



# Innovation Insights

## *Digital Railways – BIM and Beyond*

Steve Appleby

March 2016

The background is a solid blue color. On the right side, there are several thin, white, intersecting lines that create a geometric pattern, resembling a stylized star or a network of connections.

# Productivity Partnership *BIM Acceleration Committee*



# BIM Acceleration Committee

- The BIM Acceleration Committee is an alliance of industry and government.
- Established in February 2014 to coordinate efforts to increase the use of BIM in New Zealand.
- Financially supported by BRANZ and the Ministry of Business, Innovation and Employment (MBIE).

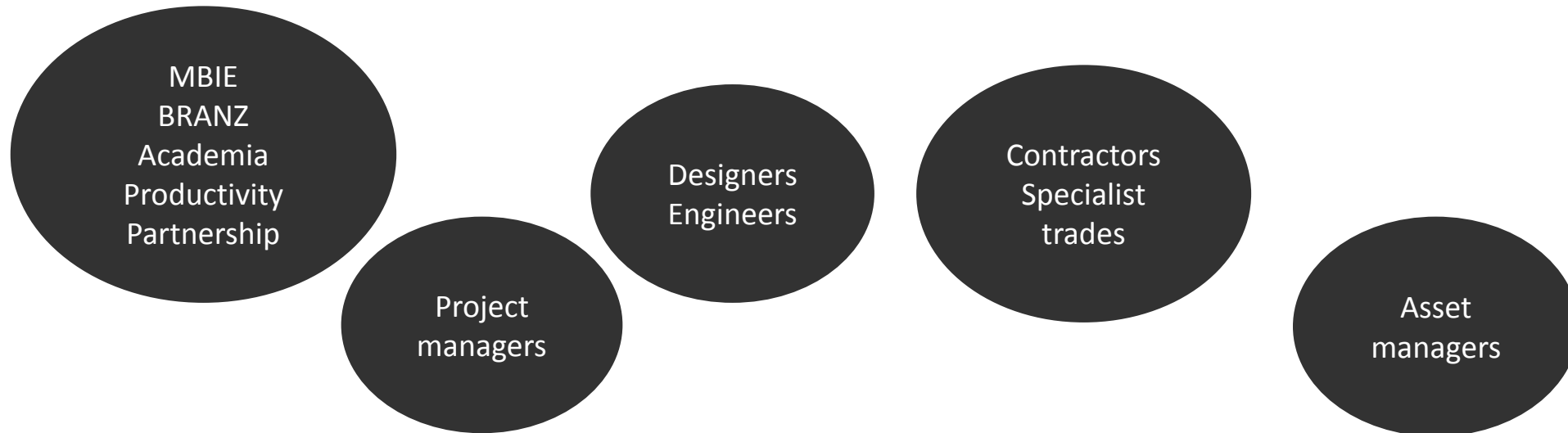


**MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT**  
HIKINA WHAKATUTUKI

- 
1. Promoting the application of BIM, by both actively promoting its use and removing barriers to its use
  2. Identifying and championing initiatives that improve productivity, safety and building quality
  3. Providing governance of any initiatives or projects the BAC engages in
  4. Providing a conduit between Industry and Government in relation to the use of BIM
  5. Monitor the use of BIM across its range of uses.

# Background

- Identify projects assisting BIM uptake
- Committee members take responsibility for projects
- Members are drawn from across the construction industry and give their time and expertise freely. With representatives from:



# Membership

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Andrew Reding – Productivity Partnership (Chair)  
Andrew Field - RCP  
Andrew Howie – MBIE  
Chris Kane – MBIE  
Dave Hunter – Fletcher Construction  
David Sharp – BRANZ  
Haydn Read – Wellington City Council  
Heather Staley – MBIE  
Jon Williams – Beca  
Robert Amor – University of Auckland  
Steve Appleby – AECOM  
Steve Davis – Assemble  
Victoria Troake – Specialist Trades and Contractors Federation

# BIM Handbook and Case Studies

## New Zealand BIM Handbook

### BIM IN ACTION

### CASE STUDY 1

#### Wellington City Council Bracken Road Flats

##### Applying BIM retrospectively

##### The project

This case study demonstrates how Building Information Modelling (BIM) is being used by Wellington City Council (WCC) to cost effectively manage its portfolio, specifically focusing on the Bracken Road Flats for asset and facilities management. The ability to forecast ongoing maintenance to extend the life of the building through BIM can help deliver housing and infrastructure for the future.

As a social housing owner, WCC's accurate building information properties are maintained to a high standard. Accessing occupied properties and their condition is difficult, but as an effective data collection tool, BIM can help predict the whole life of a building.

*"On average, approximately 29 components in a building can be managed with minimum cost. The value of a BIM is greater if you view the whole life of an asset."*

Haydn Read, Manager Strategic Asset Management  
Wellington City Council

### BIM IN ACTION

### CASE STUDY 4

#### University of Auckland

##### BIM assisting detailed building services

##### The project

An upgrade of the University of Auckland's School of Engineering required a suite of new and modern laboratories to replace the original laboratories, dating from the 1960s, which didn't meet current requirements. Bece provided building services and structural engineering design for the new laboratories using BIM to precisely plan the location and integration of services, with a view to optimising future cost, safety, performance and ongoing energy management.

The laboratories comprise two large teaching spaces for undergraduate chemistry students and a number of supporting spaces including a preparation lab, instrumentation lab, an analytical lab, a change room and a separate write-up space. This highly integrated environment needed to allow for a cross flow of air and students through pressure controlled spaces for safe handling of flammable gases, solvents, and liquid nitrogen and corrosive materials.

*"The complicated nature of this project plus the tight timeframe required intensive collaboration between the project partners and client. BIM was hugely beneficial in this regard."*

Jon Williams,  
Bece

##### Duration

Mid 2011 to January 2013

Design of the laboratories took approximately nine months and construction approximately a further nine months.

### BIM IN ACTION

### CASE STUDY 3

#### Kathleen Kilgour Centre

##### Innovative design and operation through BIM.

##### The project

The Kathleen Kilgour Centre is a new radiotherapy clinic at Teauranga Hospital. Procured by the Bay of Plenty DHB under a Public Private Partnership (PPP), it is setting New Zealand project management and design precedents through its use of Building Information Modelling (BIM) processes and technologies, combined with integrated project delivery methods.

The building's design and construction have been co-ordinated with virtual models and BIM will also aid in its operation, maintenance and management over its lifetime.

The 3,000m<sup>2</sup> healthcare facility houses three treatment spaces, along with supporting clinical and administration areas spread across three levels. From the high-tech medical equipment to the internal environment and construction methods, it is an innovative centre of excellence.

The underlying philosophy for this project has been to provide a high quality environment for the patients who use it and the staff who work there. The building is seen as an integral part of treatment with the aim of making the patient experience as stress free and comfortable as possible. This is realised by a sophisticated quality and a 'non-clinical' feel, achieved with the assistance of virtual modelling.

*"The Kathleen Kilgour Centre is an innovative centre of excellence. Its planning, construction, form and services all contribute to the better treatment of cancer patients at their most vulnerable time."*

Mark Franzdorfer,  
Kathleen Kilgour Centre General Manager

##### What is BIM?

*"BIM is a digital representation of the physical and functional characteristics of a building. As such, it serves as a shared knowledge resource for information about a building, forming a reliable basis for decisions during its life cycle from inception onward."*

The National Building Information Model Standard Project Committee



A guide to enable

**Funded by BRANZ**  
From the Building Research Levy

BUILDING AND CONSTRUCTION  
**PRODUCTIVITY  
PARTNERSHIP**  
building value.

BUILDING AND CONSTRUCTION  
**PRODUCTIVITY  
PARTNERSHIP**  
building value.



BUILDING AND CONSTRUCTION  
**PRODUCTIVITY  
PARTNERSHIP**  
building value.



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## Best-practice BIM in New Zealand

### Two-day training course

Delivered by:

the UK Building Research Establishment

Paul Oakley BA(Hons) Dip Arch RIBA Associate Director BIM, BRE

Dan Rosenthal MSc BIM Consulting/Training Manager, BRE



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 **MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT**  
HAKA WHAKATUPU

 BUILDING AND CONSTRUCTION  
**PRODUCTIVITY  
PARTNERSHIP**  
*building value*

With support from:

 **IPENZ**  
INGENIEERS PROFESSIONAL ENGINEERS NEW ZEALAND

 **NEW ZEALAND INSTITUTE OF  
ARCHITECTS**  
ARCHITECTS

 **NZIOS**  
NEW ZEALAND INSTITUTE OF OFFICIALS

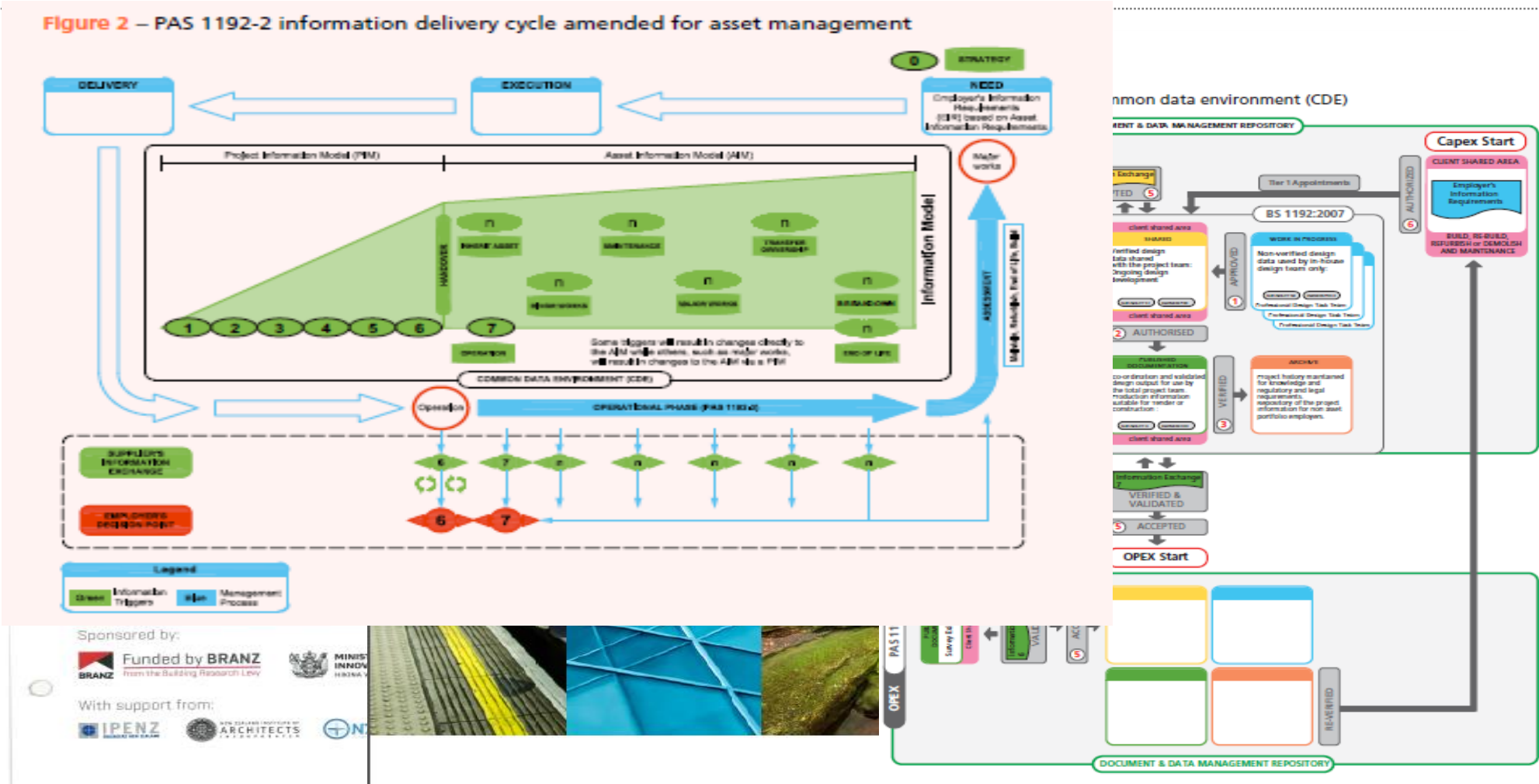
 **Specialist Trade**  
Construction Industry Training

 **New Zealand  
Institute of  
Building**  
BUILDING INDUSTRY TRAINING



# Strategy Implementation

Figure 2 – PAS 1192-2 information delivery cycle amended for asset management



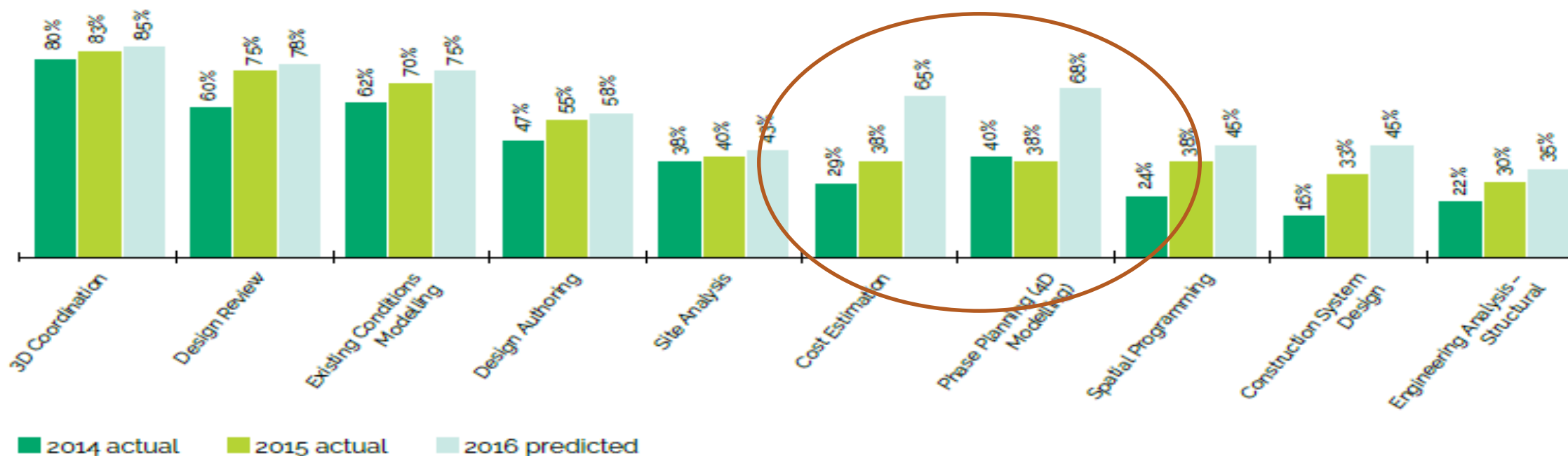
## Monitoring acceleration

- Annual Control group BIM survey



<http://www.eboss.co.nz/detailed/building-industry-insight/bim-survey-results-2015>

# 10 Most Popular Uses of BIM



## Design Documentation Guidelines

## Architecture

### Concept Design Phase

Design Process	Deliverables	Commentary
<b>Inputs:</b> <ul style="list-style-type: none"> <li>Client brief, including budget and time schedule. <input type="checkbox"/></li> <li>Client advice in respect to structure of design process. <input type="checkbox"/></li> <li>Data Collection Including: <input type="checkbox"/> <ul style="list-style-type: none"> <li>topographical survey. <input type="checkbox"/></li> <li>existing structures and services. <input type="checkbox"/></li> <li>certificate of title. <input type="checkbox"/></li> <li>other legal information. <input type="checkbox"/></li> <li>geotechnical information. <input type="checkbox"/></li> <li>as-built measure of existing structures where additions or alterations are involved. <input type="checkbox"/></li> <li>engineering reports on existing structures. <input type="checkbox"/></li> <li>district plan rules and objectives including any existing resource consent, LIM and PIM. <input type="checkbox"/></li> <li>other design constraints. <input type="checkbox"/></li> </ul> </li> </ul> <b>Tasks:</b> <ul style="list-style-type: none"> <li>Attend regular design phase meetings with relevant parties. <input type="checkbox"/></li> <li>Inspect site and prepare site analysis. <input type="checkbox"/></li> <li>Prepare schedule of accommodation. Agree with client. Distribute. <input type="checkbox"/></li> <li>Prepare document register. <input type="checkbox"/></li> <li>Inspect the site and prepare site analysis diagrams. <input type="checkbox"/></li> </ul>	<ul style="list-style-type: none"> <li>Agreed design brief and schedule of accommodation. <input type="checkbox"/></li> <li>Report on existing facilities and engineering systems if applicable. <input type="checkbox"/></li> <li>Options studies report. <input type="checkbox"/></li> <li>Conceptual drawings including: <input type="checkbox"/> <ul style="list-style-type: none"> <li>overall site plan. <input type="checkbox"/></li> <li>floor plans. <input type="checkbox"/></li> <li>elevations. <input type="checkbox"/></li> <li>sketches. <input type="checkbox"/></li> <li>sections (indicative sufficient to illustrate overall concept.). <input type="checkbox"/></li> </ul> </li> <li>Model. <input type="checkbox"/></li> <li>Preliminary cost estimate (prepared by quantity surveyor). <input type="checkbox"/></li> <li>Concept schedule of materials and finishes. <input type="checkbox"/></li> </ul>	<ol style="list-style-type: none"> <li>Confirm conditions of engagement at outset of commission.</li> <li>Note that the preparation of brief is not part of architect's standard service.</li> <li>Agree roles and responsibilities for all participants in building procurement process particularly responsibility for obtaining resource consents.</li> <li>Agree with client the requirements and programme for client information and approvals.</li> <li>Costing may be only on square metre rate basis – quantity surveyor should provide concept cost plan to accompany deliverables.</li> <li>Concept and preliminary design phases may be combined.</li> <li>The approved design may be submitted for a PIM at this stage to identify resource consent issues and to obtain existing conditions/services information.</li> <li>Agree the scale of drawing deliverables for each phase according to project type.</li> <li>Dimensioning and co-ordination is often the responsibility of the architect but this will vary with commission.</li> <li>Advise client on the advantages in maintaining consultant advice at every stage, and the risks incurred where this is not commissioned.</li> </ol>

## Developed Design

### MANAGE

**Health and Safety:** update overall project H&S plan/register incorporating both HSD and HSE matters

**Design Brief:** updated

**Programme:** updated

**Project Execution Plan:** establish and consult with others, finalise and issue

**BIM:** produce, coordinate and agree BIM execution Plan including the scope of BIM for the project, Level of Development, data sharing and integration strategy and roles and responsibilities.

**Risks:** prepare/update schedule

**Document Register:** Update individual

**Quality assurance:** monitor QA Plan and carry out regular reviews/checks on documentation.

**Value Management:** coordinate VM

**Client Meetings:** facilitate, chair, issue notes/minutes, attend

**Design Meetings:** facilitate, chair, issue notes/minutes

**Contractor Procurement:** Identify and agree preferred procurement methodology with Client

**Construction methodology:** Define assumed construction methodology governing design.

**Buildability:** Highlight significant or unusual buildability

**Elements not covered:** in Developed Design (outline).

**Checklist for Building Code Compliance:** clarify who is providing what.

**Approve Design** for progress to next stage, with list of matters to be addressed in next stage

**Provide deliverables** from this stage at commencement of next

**Other:** (specify)

deliverables	required	Client	Project Manager	Architect	Quantity Surveyor	Town planner/ Traffic	Topographical Surveyor	Structural	HVAC	Electrical and Comms	Plumbing	Drainage	Civil	Fire	Constructor	Other	N/A
Plan	●		●	○				○	○	○	○	○	○	○			
Report	●	●	●	○													
Report	●		●														
Plan	●		●	○				○	○	○	○	○	○	○			
Plan	●		○	●				○	○	○	○	○	○	○			
Schedule	●	○	●	○				○	○	○	○	○	○	○			
Schedule	●		●					●	●	●	●	●	●	●			
Plan	●		●	●				●	●	●	●	●	●	●			
minute/note	●	○	●	○	○			○	○	○	○	○	○	○			
minute/note	●	○	●	○	○												
minute/note	●		○	●	○			○	○	○	○	○	○	○			
Report	●	○	●	○	○												
Report		○	●	○	○			○	○	○	○	○	○	○			
Report		○	●	○	○			●	○	○	○	○	○	○			
Report			●					●	●	●	●	●	●	●			
Schedule			○	●	○			○	○	○	○	○	○	○			
Approve	●	○	●														
Issue		●	●		●			●	●	●	●	●	●	●			



The background is a solid blue color. On the right side, there are several thin, white, straight lines that intersect to form a series of triangles and other geometric shapes, creating a modern, abstract design.

# Digital Railways

## *The UK Approach*



# Major Milestones

Major investment in infrastructure  
Global construction market  
Set to grow by **70% by 2025.**

Infrastructure railway needs for  
A growing population.

**However we need to create and  
Care for our assets differently**

2016





# Time To Disrupt Digitally!

**23** This month's big issue:  
**Delivering Differently**



We are in the midst of a global digital revolution which is transforming the way in which people and businesses connect. It is also transforming the potential for businesses to innovate and improve their productivity. Is 2016 the year of delivering differently?



# Data Driven, Hyper Connected, Digital Railways







# Data Driven, Hyper Connected, Digital Railways

## So what does that actually mean

- 1) The edge does not come from technology itself , technology is just a means to a different outcome
- 2) Digital rail is all about greater impact on customer experience by extracting real Intelligence from data to ensure (contextual) better outcomes
- 3) The digital railway is underpinned by a integrated engineering and integrated asset management environment
- 4) Real time information can be used to make better decisions including the passenger
- 5) Optimisation – signalling, system reliability and greater throughput
- 6) More sustainable and probabilistic
- 7) Focus on automation
- 8) Real time condition monitoring and POE
- 9) Has a Totex approach
- 10) Is a great experience



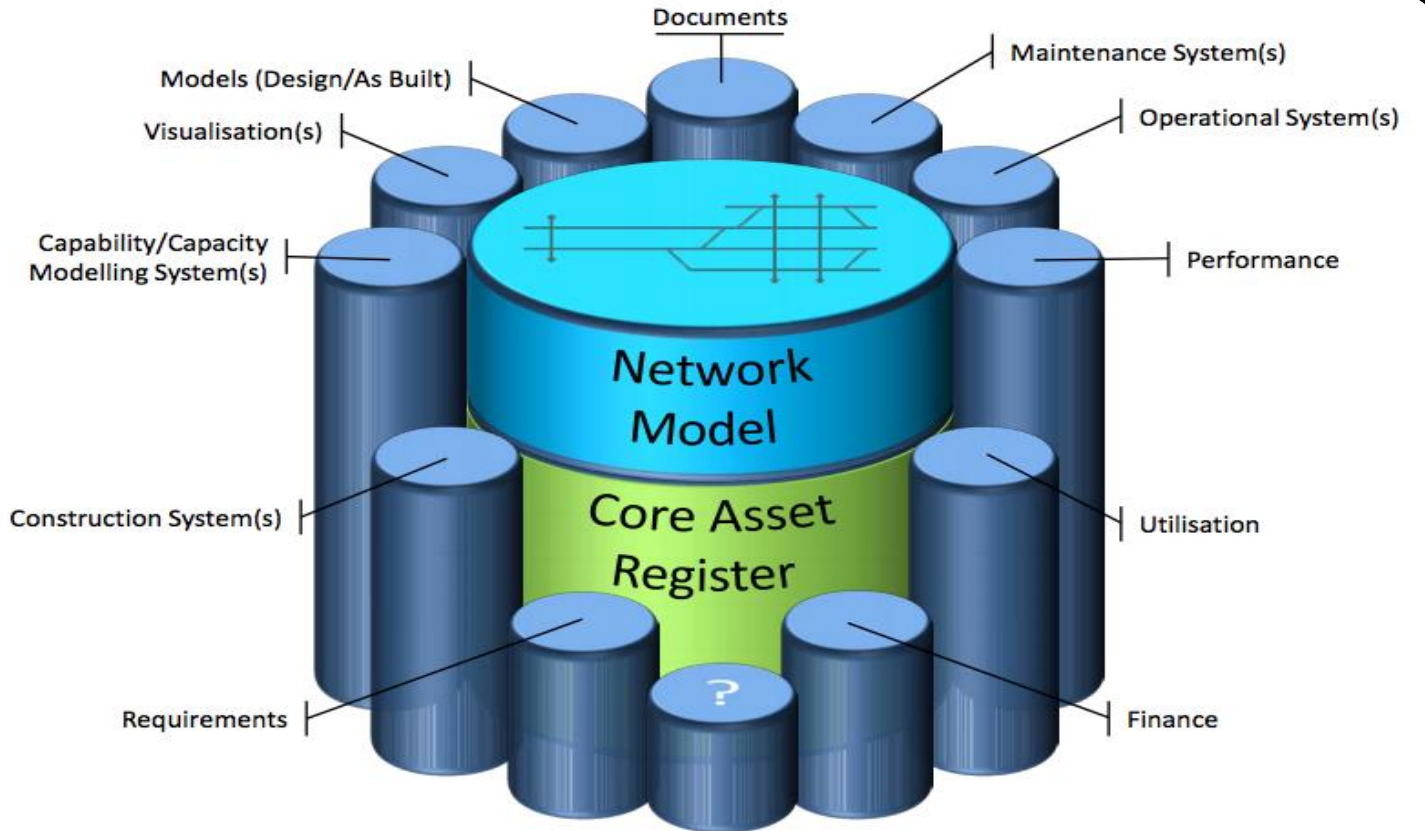
# OPPORTUNITY

Realise real value from our digital assets

# ASSET INFORMATION

## THE HEART OF THE VIRTUAL RAILWAY

- What?
- Where?
- Why?
- When?
- Which?
- Who?
- Whole-life?





The background of the slide is a dark, textured surface with a faint, large-scale image of a US dollar bill. The bill is oriented diagonally, with the top-left corner towards the upper left of the frame. The dollar sign and the number '1' are visible on the bill. The text is overlaid on this background in a bright yellow color.

HIGH SPEED 2  
£0.5BN SAVING  
LINKED TO BIM



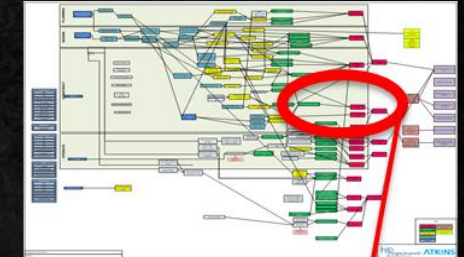
“BIM is our lifeblood ...  
our central nervous  
system”

Prof. Andrew McNaughton, Technical Director, HS2

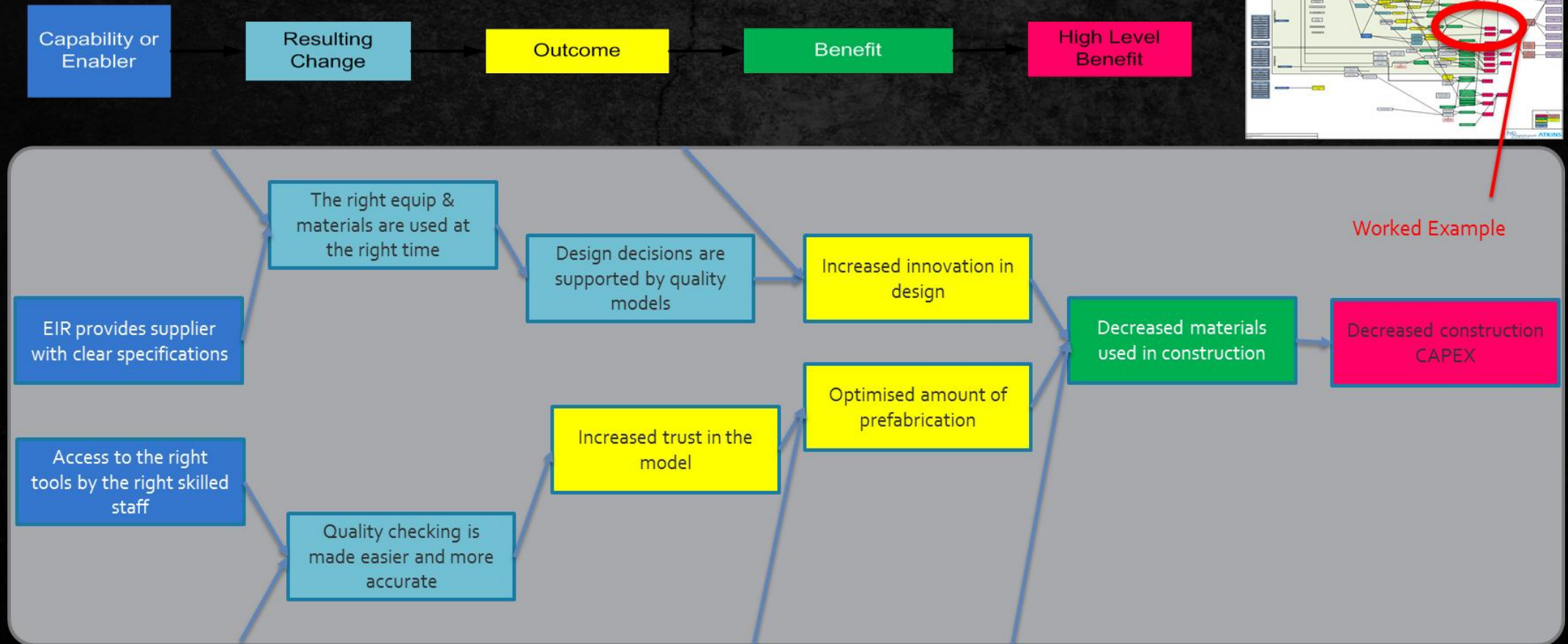


# MEASURING VALUE

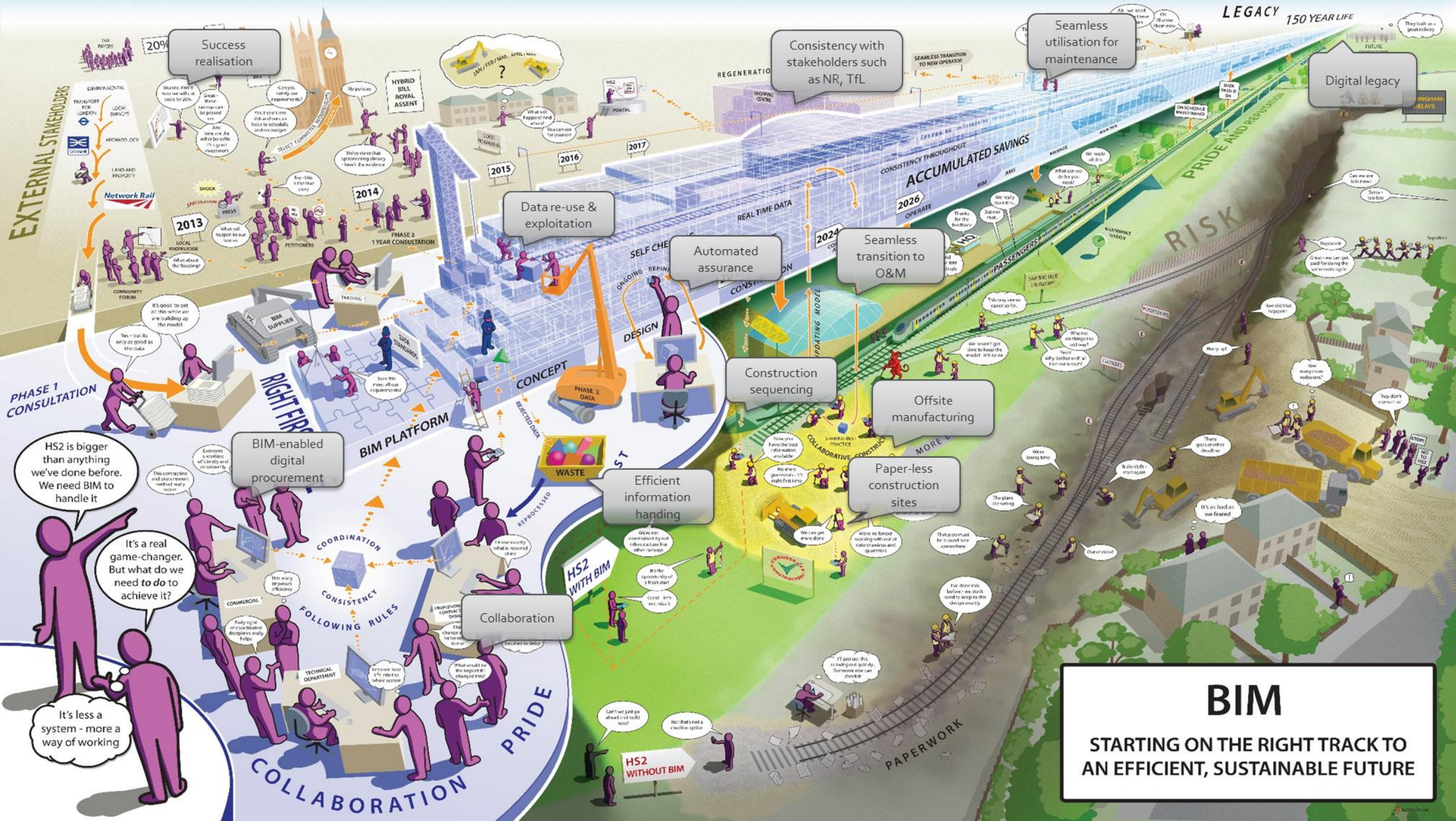
## BENEFITS



Worked Example

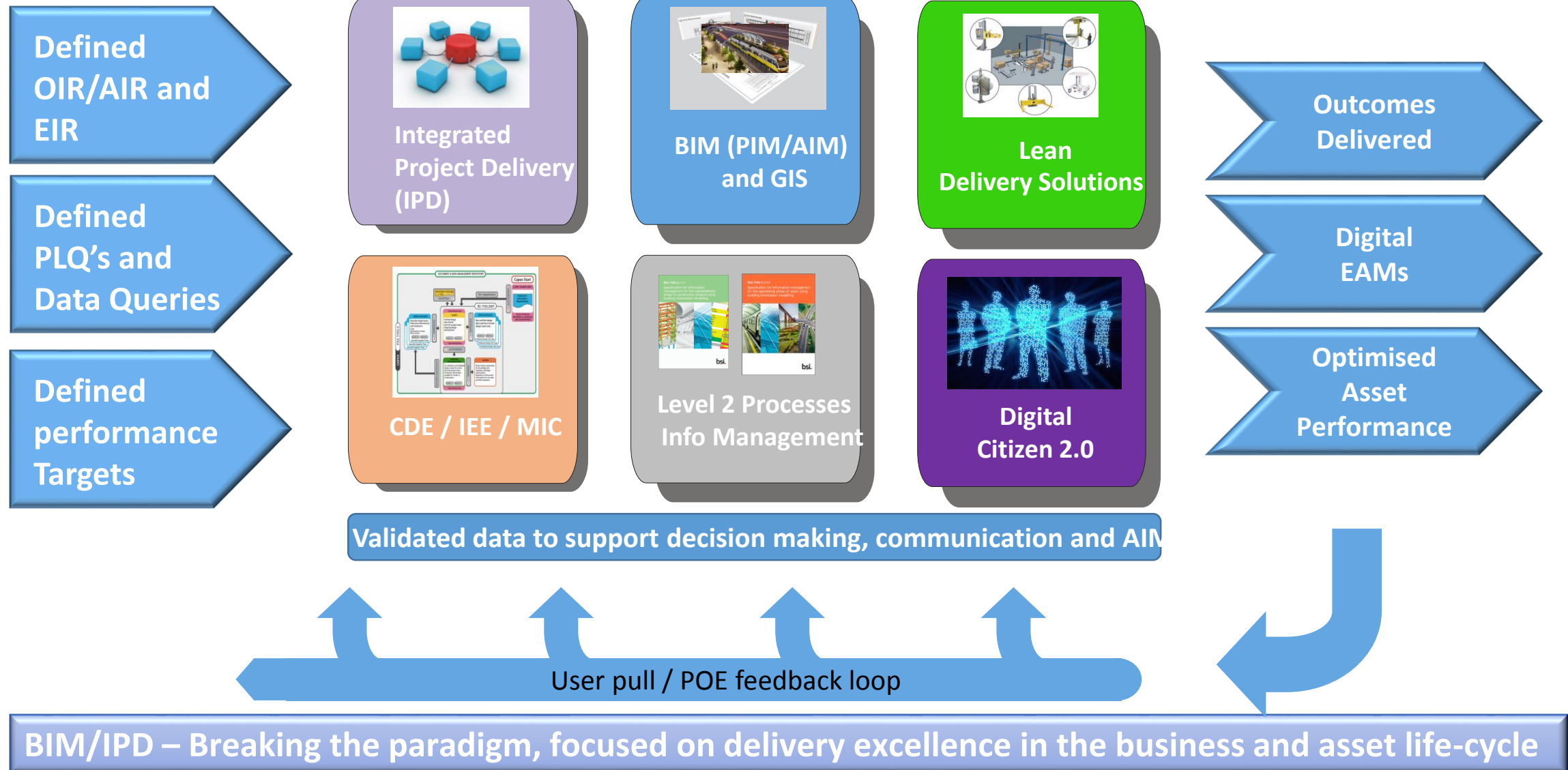








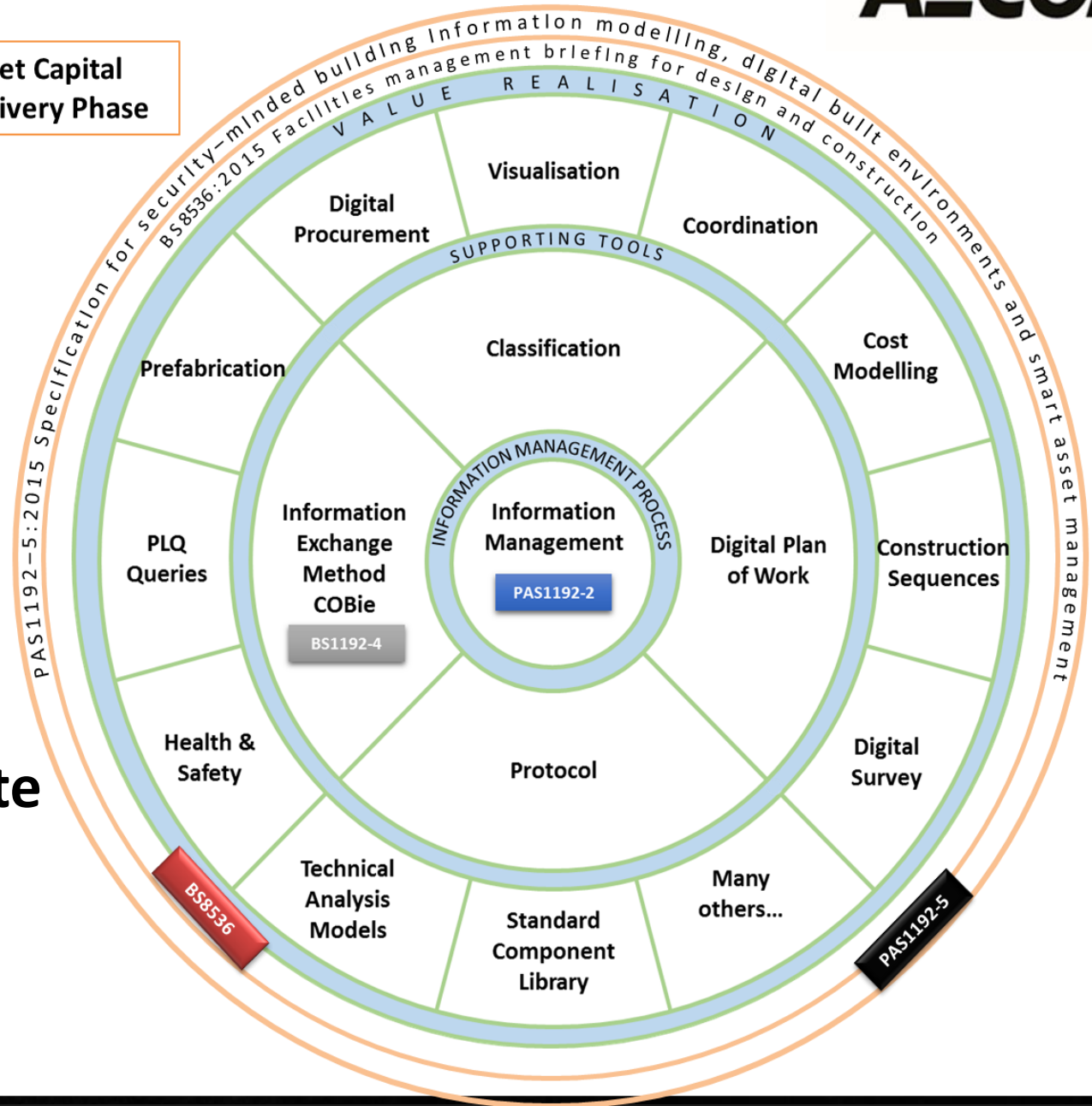
# BIM is just a component of a much wider issue. **Mass transit: we move people**



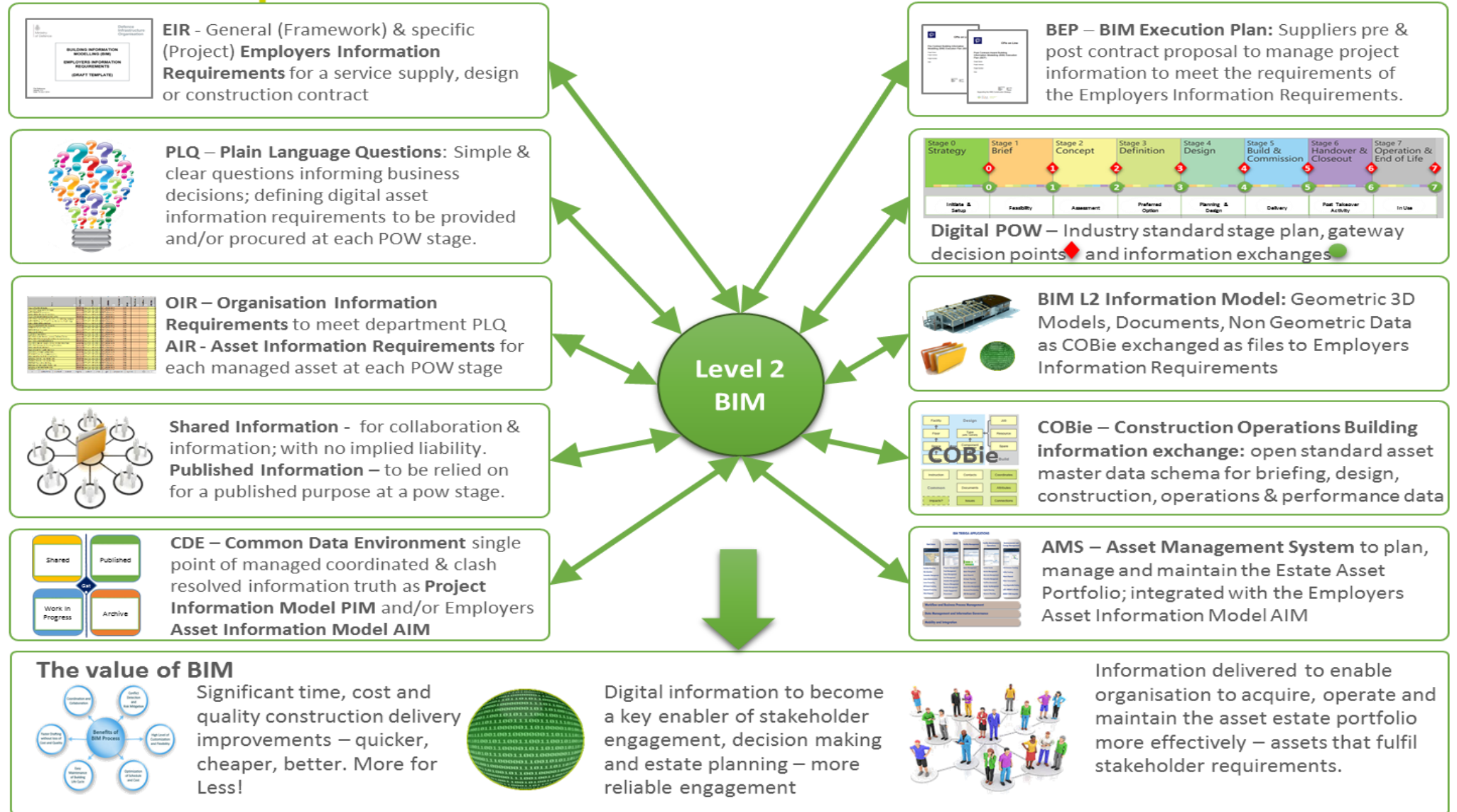
**Asset Capital  
Delivery Phase**



All centrally funded  
Government Departments  
will provide clear and complete  
“EIRs” with all contracts.



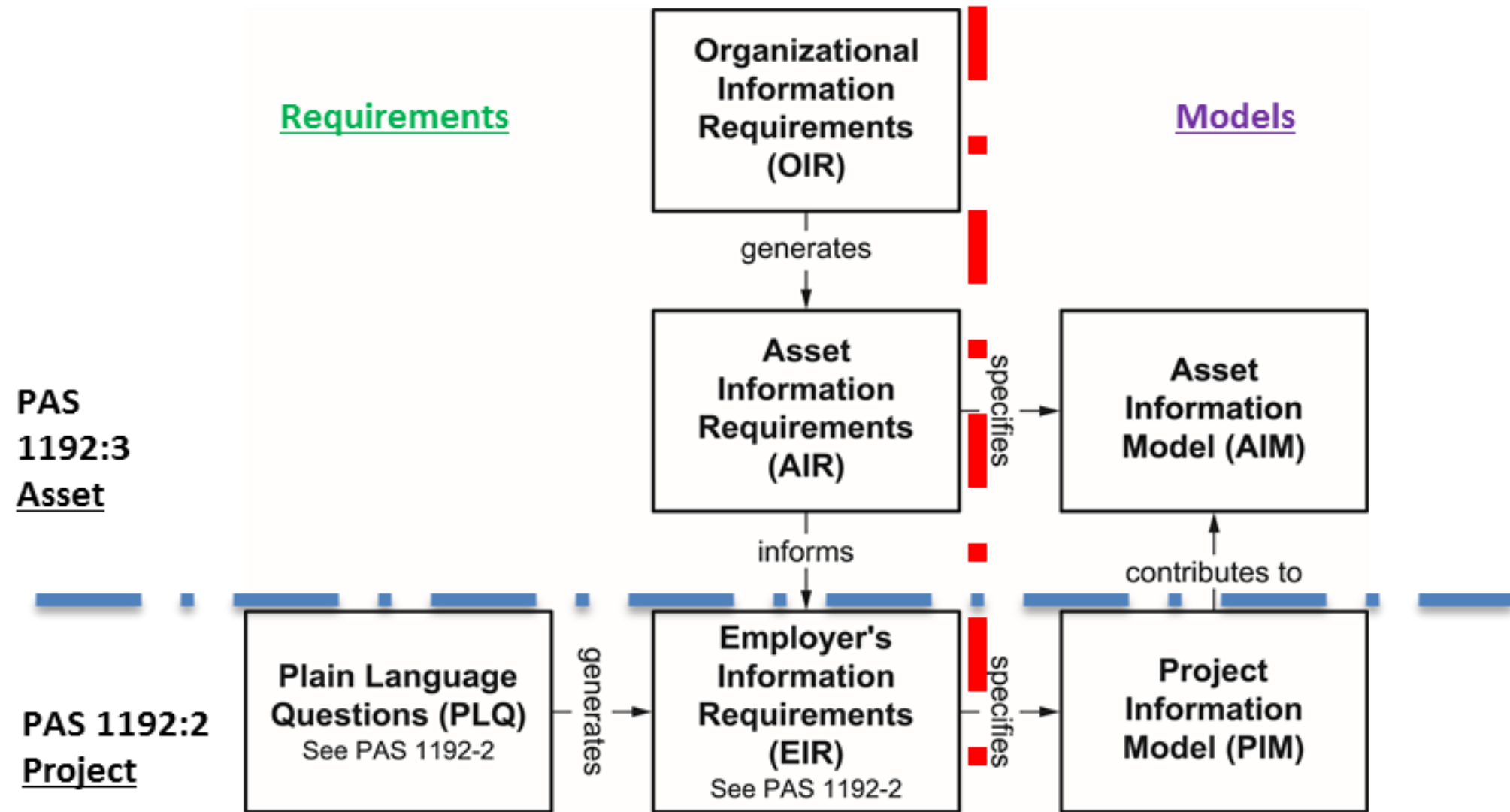
# BIM Level 2 components





# Essential components to a digital railway

Acknowledgement to BSI standards Ltd for underlying content.



# Data Driven Validated Stage Gateway Workflow



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

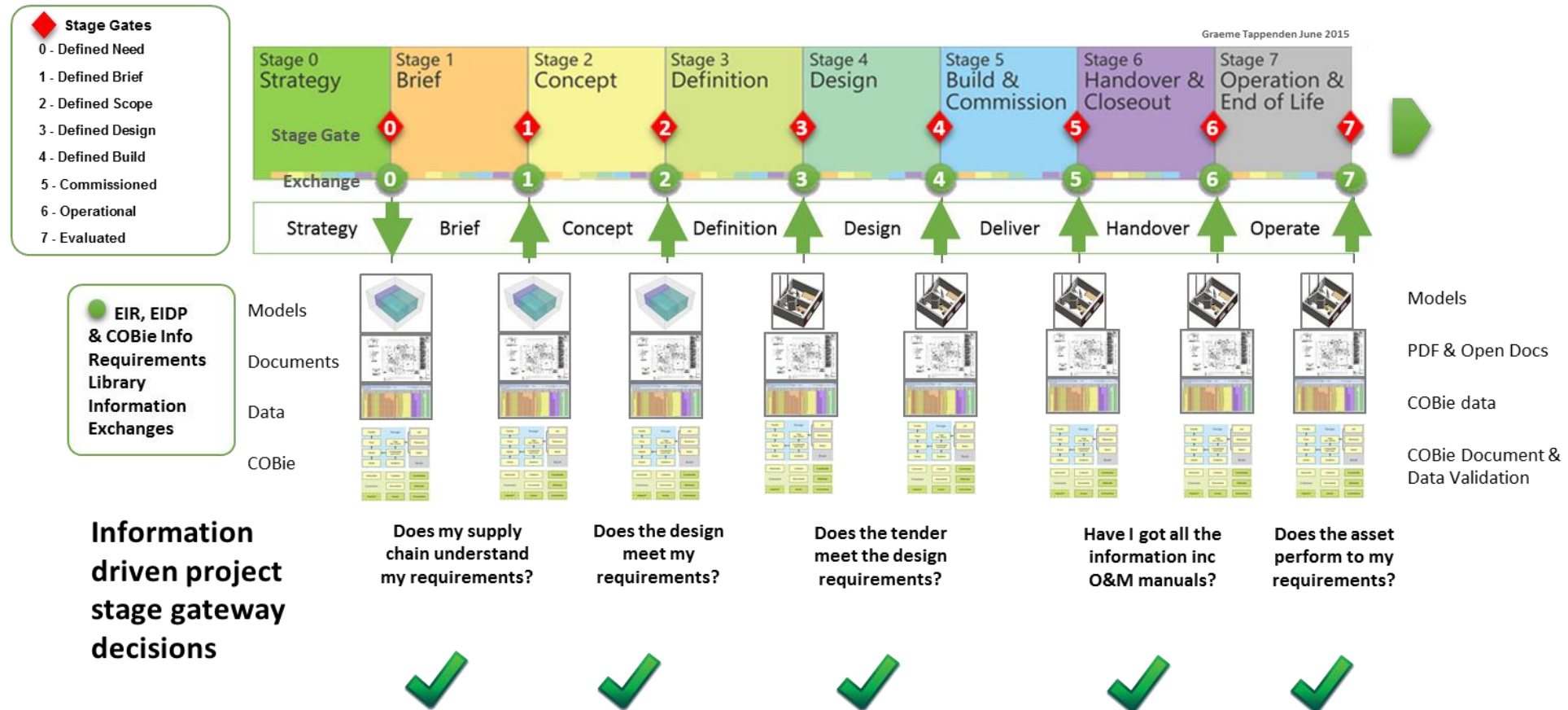
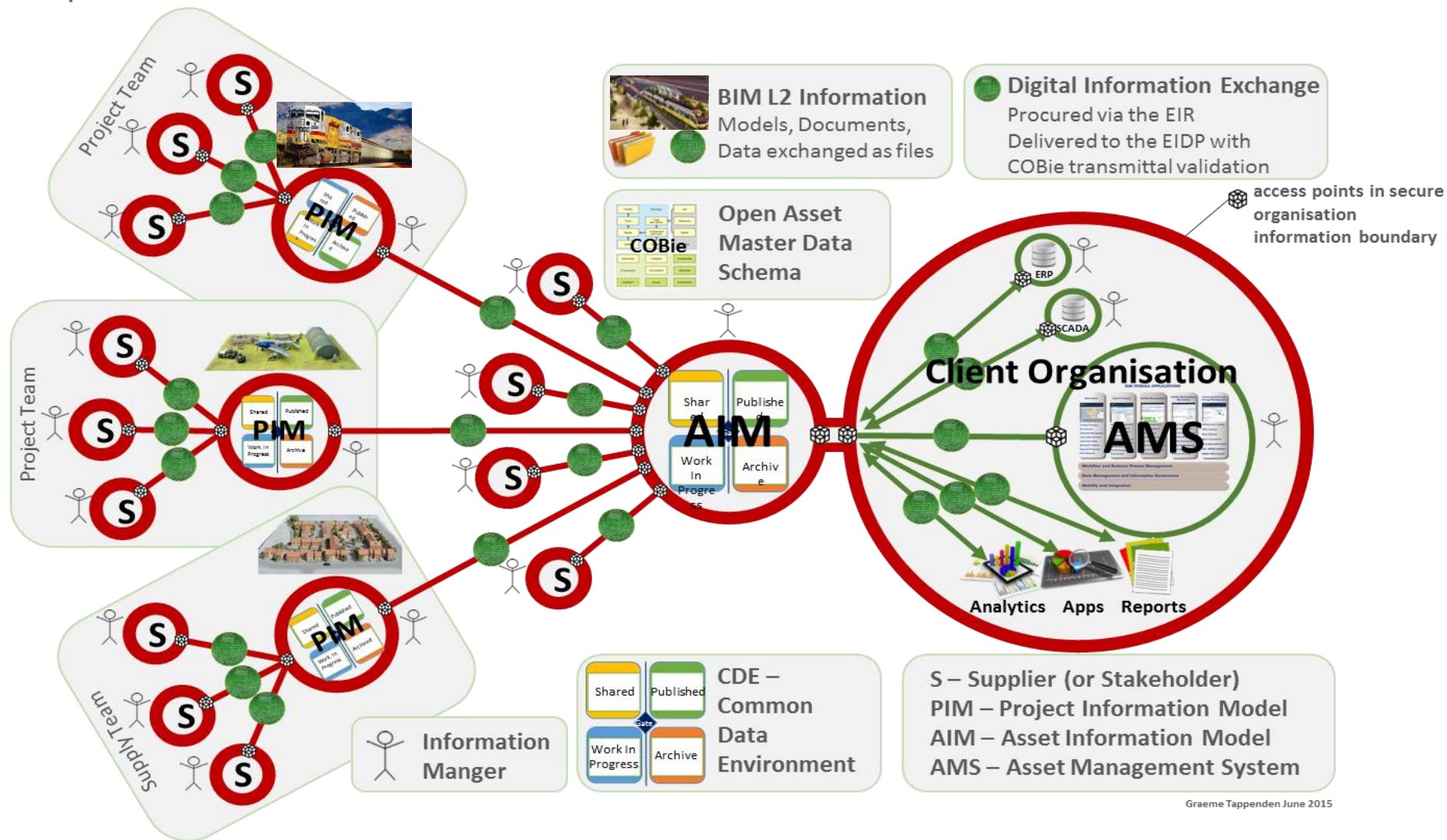


Image courtesy: Graeme Tappenden

# The Digital Built Rail Estate

## BIM Level 2 Implementation





Thank You

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