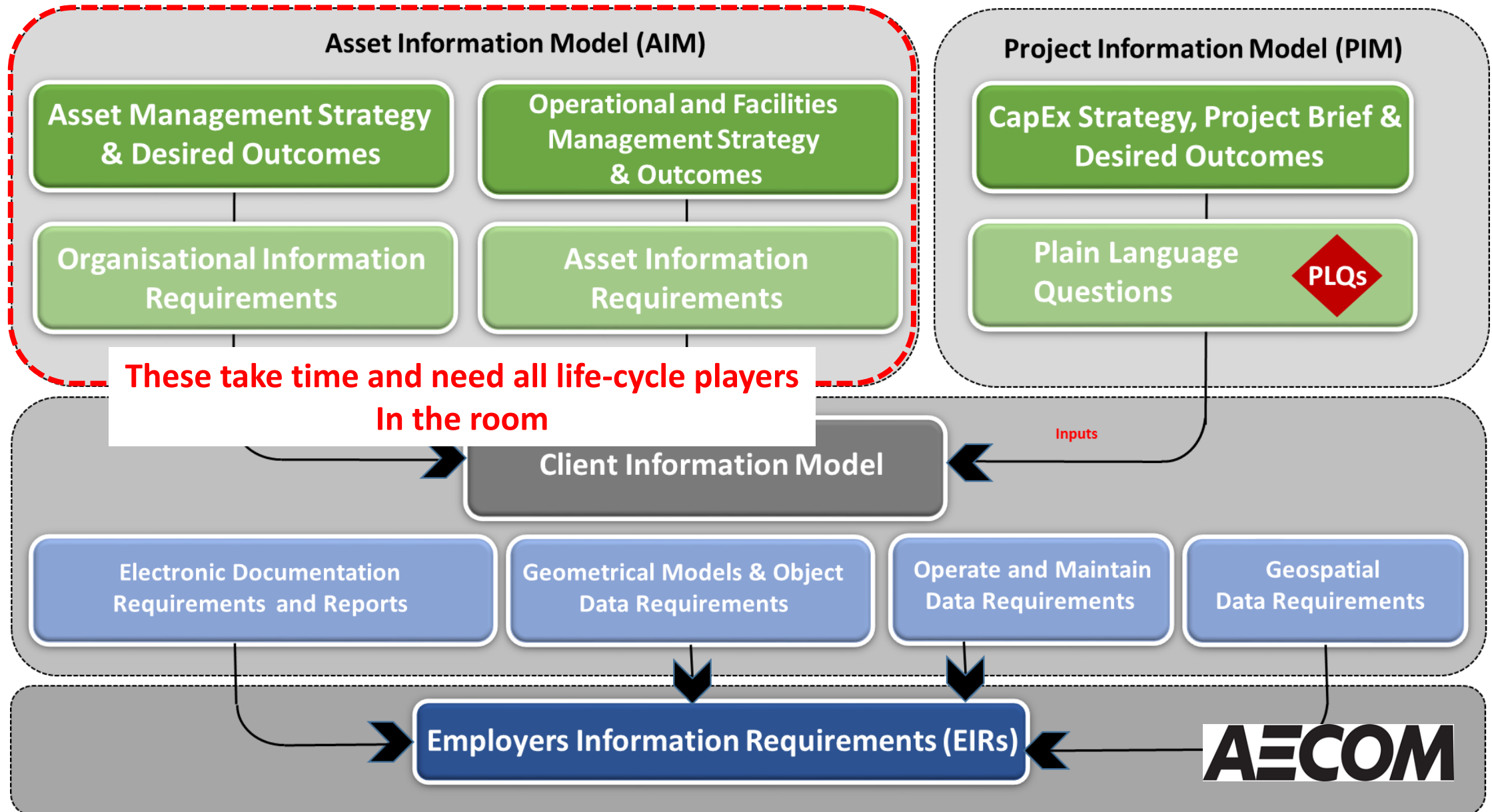
# ENSURE THAT THERE IS A FOCUS ON INFORMATION REQUIREMENTS



Data supply comes from the lower tiers of the pyramid, and in order for it to easily flow up the pyramid, the following needs to be in place:

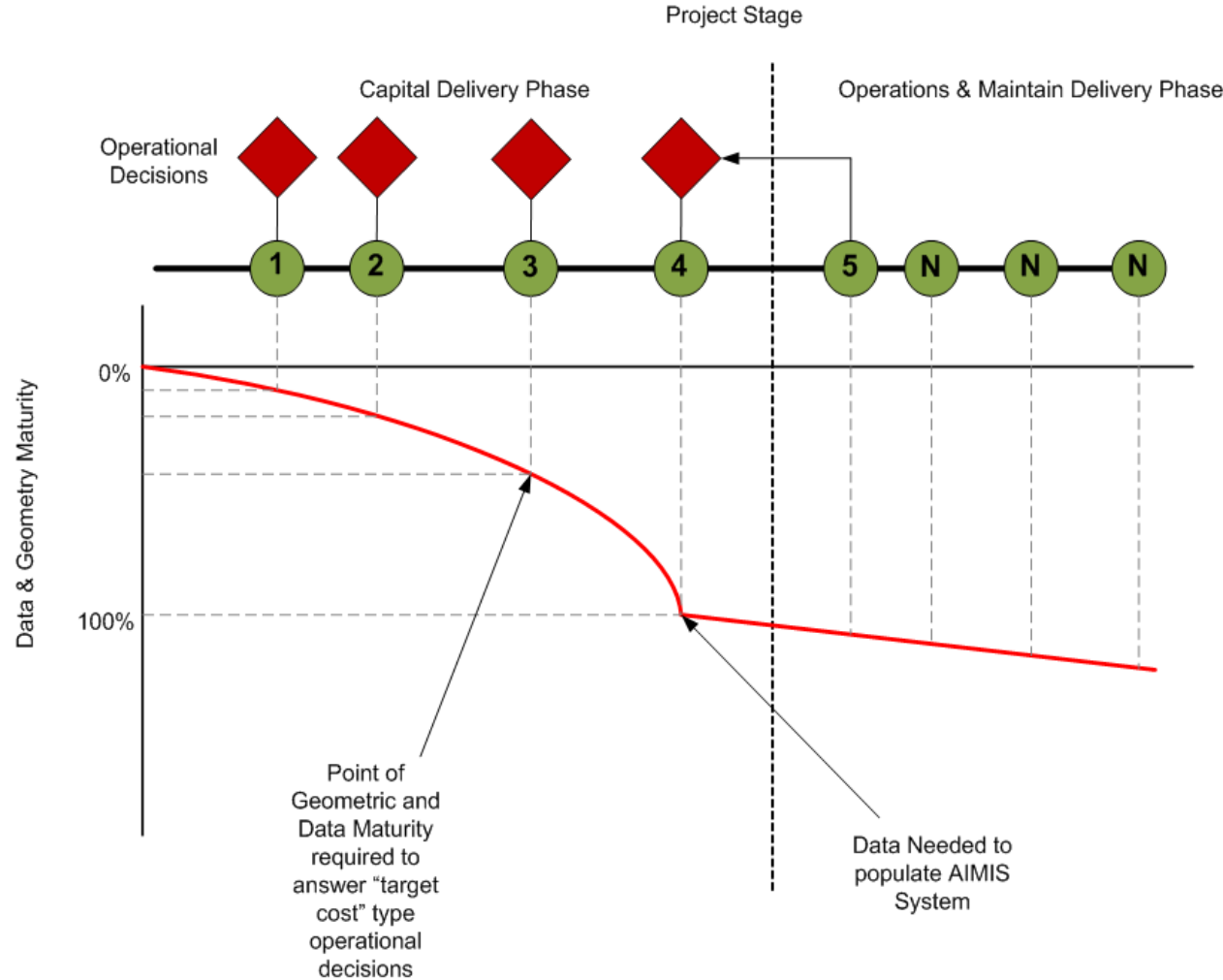
- 1 A clear definition of what data and information is required.
- 2 Common data and Information Standards established.
- 3 The supporting data transaction processes within each level of the pyramid and between layers of the pyramid need to be understood.

# ENSURE THAT THERE IS A FOCUS ON INFORMATION REQUIREMENTS

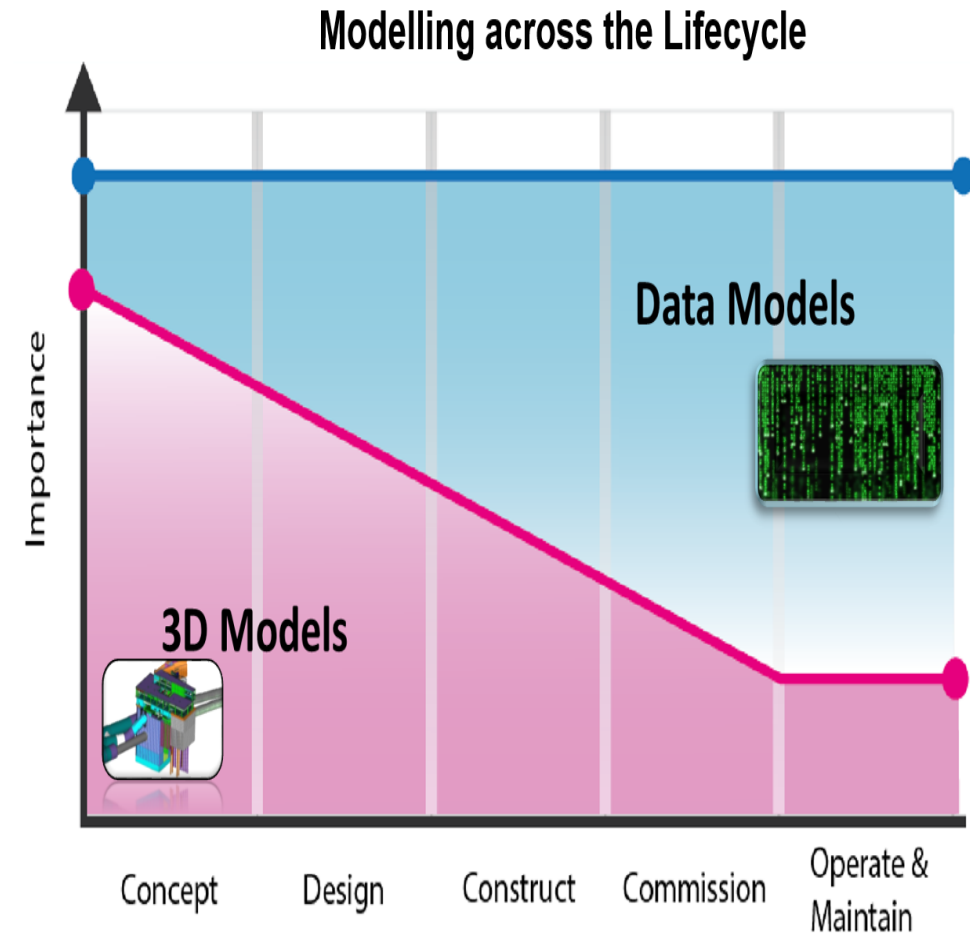




# CREATE A DIGITAL PLAN OF WORKS

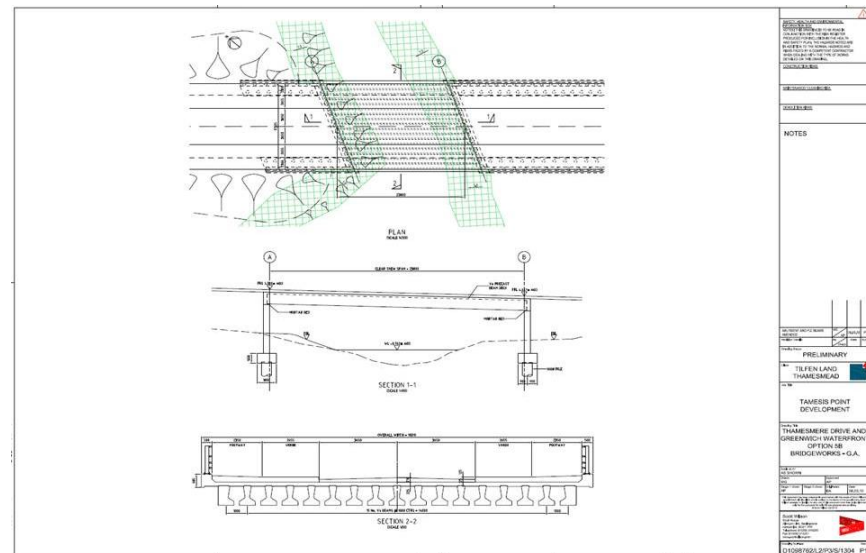


## Level of Definition: Graphical v Non-graphical



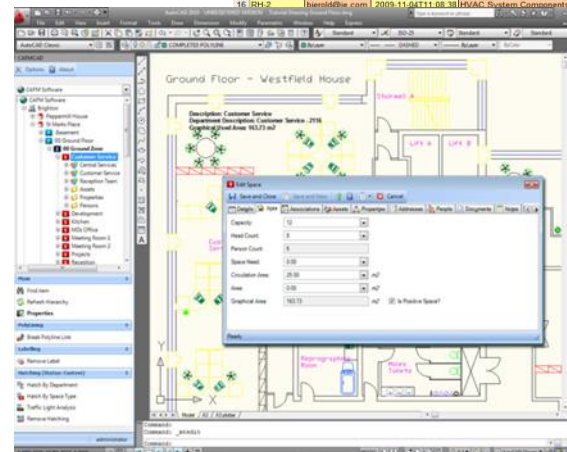
Courtesy:  
Malcolm Taylor  
[Crossrail](#)

# Defined Data exchange uses native models, PDFs and COBie



Microsoft Excel - Rallyard


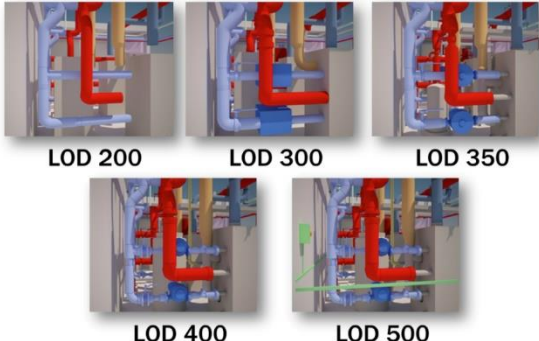

	A	B	C	D	E	F	G	H	I	J	K
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2	Door-100P	berndt@e.com	2009-11-04T11:08:39	Hardware Rems	100P	Door Type D1	100P	Door	000-012	2009-03-01	2009-03-01
3	Door-100G	berndt@e.com	2009-11-04T11:08:39	Hardware Rems	100G	Door Type D1	100G	Door	000-013	2009-03-01	2009-03-01
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8	Door-105A	berndt@e.com	2009-11-04T11:08:39	Hardware Rems	100A	Door Type D1	100A	Door	000-018	2009-03-01	2009-03-01
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# Our EIR Template core content

The core content of our EIR template is split into the following sections:

Technical	Management	Commercial
<ul style="list-style-type: none"><li>• Software Platforms</li><li>• Data Exchange Format</li><li>• Co-ordinates</li><li>• Level of Detail (general)</li><li>• Level of Detail (components)</li><li>• Training</li></ul> <div></div> <div></div>	<ul style="list-style-type: none"><li>• Standards</li><li>• Stakeholder Roles and Responsibilities</li><li>• Planning the Work and Data Segregation</li><li>• Security</li><li>• Coordination and Clash Detection Process</li><li>• Collaboration Process</li><li>• Model review meetings</li><li>• Health and Safety and Construction Design Management</li><li>• System Performance Constraints</li><li>• Compliance Plan</li><li>• Delivery Strategy for Asset Information</li></ul>	<ul style="list-style-type: none"><li>• Timing of data drops</li><li>• Clients Strategic Purpose</li><li>• Defined BIM/Project Deliverables</li><li>• BIM-specific competence assessment</li></ul> <div></div>

# L3 and DBB



Digital Built Britain



## Construction 2025...



## HM Government 2013

Industrial Strategy: government and industry in partnership

**Lower costs**

33%

reduction in the initial cost of construction and the whole life cost of built assets

**Faster delivery**

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

**Lower emissions**

50%

reduction in greenhouse gas emissions in the built environment

**Improvement in exports**

50%

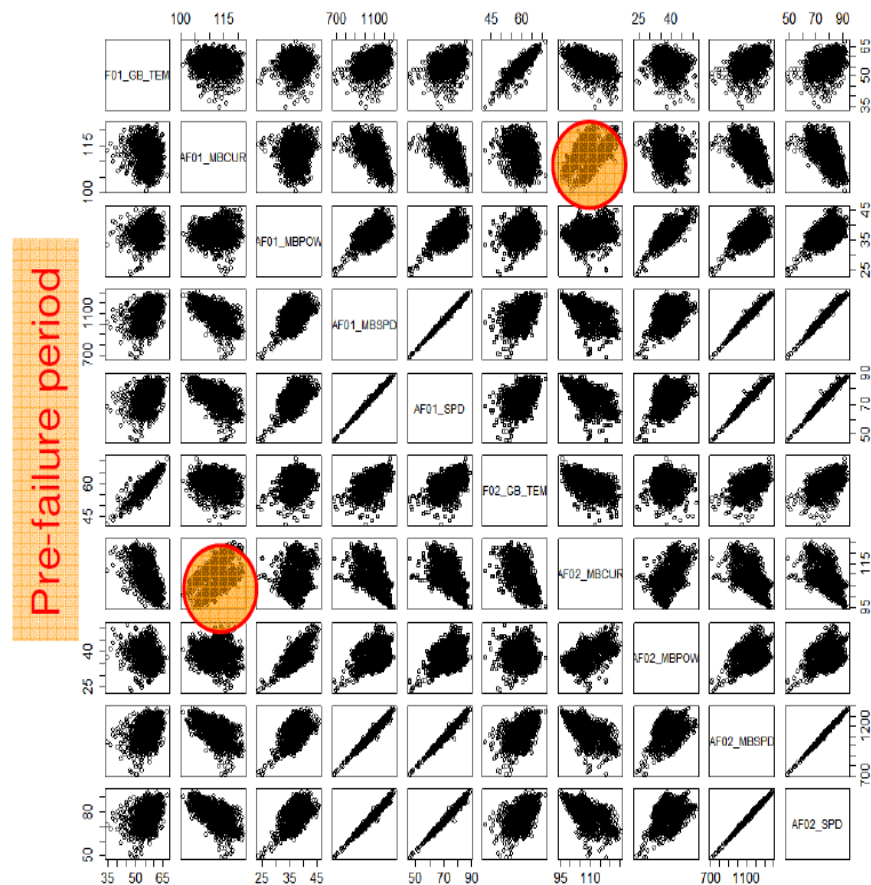
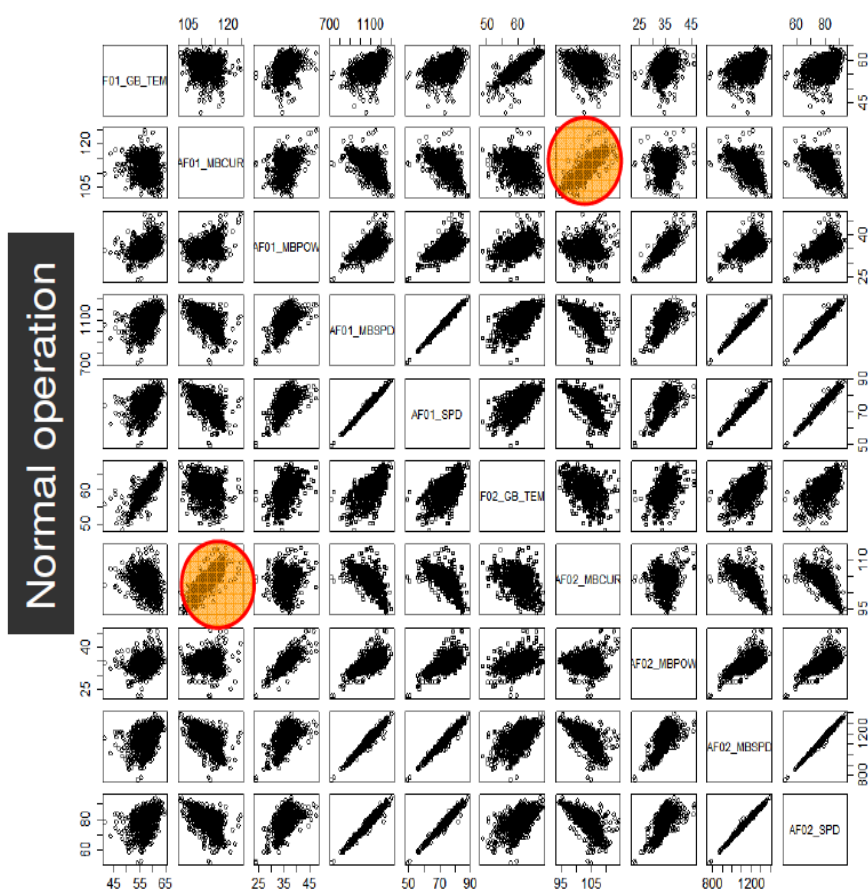
reduction in the trade gap between total exports and total imports for construction products and materials

**Towards a Digitally Built Britain  
With 21<sup>st</sup> Century Assets**



**A sector that is technologically  
Advanced and Innovative**

## Example – pattern change on synchronous motor

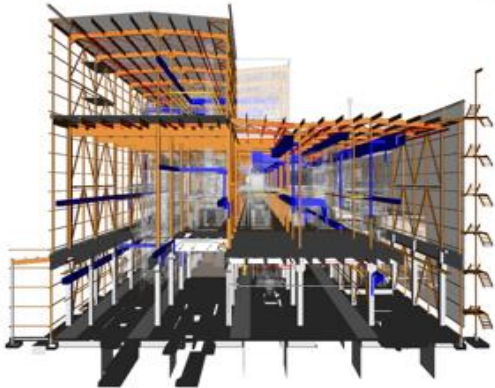


Towards Cognitive Automation of Data Science



# Digital Asset Performance Management

## Digital Prototyping and Life-cycle Modelling



**BIM / AIM / GIS  
Data Management**

## Understanding Operating Factors and Predictors



**Telemetry and  
Asset Health Monitoring**

## Cognitive Condition Management



**Predictive Analytics  
& Data Visualisation**

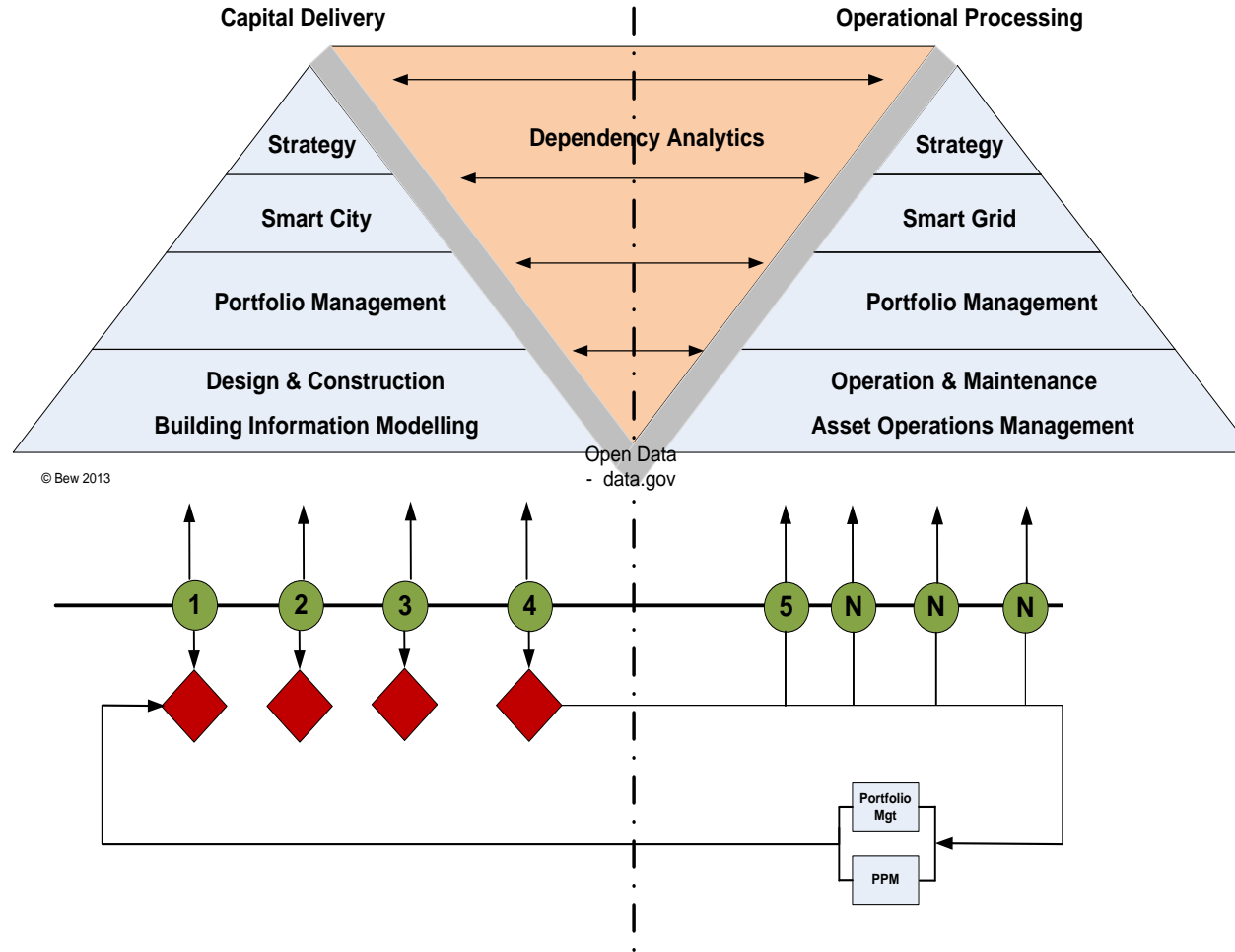
## Optimisation Of Operational Activities



**Digital Enterprise  
Asset Management**

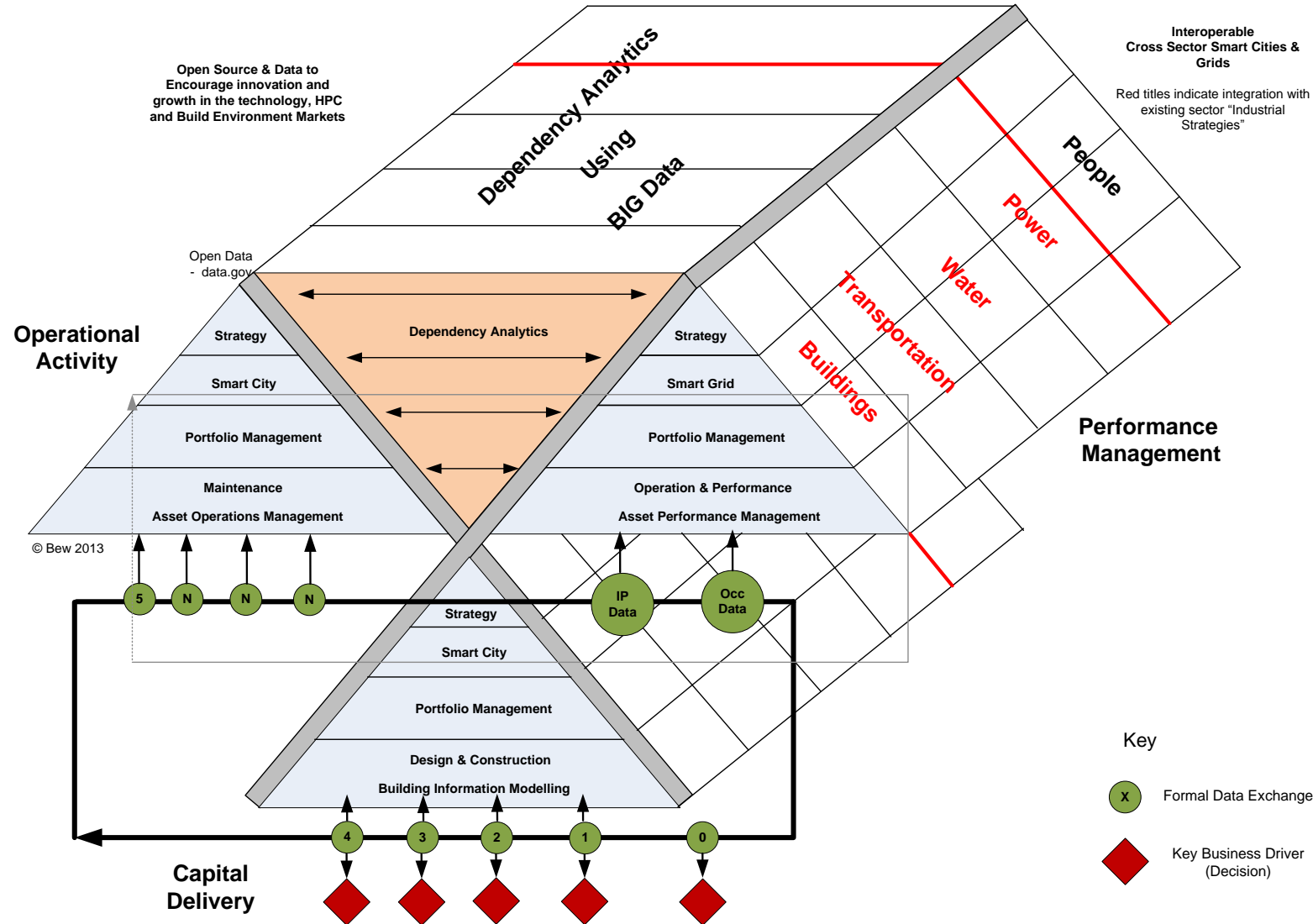
**Reduced Maintenance Costs, Maximised Reliability and Service Delivery**

# Level 2 – Data Management





# Level 3 – Smart



# Any questions?

David Philp – Global BIM/IM Consultancy  
Director

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