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# Building Information Modelling An Introduction

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## Overview of Presentation

- BIM Terminology & Acronyms
- Industry Context
- Development of BIM
- BIM Levels, Codes & Standards
- Critical Aspects of BIM
- BIM Research@cit
- Where to next?
- Concluding Remarks

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# BIM Terminology & Acronyms

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## Terminology and acronyms?!

**BIM** is an acronym for...

*a process known as...*      **'Building Information Modelling'**

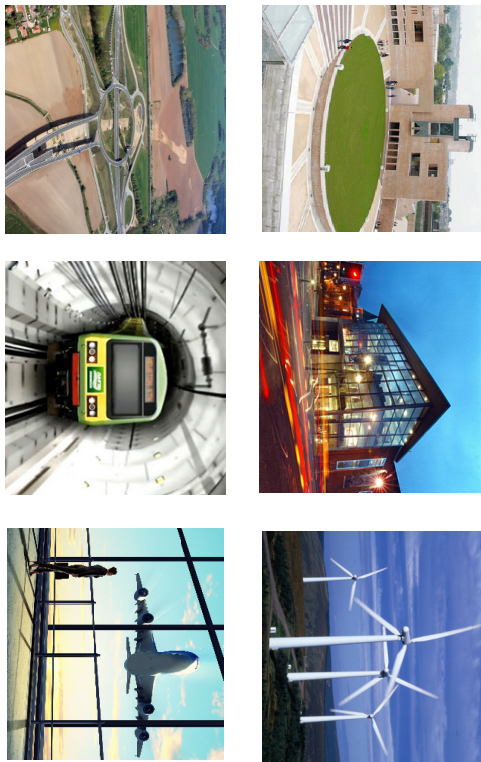
*an entity known as the...*      **'Building Information Model'**

*Note:*      Sometimes referred to as **'Building Information Management'**

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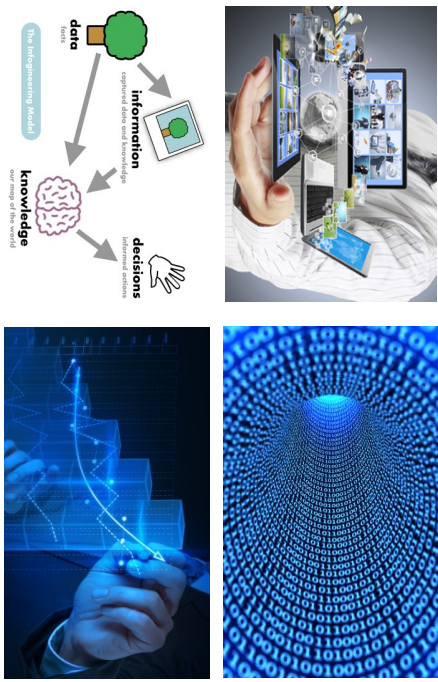
# Terminology and acronyms?!

## BUILDING



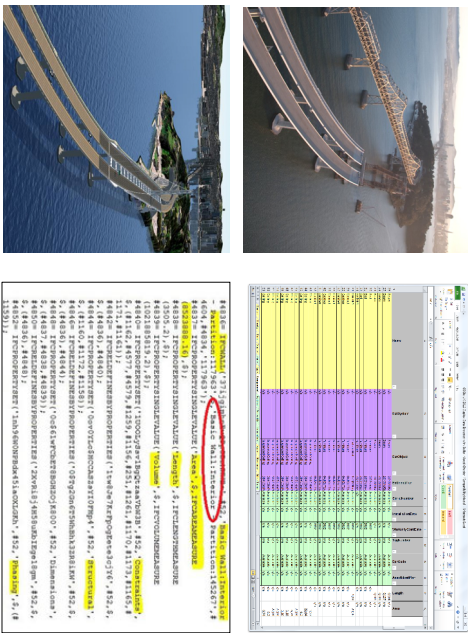
# Terminology and acronyms?!

## INFORMATION



# Terminology and acronyms?!

## MODELLING



## Definition

**BIM may be defined as...**

*“a digital representation of physical and functional characteristics of a facility.. and a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.” [1]*

*“a rich information model, consisting of potentially multiple data sources, elements of which can be shared across all stakeholders and be maintained across the life of a building from inception to recycling”. [2]*

Reference:  
1- [www.nationalbimstandard.org/faq.php#faq1](http://www.nationalbimstandard.org/faq.php#faq1)  
2- NBS UK.



# Industry Context

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# Industry Context

Features of current construction industry projects:

- High cost
- Unreliable cost
- Confrontational & litigious
- Late Delivery
- Unpredictable outcomes
- Poor as built data delivery
- Waste in process
- Whole life cost (Capex + Opex = Totex)

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## Industry Context

Continuity of information within the AEC industry is poor, consequently industry stakeholders need to address information that is

- Inaccurate
- Incomplete
- Ambiguous

*....but how will this be achieved?*

### **Building Information Modelling**

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## Development of BIM

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# Development of BIM – 1994



Key points:

- UK Government commissioned
- By Sir Michael Latham
- Investigate Construction Industry problems
- Author describes industry as:
  - Ineffective
  - Adversarial
  - Fragmented
  - Incapable of delivering for its customers
- Recommendations:
  - Client should be at the core of construction process
  - Integrated approach required with greater teamwork

# Development of BIM – 1998



Key points:

- Commissioned by Deputy Prime Minister
- By Sir John Egan
- Review progress since Latham Report (1994)
- Scope for improving quality and efficiency
- Outcomes:
  - Concern that industry was underachieving
  - Low profitability
  - Research, development and training under resourced
  - Excessive client dissatisfaction with industry performance
- Recommendations:
  - Target **10%** reduction in time and cost
  - Target 20% reduction in defects on projects
  - Create an integrated project process

# Avanti Project



- Avanti was a project from 2001-5 which formed the basis of BIM Standard BS1192
- Avanti DTI Project documentation & brand ownership transferred to Constructing Excellence
- Avanti is an approach to collaborative working that enables construction project partners to work together effectively

***“Construction comprises varying projects that require co-ordinated contributions from an increasing number of participants”***

Three aspects of the Avanti approach:

- 1) Getting people to work together
- 2) Providing processes to enable collaboration
- 3) Applying tools to support collaborative working

# Avanti Process – 1993-2008



Development of Heathrow Terminal 5 by the British Airport Authority (BAA):

- BAA sought to manage the design and construction much more closely
- Latest techniques in design data management as well as off-site manufacturing for construction introduced
- ‘Single Model Environment’ (SME) was at the core
- T5 programme achieved its major design and construction goals on time and on budget
- Mervyn Richards used the T5 project documentation to work within the UK government sponsored AVANTI project investigating ways to improve collaboration within AEC sector
- The principles of the AVANTI approach have now been enshrined in BS 1192:2007



**Project:**  
**Heathrow Terminal 5**  
**Client:**  
**British Airport Authority**  
**Architect:**  
**Richard Rogers**  
**Engineers:**  
**Arup & Mott MacDonald**  
**Contractor:**  
**Laing O'Rourke**

# Avanti Process – 1993-2008



AVANTI then implemented similar processes in other projects including the following with reported successes listed also:

**Endeavour House (Stansted, 1999)**

- Project cost saving of 9.8% (i.e. GB£365,000, equivalent to 50% of the expected overspend on previous buildings in the set of 5)
- Construction time reduction of 4 weeks



**PalaceXchange (Enfield 2005-06)**

- Project cost saving of 10% (GB£3,000,000)
- Contractor's profit margin increased from 2% to 4%
- Reduction in design iterative cycle of 25%



**St Helens and Knowsley Hospitals (Prescot 2006-09)**

- Reduced time in accessing project information
- Information accuracy and correct format ensured
- Improved design coordination

# Development of BIM – 2011



Government  
Construction  
Strategy

May 2011

Key points:

- Developed by UK Cabinet Office
- Recent studies indicate the UK does not achieve full value from public sector construction
- Identifies UK Central Government as the largest construction client
- Calls for a profound change in the relationship between public authorities and the construction industry
- Key target is to reduce costs by **20%** in five years

## Development of BIM – 2011



### Right Model:

- Clients issue a performance and outcome focused brief, designers and constructors work together on integrated solution
- Contractors engage key members of their supply chain in the design process where their contribution creates value
- Value for money and competitive tension are maintained by effective price benchmarking and cost targeting, by knowing what projects should cost, rather than through lump sum tenders based on inadequate documentation
- Supply chains are engaged on a serial order basis of sufficient scale and duration to incentivise research and innovation around a standardised (or mass customised) product
- Industry provided with sufficient visibility of the forward programme to make informed choices (at its own risk)
- Alignment of interest between those who design, construct, occupy and manage an asset/facility

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## Development of BIM – 2016



### 4<sup>th</sup> April 2016 – Start line for BIM Level 2!

Level 2 BIM for all UK central government infrastructure projects

Centrally funded government departments will be required to provide “clear and complete” Employer’s Information Requirements (EIRs) with all contracts

“4 April is BIM mandate date. Govt has handed the gauntlet to industry to meet it. Time for push is over. It’s time for [#AEC](#) to pull [#ICEBIM](#)”

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# Development of BIM – 2025

Start line for BIM Level 3!

The vision:

**33% Lower costs**

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

**50% Faster delivery**

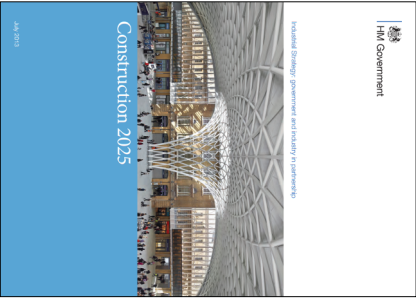
Reduction in the overall time, from inception to completion, for new-build and refurbished assets

**50% Improvement in exports**

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

**50% Lower emissions**

Reduction in greenhouse gas emissions in the built environment

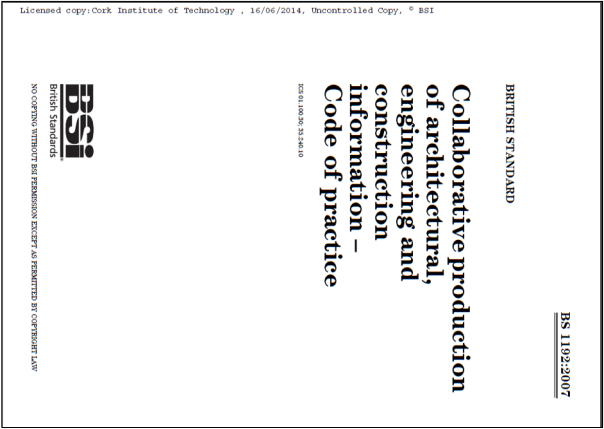


# BIM Levels, Codes & Standards

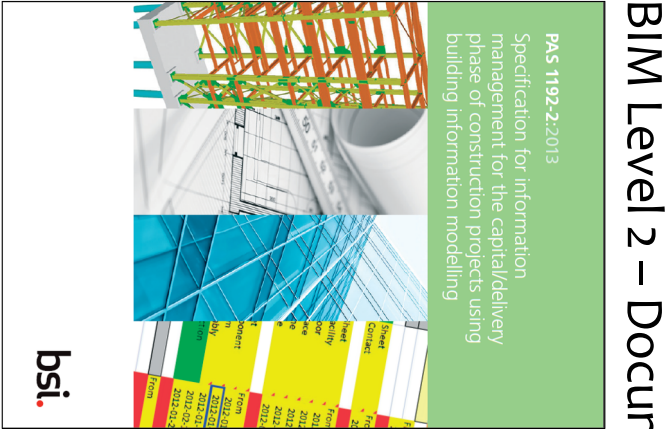




# BIM Level 2 – Documents & Tools



- BS 1192 Collaborative **production of architectural, engineering and construction information** – Code of practice
- Developed on Heathrow Terminal 5 and finalised by AVANTI
- Applicable to both the delivery and operational phases
- Process and structure of Common Data Environment (CDE)
- Standard container (e.g. file) naming convention
- Standard revision and status coding convention
- Standard suitability description convention



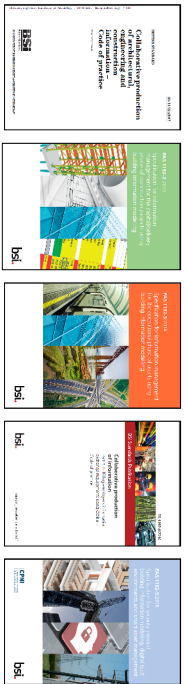
PAS 1192-2 Specification for **information management for the capital/delivery phase** of construction projects using building information modelling

- Publicly available standard
- Builds upon BS 1192:2007
- Framework document for BIM Level 2
- Technology agnostic
- Applicable to:    All sizes of project  
                          All types of procurement  
                          All types of asset

# BIM Level 2 – Documents & Tools



- PAS 1192-3 Specification for **information management** for the **operational phase** of assets using building information modelling
- For a client/employer this is a prequel to PAS 1192-2
  - Cross-references existing asset management standards
  - Applies to planned and unplanned events
  - PAS 1192-3 may be applied to existing 'non-BIM' assets where a suitable business case may exist

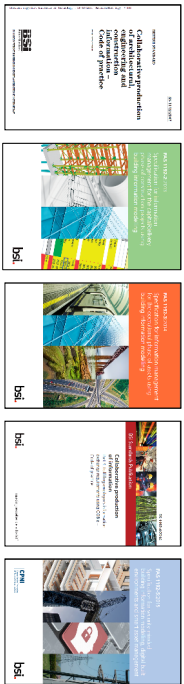


# BIM Level 2 – Documents & Tools




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

- Methodology for transfer of structured information
- Assists the demand side (e.g. employers, asset managers and facility managers) to specify expectations
- Assists information providers (e.g. lead designers and contractors) to prepare concise, unambiguous and accessible information
- Accommodates validation for compliance, continuity and completeness







# BIM Level 2 – Documents & Tools



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

CPNI  
Cork Institute of Technology  
Institute of Technology

bsi.



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

- Defines a 'sensitive asset', if 'sensitive' apply Part 5 (Not much that isn't sensitive, possibly a bus shelter)
- Covers a wide range of issues which have a common sense solution

# BIM Level 2 – Documents & Tools



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

bsi.



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

bsi.

Reference to the EIR places the BS/PAS 1192 series ahead of its only real rival NBIMS (i.e. National BIM Standard – United States) released in July 2015 (Version 3)





# BIM Level 2 – Documents & Tools



Developed over 4-5 year period by varying committees has resulted in inconsistencies

# BIM Level 2 – Documents & Tools

- BS1192 and PAS 1192-2 are process documents and are currently undergoing 'due process' to become ISO standards:

**ISO/WD 19650-1**

Organization of information about construction works --

Information management using building information modelling –

**Part 1: Concepts and principles**

**ISO/WD 19650-2**

Organization of information about construction works --

Information management using building information modelling –

**Part 2: Delivery phase of assets**

- CEN confirmed that it will adopt these standards (Decision November 2015)
- Publication expected in early 2017
- Individual countries will be determine their own approach to Part 4, Part 5, BS 8536-1 and the 'BIM Toolkit'

# BIM Level 2 – Documents & Tools

BIM Toolkit includes two key aspects:

Digital Plan of Work  
(DPoW)

Unified Classification  
System

- Free and easy to use web portal which guides users through the construction process
- Provides step-by-step support to define, manage and validate responsibility for information development and delivery at each stage of the asset lifecycle
- Fundamental to successful delivery of project to BIM Level 2
- It is said to save time, reduce risk and assist users in following best practice



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# BIM Level 2 – Documents & Tools

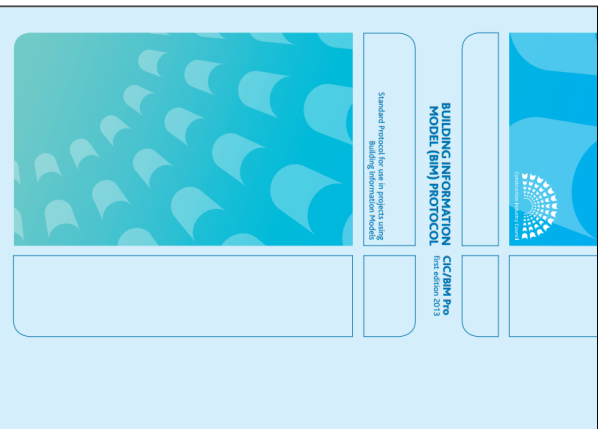
BS 8536-1:2015 Briefing for design and construction.  
Part 1: Code of practice for facilities management  
(Buildings infrastructure)

- Originally published in 2010 and separate to Government Soft Landings (GSL) policy statements
- In 2015 GSL policy statements were integrated into BS 8536
- Requirement for commitment from design and construction team to aftercare post construction
  - Applies to projects commencing after 4<sup>th</sup> April 2016
  - Policies are in place to address insurance issue
  - Full details of “commitment” yet to be defined



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## BIM Level 2 – Documents & Tools



- CIC Building Information Model (BIM) **Protocol**
- Solely related to the exchange, use and liability of information (i.e. all design responsibility remains separate)
- Priority of contract documents
- Obligations of Employer and Project Team
- May be simply attached to existing contracts but this can lead to issue
- Network Rail incorporated the Protocol within their main suite of contracts to 'plug the gaps' – this approach is advised but may be costly
- “Written by lawyers for lawyers”

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Critical Aspects of the BIM

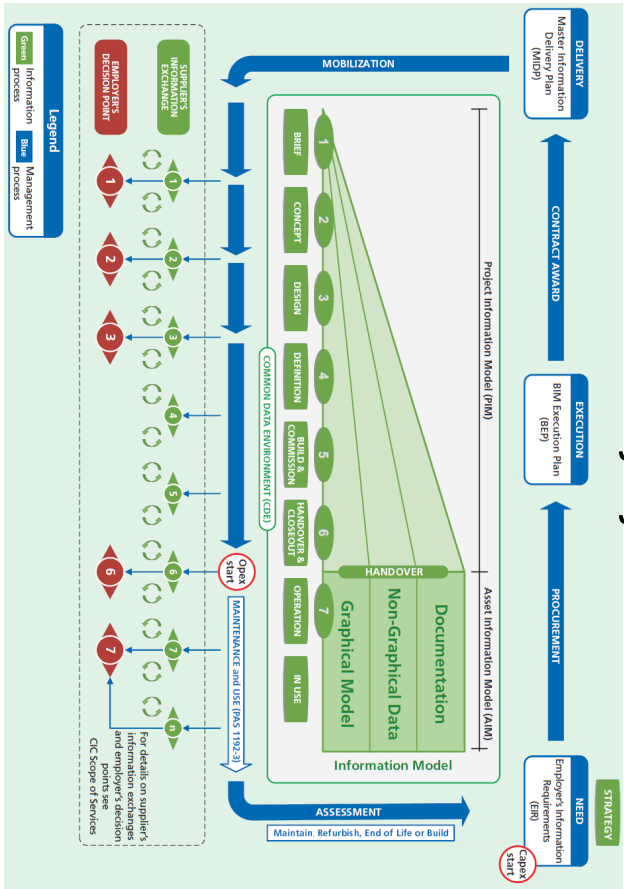
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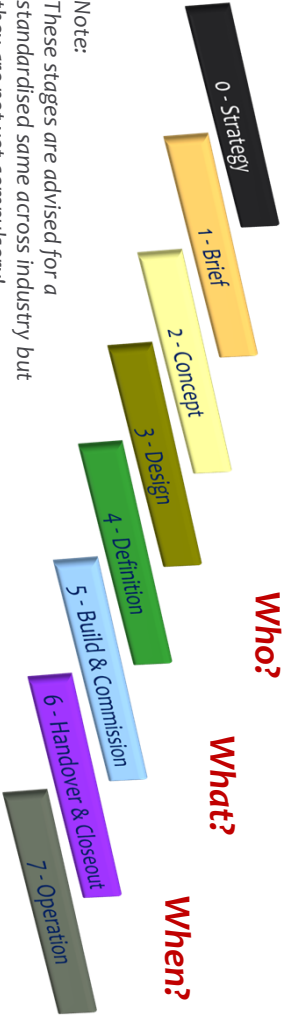
# Critical Aspects of BIM

- Information Delivery Cycle
- Digital Plan of Work (DPoW) & Classification
- Level of Definition
- Common Data Environment (CDE)
- Federated Model
- Data Exchange

# Information Delivery Cycle



# Digital Plan of Work



Note:  
These stages are advised for a standardised same across industry but they are not yet compulsory!

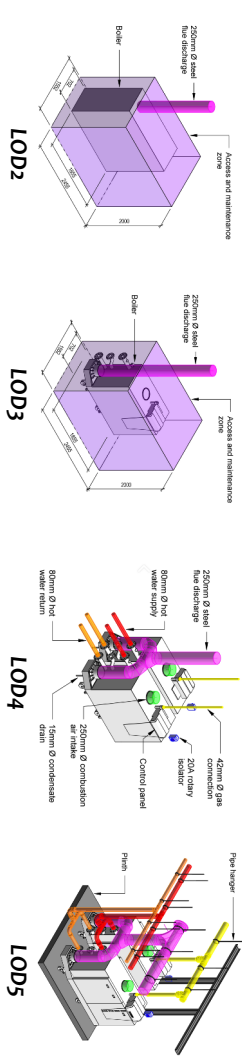
- Free tool specifically designed to enable the project lead to clearly define the team, responsibilities and an information delivery plan for each stage of a project
- The DPOW will be intrinsically linked to a new pan-industry naming system (i.e. Uniclass 2015)

# Level of Definition

Defined in PAS 1192-2 as the .....  
“collective term used for and including ‘level of model detail’ and the ‘level of information detail’”.

## Level of model Detail

- Description of graphical content on models at each of the defined delivery stages

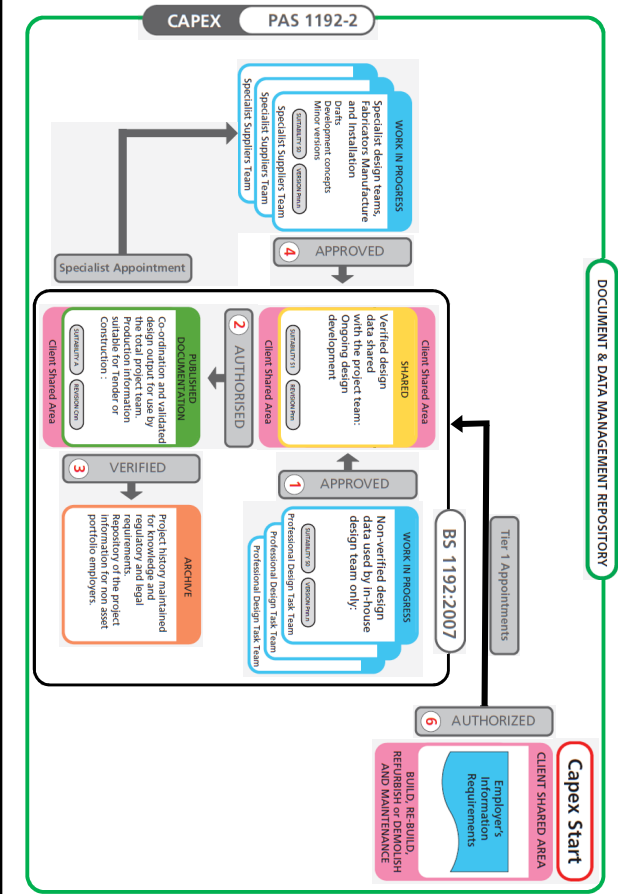


## Level of model information

- Description of non-graphical content in models at each of defined delivery stages
- Level of information defines how much detail is required at each of these stages – i.e. whether spatial, performance, standard, workmanship, certification etc.

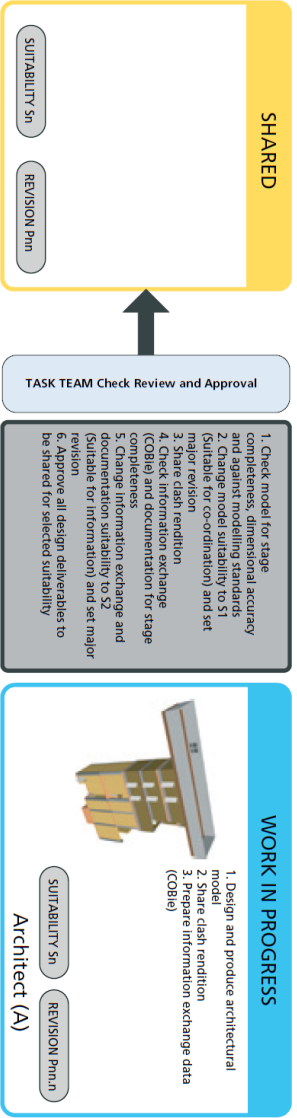
# Common Data Environment (CDE)

PAS 1192-2  
(Section 9 - Page 26)  
PAS 1192-2  
Figure 15  
Extending the  
common data  
environment  
(CDE)

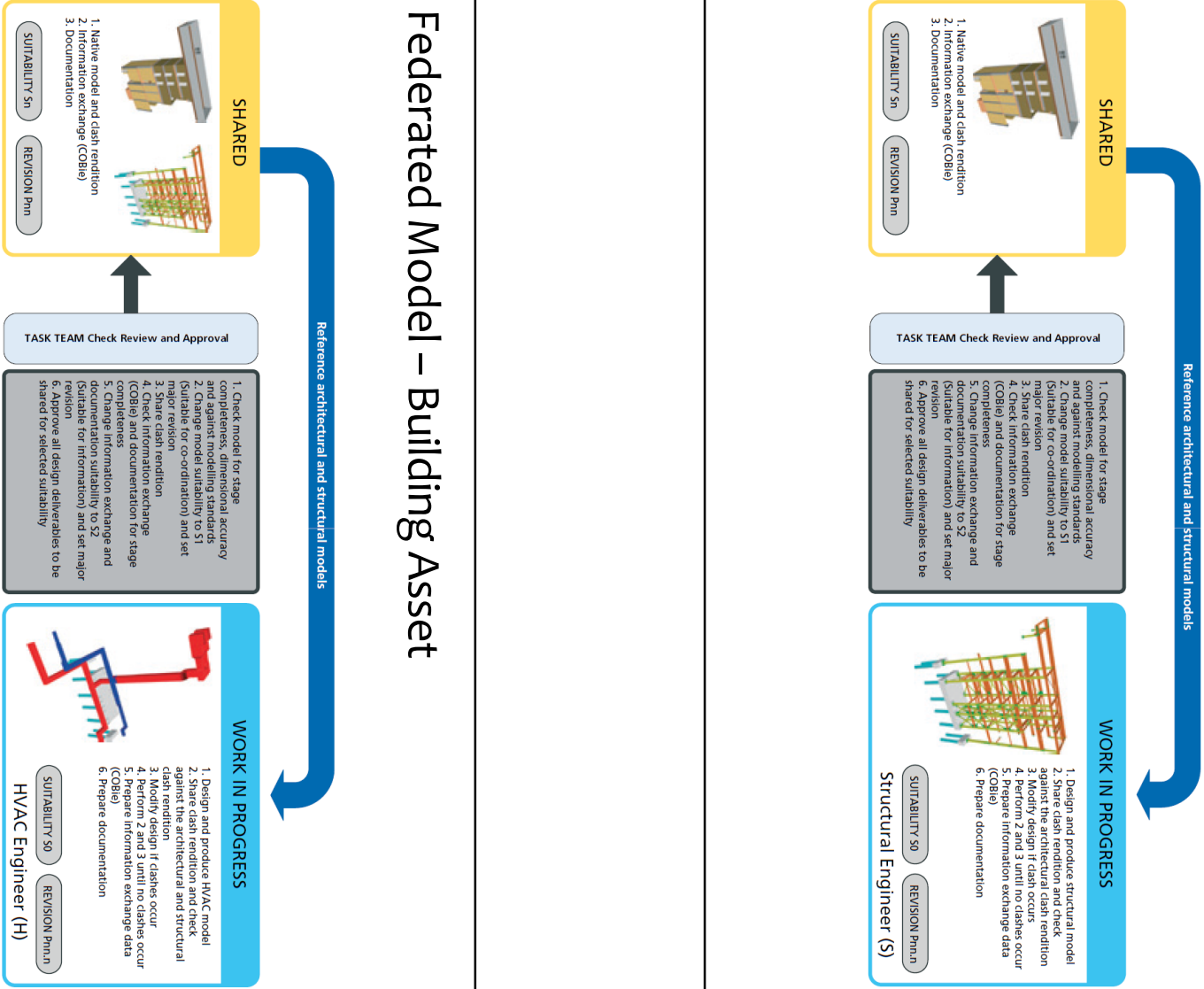


# Federated Model – Building Asset

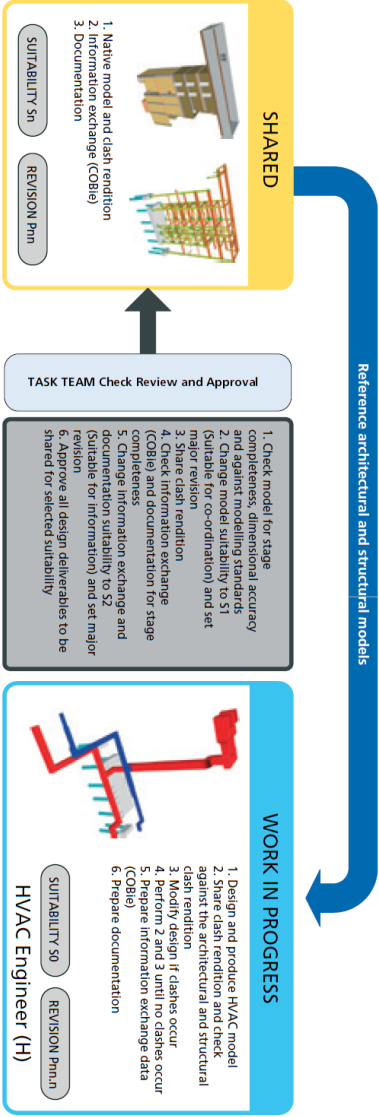
Combined Building Information Model compiled by amalgamating several different models into one (or importing one model into another; i.e. 'collaborative' working).



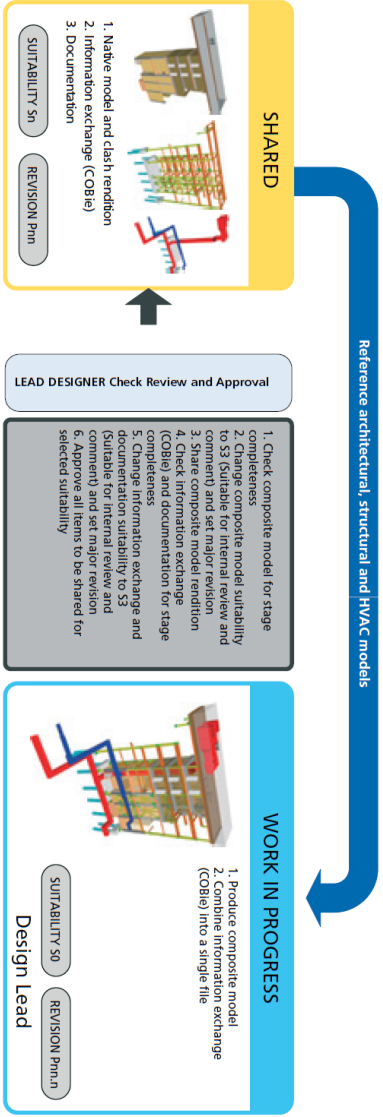
# Federated Model – Building Asset



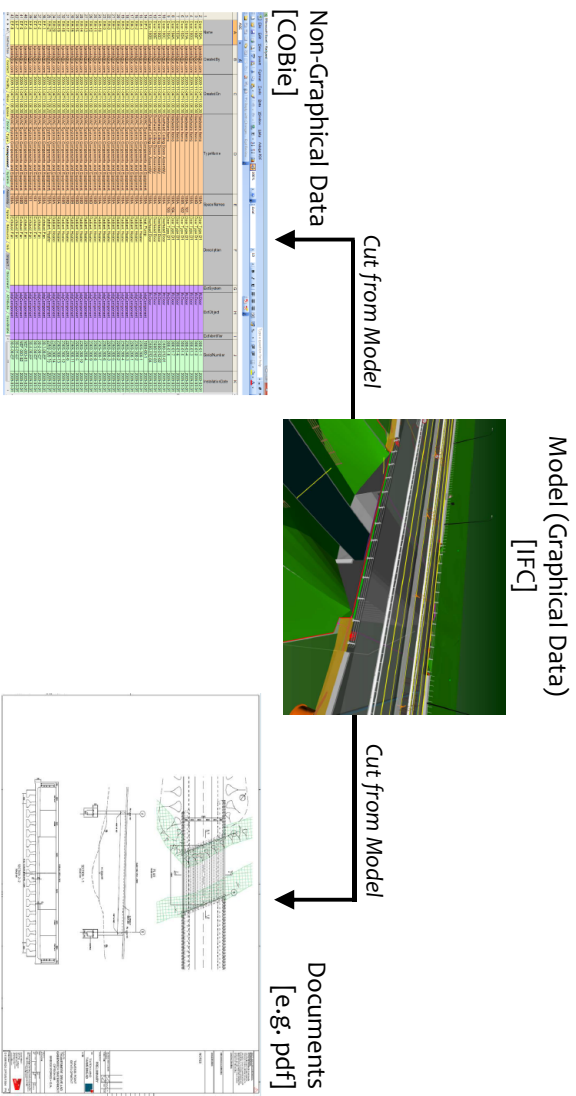
# Federated Model – Building Asset



# Federated Model – Building Asset



# Information Exchange





# Barriers to Collaboration

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## Barriers

*“I don’t want to use other peoples models - they are usually incorrect”*

**‘Check-Review-Approve’ procedure as per PAS 1192-2**

*“I don’t want to share my models – someone may change them”*

**Model cannot be changed outside of the WIP state**

*“Other people will use my information for a purpose that I have no control over”*

**Suitability status set as per PAS 1192-2 & CIC BIM Protocol requirements**

*“My professional indemnity does not allow me to share my information”*

**CIC Best Practice Guide for Professional Indemnity Insurance  
when using Building Information Modelling**

*“It’s too expensive”*

**It can be at the outset but efficiencies are  
typically realised after three projects.**

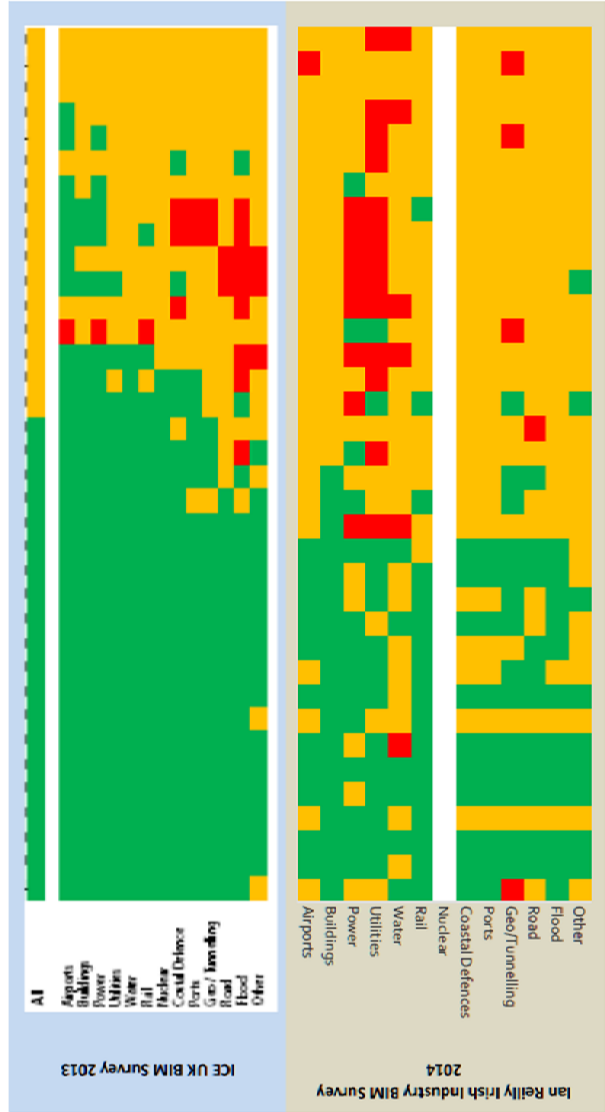
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# BIM Research@cit

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## BIM in Ireland



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# BRIM – Chetwynd Viaduct



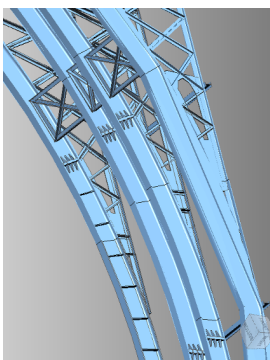
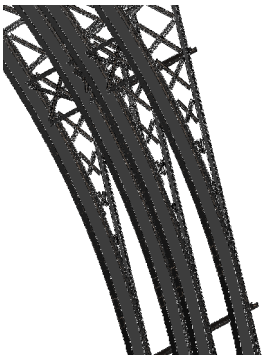
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# BRIM – Chetwynd Viaduct

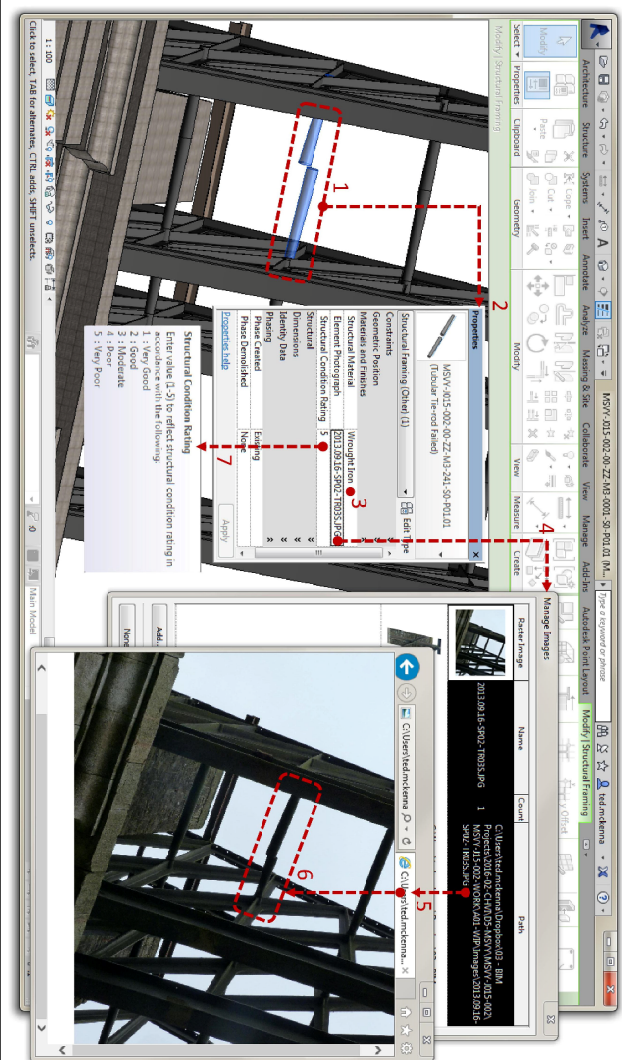


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# BRIM – Chetwynd Viaduct



# BRIM – Chetwynd Viaduct



# Open Invitation

- Industry is where 'real' BIM is delivered
- CIT recognises its responsibility to support local industry
- CIT is open to collaboration.....

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Where to next?

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# Concluding Remarks

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# Summary

BIM is about **Information**.....

- Need for accurate, complete, unambiguous **Information** (Avanti Programme in UK)
- Planning for **Information** (NBS BIM Toolkit (UK); Who?What?When?)
- Employers **Information** Requirements (EIR)
- Production of AECCO **Information** (BS 1192; CDE)
- Management of **Information** (PAS 1192-2&3; Information Delivery Cycle; Federated Models)
- **Information** Exchange (BS 1192-4; COBie)
- **Information** Security (PAS 1192-5)
- **Information** for performance evaluation (BS 8536; Soft Landings)

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# Summary

BIM is about **Collaboration**.....

- **Collaborate** using existing contracts .....*for now* (CIC BIM Protocol)
- Employers need to be **central** to the process
- Processes to enable people to work **together**
- Multi-discipline **teamwork** to achieve optimum solutions
- **Multi-stakeholder** involvement to inform lifecycle decision making

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Thank you for listening

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