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AECOM

BIM

A UK Perspective

RIBA Plan of Work 2013

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Context – Computerisation & Employment

THE FUTURE OF EMPLOYMENT: HOW SUSCEPTIBLE ARE JOBS TO COMPUTERISATION?*

Carl Benedikt Frey† and Michael A. Osborne‡

September 17, 2013

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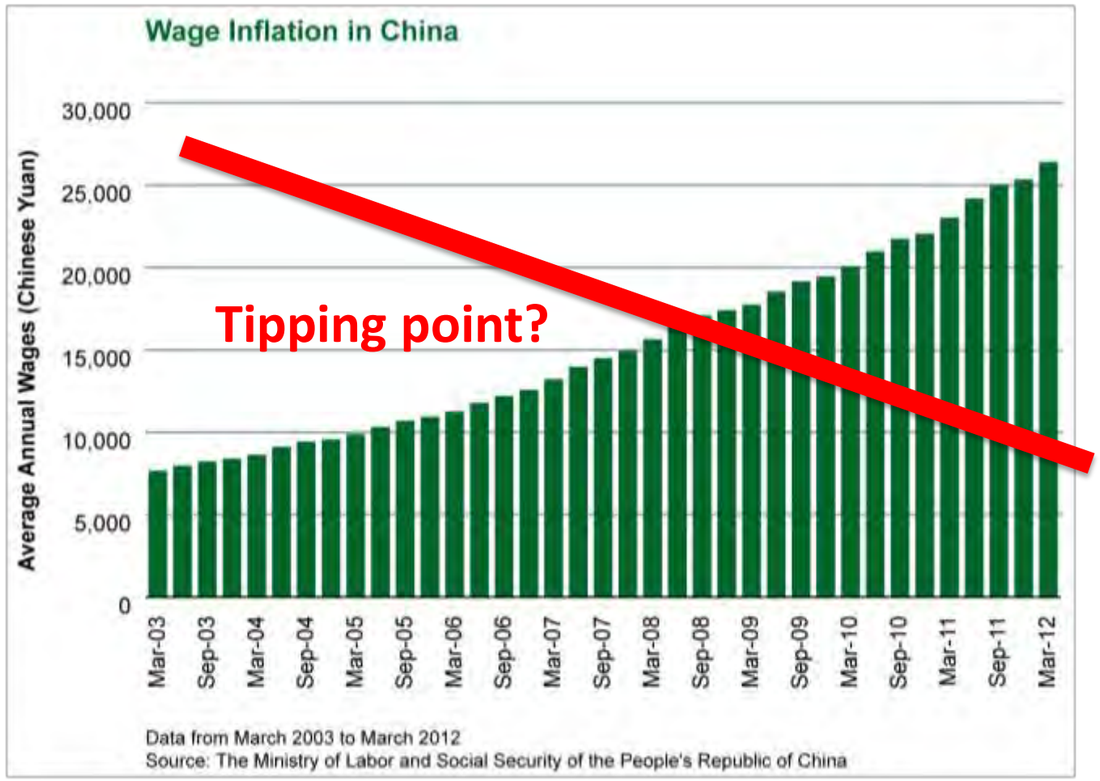
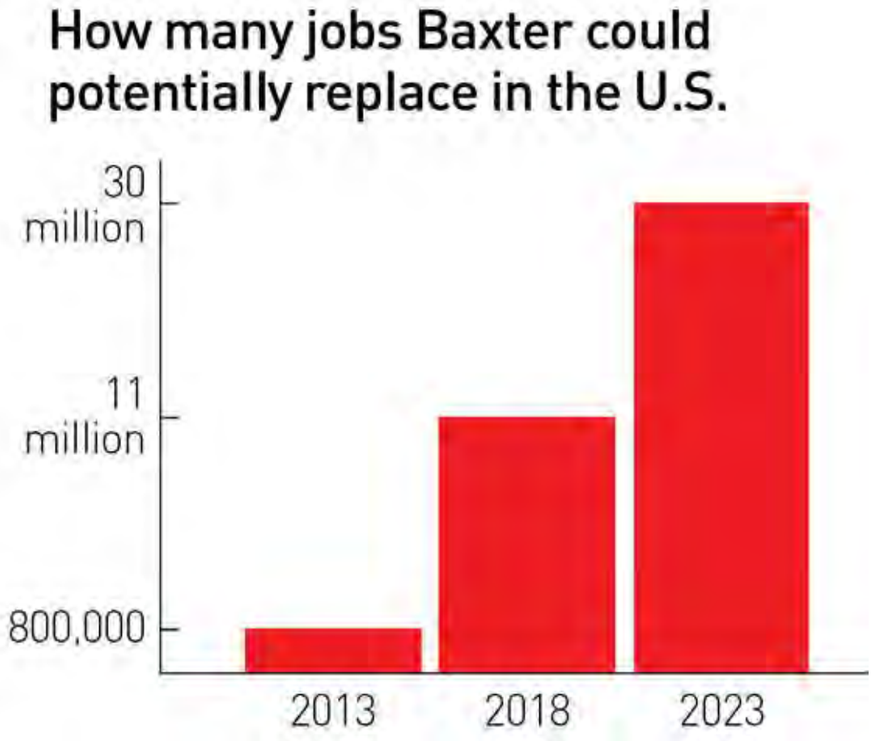
Context

RIBA Plan of Work 2013

Context





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Context – Computerisation & Employment

Occupation	Probability
Mechanical Engineers	0.011
Architectural & Engineering Managers	0.017
Architects	0.018
Civil Engineers	0.019
Interior Designers	0.022
Lawyers	0.035
Landscape Architects	0.045
Construction Managers	0.071
Electrical Engineers	0.1
Electricians	0.15
Construction Trades Supervisors	0.17
Engineering Technicians	0.24
Plumbers & Pipefitters	0.35
Surveyors	0.38
Mechanical Engineering Technicians	0.38
Architect and Civil Draftsmen	0.52
Tapers	0.62
Construction & Building Inspectors	0.63
Mechanical Insulation Workers	0.64
Mechanical Draftsmen	0.68

Occupation	Probability
Construction & Related Workers	0.71
Carpenters	0.72
Glaziers	0.73
Tile & Marble Setters	0.75
Painters	0.75
Civil Engineering Technicians	0.75
Drywall and Ceiling Installers	0.79
Floor layers	0.79
Brick masons	0.82
Labourers	0.88
Terrazzo workers	0.88
Roofers	0.9
Crane and tower operators	0.9
Electrical Installers (inc lifts)	0.91
Model makers	0.93
Accountants	0.94
Surveying and mapping technicians	0.96
Estate agents	0.97
Insurance underwriters	0.99

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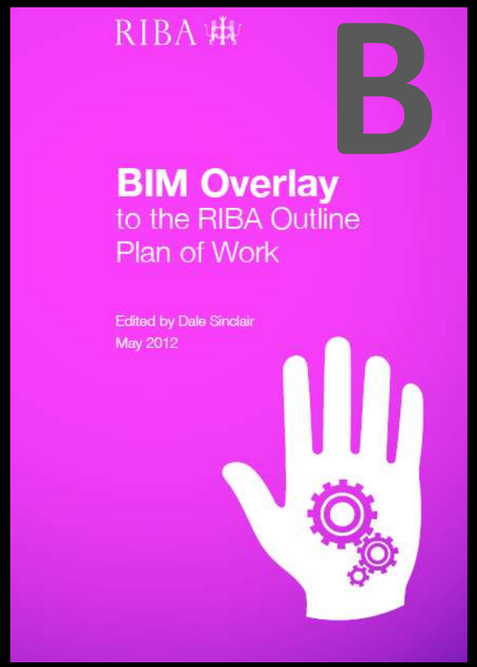
BIM Maturity



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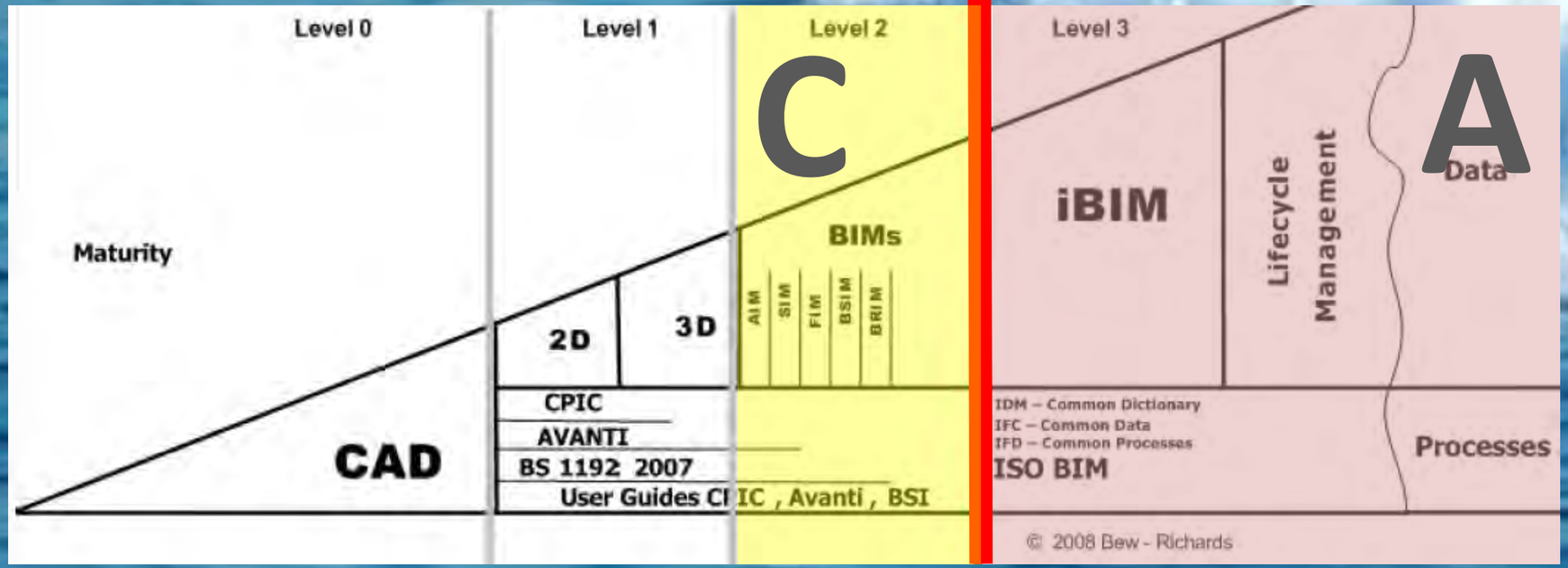
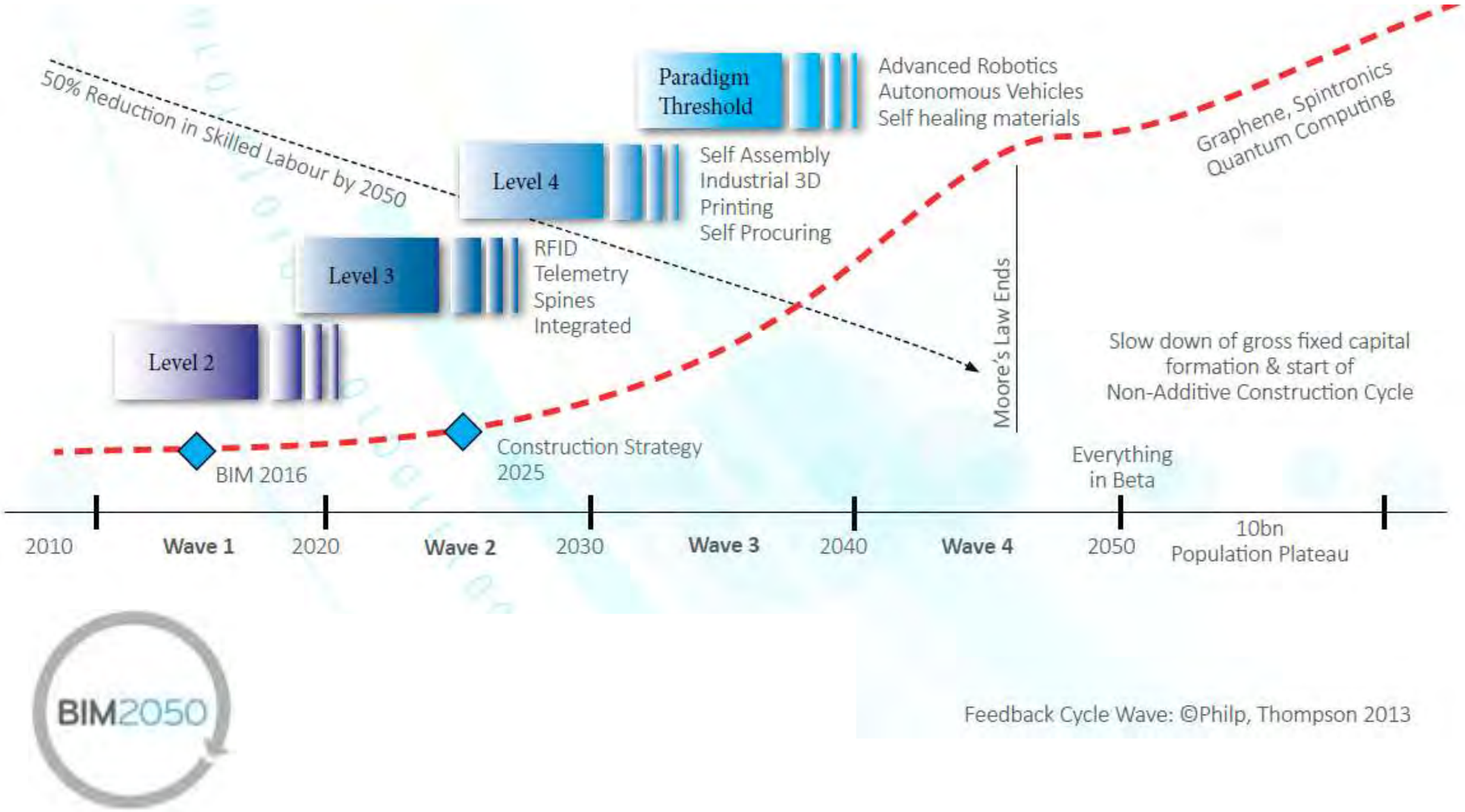
Work
2013

2016

- **L0 – Processes & protocol**
- **L1 – Geometry & data**
- **L2 – Analogue to digital**



Level 3


50% Reduction in Skilled Labour by 2050
Paradigm Threshold
Advanced Robotics
Autonomous Vehicles
Self healing materials
Level 4
Self Assembly
Industrial 3D Printing
Self Procuring
Level 3
RFID
Telemetry
Spines
Integrated
Level 2
Graphene, Spintronics
Quantum Computing
Moore's Law Ends
Slow down of gross fixed capital formation & start of Non-Additive Construction Cycle
BIM 2016
Construction Strategy 2025
Everything in Beta
2010
Wave 1
2020
Wave 2
2030
Wave 3
2040
Wave 4
2050
10bn Population Plateau
BIM2050
Feedback Cycle Wave: ©Philp, Thompson 2013

Level 3

1. L2 with improved contracts and IFC (instead of COBie)
2. New Contracts
3. Internet of Things
4. International

. . . . . Geared to parliamentary cycles

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RIBA Outline Plan of Work 2007

This Outline Plan of Work organises the process of managing and designing building projects and administering building contracts into a number of key Work Stages. The sequence or contents of Work Stages may vary or they may overlap to suit the procurement method (see pages 2 and 3).

		RIBA Work Stages	Description of key tasks	OGC Gateways
Preparation	A	Appraisal	Identification of client's needs and objectives, business case and possible constraints on development. Preparation of feasibility studies and assessment of options to enable the client to decide whether to proceed.	1
	B	Design Brief	Development of initial statement of requirements into the Design Brief by or on behalf of the client confirming key requirements and constraints. Identification of procurement method, procedures, organisational structure and range of consultants and others to be engaged for the project.	2
Design	C	Concept	Implementation of Design Brief and preparation of additional data. Preparation of Concept Design including outline proposals for structural and building services systems, outline specifications and preliminary cost plan. Review of procurement route.	3
	D	Design Development	Development of concept design to include structural and building services systems, updated outline specifications and cost plan. Completion of Project Brief. Application for detailed planning permission.	
	E	Technical Design	Preparation of technical design(s) and specifications, sufficient to co-ordinate components and elements of the project and information for statutory standards and construction safety.	4
Pre-Construction	F	Production Information	F1 Preparation of detailed information for construction. Application for statutory approvals. F2 Preparation of further information for construction required under the building contract. Review of information provided by specialists.	
	G	Tender Documentation	Preparation and co-ordination of tender documentation in sufficient detail to enable tenders or versions to be obtained for the project.	
	H	Tender Action	Identification and evaluation of potential contractors and/or specialists for the project. Obtaining and appraising tenders; submission of recommendations to client.	5
Construction	J	Mobilisation	Letting the building contract, appointing the contractor. Issuing of information to the contractor. Arranging site hand over to the contractor.	
	K	Construction to Practical Completion	Administration of the building contract to Practical Completion. Provision to the contractor of further information as and when reasonably required. Review of information provided by contractors and specialists.	6
Use	L	Post Practical Completion	L1 Administration of the building contract after Practical Completion and making final inspections. L2 Assisting building user during initial occupation period. L3 Review of project performance in use.	7

These tasks in italics may be carried out to suit project requirements, ie:
D Application for detailed planning approval;
E Statutory standards and construction safety;
F1 Application for statutory approvals; and
F2 Further information for construction.
G-H Invitations and appraisal of tenders

Royal Institute of British Architects Page 1 of 1 ©RIBA 2007

1963

Plan of Work for Design Team Operations

1967

1973

1998

2007

2013

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Context – Paradigm Shifts

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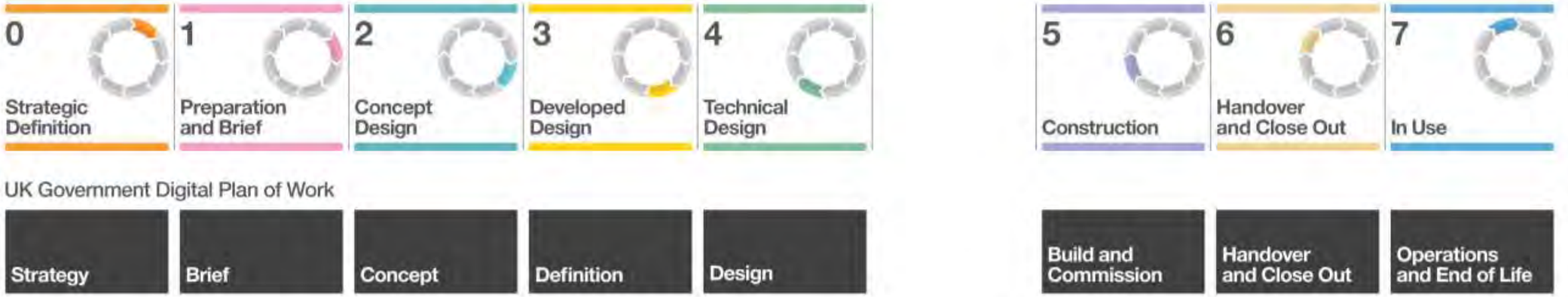
RIBA Plan of Work 2013: Unified Industry Stages



RIBA Plan of Work 2013

Whole Life and the Project Team

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Plan of
Work
2013

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Level 2

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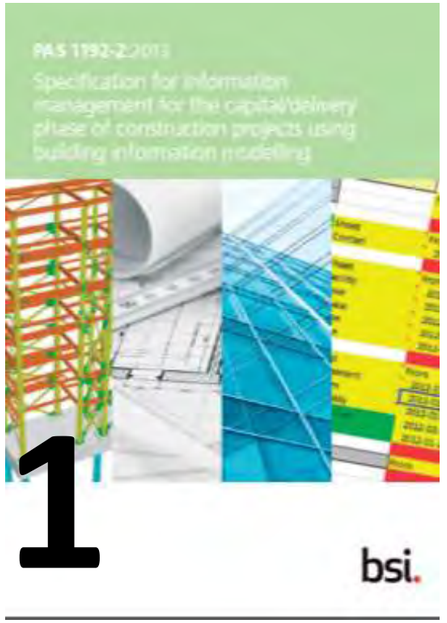
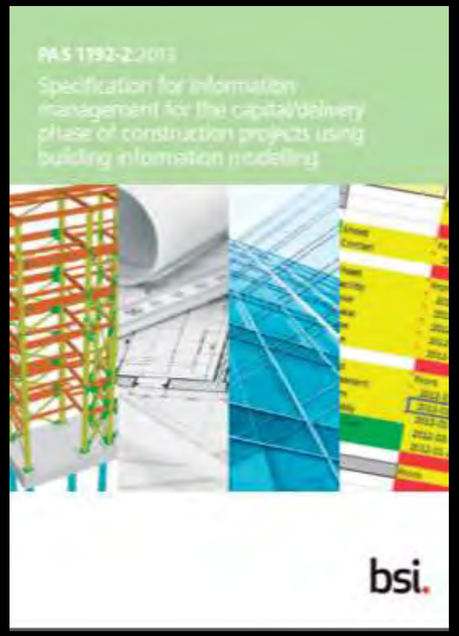
seven core documents



Information Management - Capex



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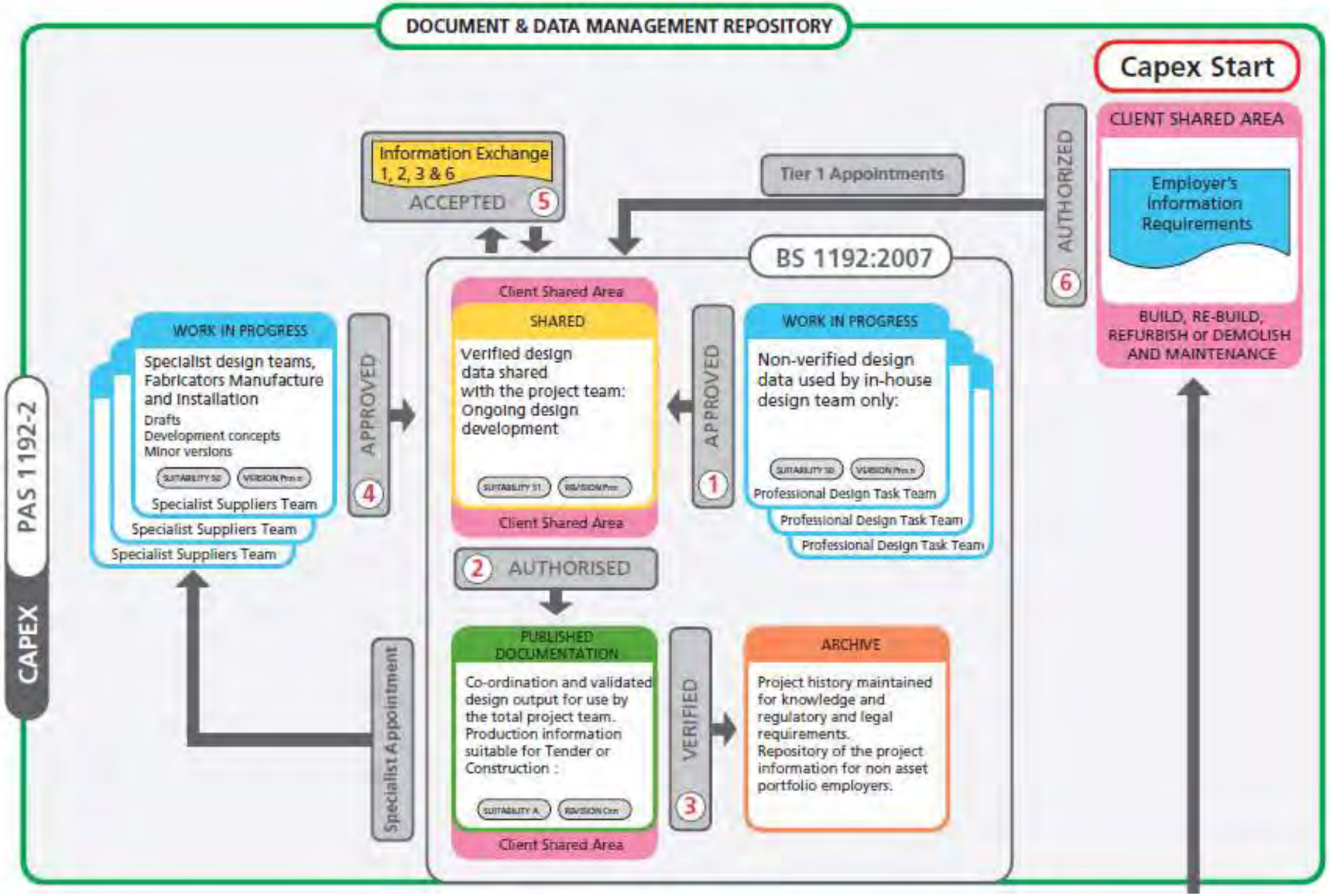

Collaborative working

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Adopting BS11000 was a "no-brainer" and doing so will demonstrate to our customers that we do what we say- ***Costain***

BS11000 provides a framework and a language to improve the way we create and sustain our collaborative business relationships
- Skanska

BS 11000 gives us a 'universally' recognised structure and the catalyst to develop the next stage of our collaborative working capabilities
– Balfour Beatty

Collaborative working

- How can goals & objectives be aligned?
- Who is the best person to lead the team?
- How can more data be shared?
- Can the project team raise issues honestly and openly?
- Who defines value?

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TEAMWORK

coming together is a beginning
keeping together is progress
working together is success

- Henry Ford

Collaborative working

- Physiologists
- Sport scientists
- Psychologists
- Epidemiologists
- Mathematicians
- Statisticians

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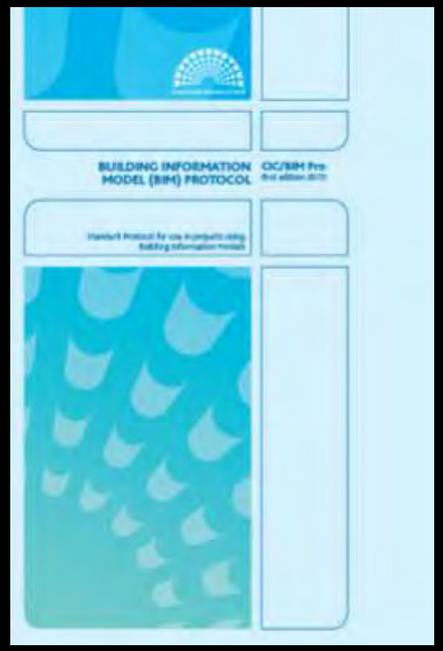
UCL

ActiveBuildings

Information Management Opex

RIBA Plan of Work 2013

BIM Protocol



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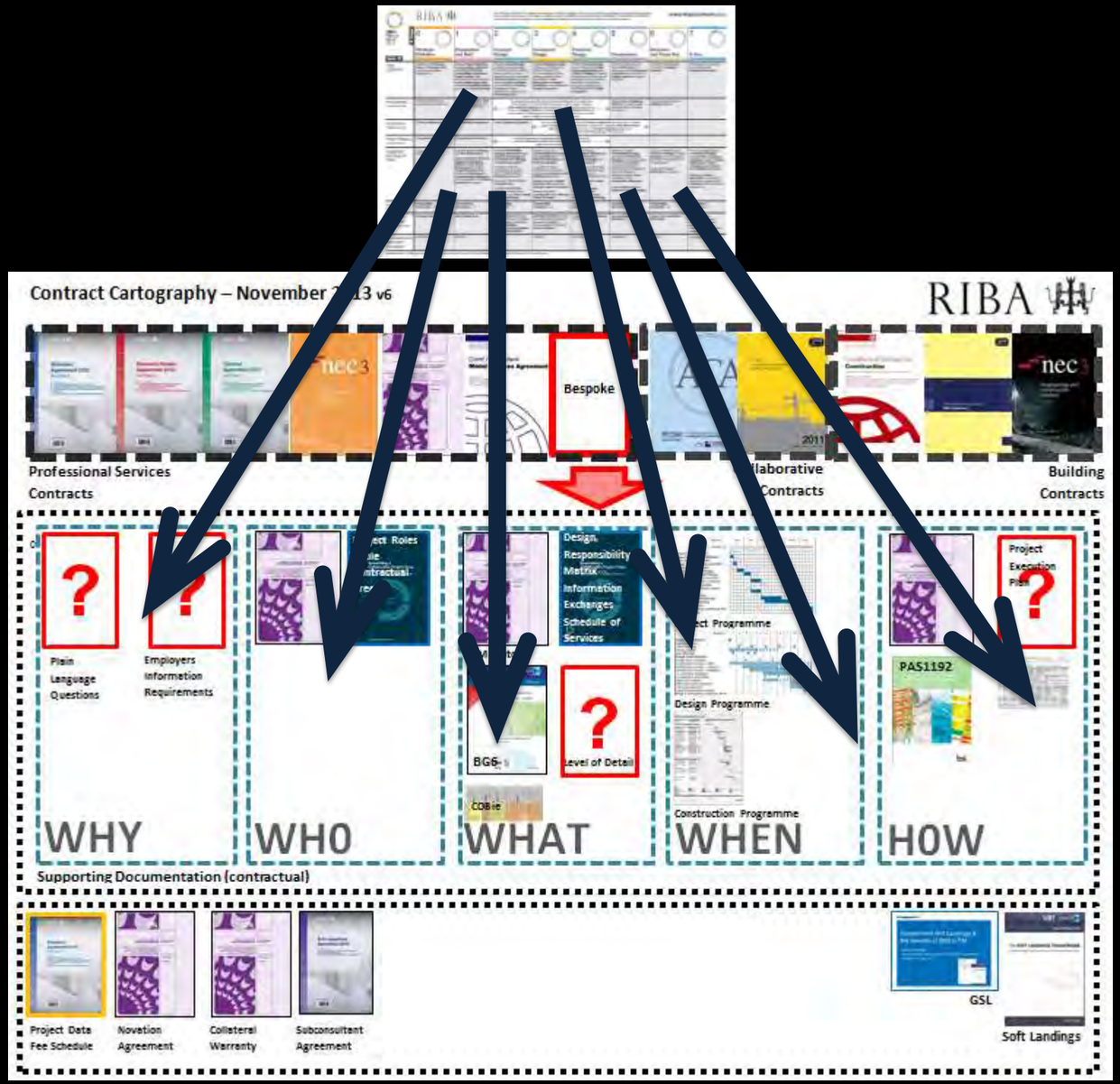
why

who

what

when

how



BIM Protocol

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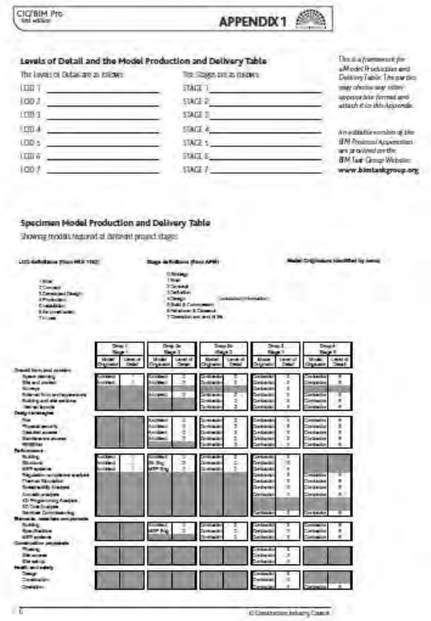
Specimen Production and Delivery Table for BIM Protocol user Guide

	Drop 1 Stage 1		Drop 2a Stage 2		Drop 2b Stage 2		Drop 3 Stage 3		Drop 4 Stage 6	
	Model Originat	Level of Detail	Model Originat	Level of Detail	Model Originat	Level of Detail	Model Originat	Level of Detail	Model Originat	Level of Detail
Overall form and content										
Space planning	Architect	1	Architect	2	Contracte	2	Contracte	3	Contracte	6
Site and context	Architect	1	Architect	2	Contracte	2	Contracte	3	Contracte	6
Surveys							Contracte	3		
External form and appearance			Architect	2	Contracte	2	Contracte	3	Contracte	6
Building and site sections					Contracte	2	Contracte	3	Contracte	6
Internal layouts					Contracte	2	Contracte	3	Contracte	6
Design strategies										
Fire			Architect	2	Contracte	2	Contracte	3	Contracte	6
Physical security			Architect	2	Contracte	2	Contracte	3	Contracte	6
Disabled access			Architect	2	Contracte	2	Contracte	3	Contracte	6
Maintenance access			Architect	2	Contracte	2	Contracte	3	Contracte	6
BREEAM					Contracte	2	Contracte	3	Contracte	6
Performance										
Building	Architect	1	Architect	2	Contracte	2	Contracte	3		
Structural	Architect	1	Str Eng	2	Contracte	2	Contracte	3		
MEP systems	Architect	1	MEP Eng	2	Contracte	2	Contracte	3		
Regulation compliance analysis							Contracte	3	Contracte	6
Thermal Simulation							Contracte	3	Contracte	6
Sustainability Analysis							Contracte	3	Contracte	6
Acoustic analysis							Contracte	3	Contracte	6
4D Programming Analysis										
5D Cost Analysis										
Services Commissioning							Contracte	3	Contracte	6
Elements, materials components										
Building			Architect	2	Contracte	2	Contracte	3	Contracte	6
Specifications			MEP Eng	2	Contracte	2	Contracte	3	Contracte	6
MEP systems					Contracte	2	Contracte	3	Contracte	6
Construction proposals										
Phasing							Contracte	3		
Site access							Contracte	3		
Site set-up							Contracte	3		
Health and safety										
Design							Contracte	3		
Construction							Contracte	3		
Operation							Contracte	3	Contracte	6


CIC/BIM Pro 1st edition

APPENDIX 1

Levels of Detail and the Model Production and Delivery Table

Specimen Model Production and Delivery Table

Showing models required at different project stages

Construction Industry Council

What does the client need?

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Employer's Information Requirements (EIR)

+

Defined progressive fixity of design information (COBie)

+

PAS1192-2

=

Information at handover suitable for:

- **CAFM & Asset Management systems (stage 7)**

+

- **Data mining (stage 7 to 0)**

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Soft Landings

- Focus on client (user) not Building Contract
- New stage 6 with related activities and processes
- Emphasis on Post Occupancy Evaluation (POE) and Building Performance Evaluation (BPE)

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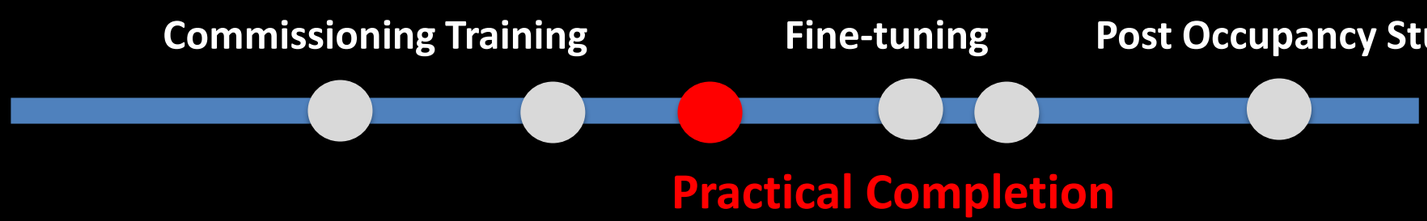

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Digital Plan of Work

who

what

when

RIBA Plan of Work 2013

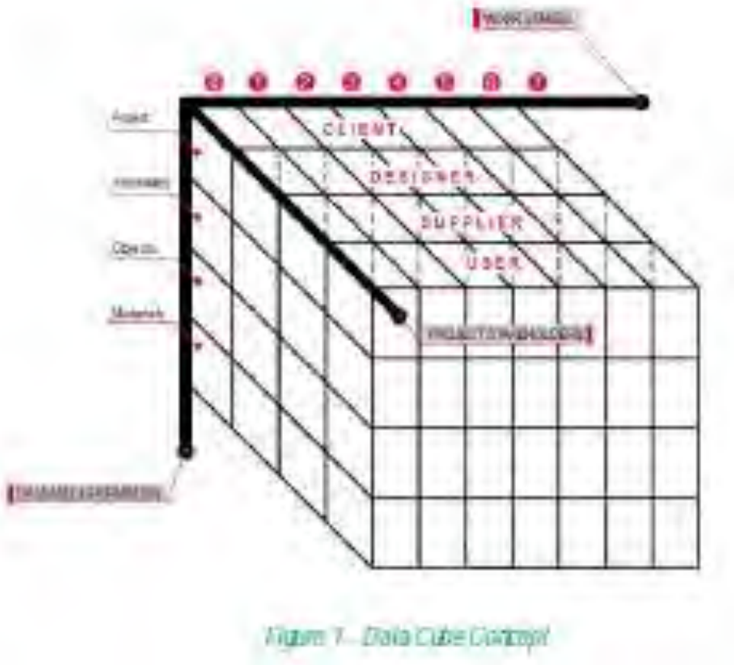
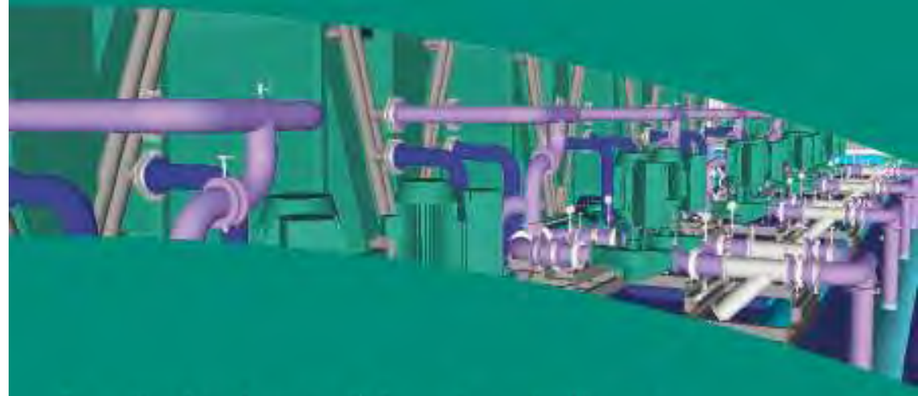


Figure 7 Data Cube Concept

Technology Strategy Board
Driving Innovation



A digital tool for building information modelling

SBRI competition for contracts
February 2014

SBRI Government challenges. Ideas from business. Innovative solutions.

Digital Plan of Work

C8

RIBA Plan of Work 2013

RIBA

apm

RICS

BIFM

CIBSE

ice

Institution of Civil Engineers

IStructE

CIOB

THE CHARTERED INSTITUTE OF BUILDING

C8 Data Cube

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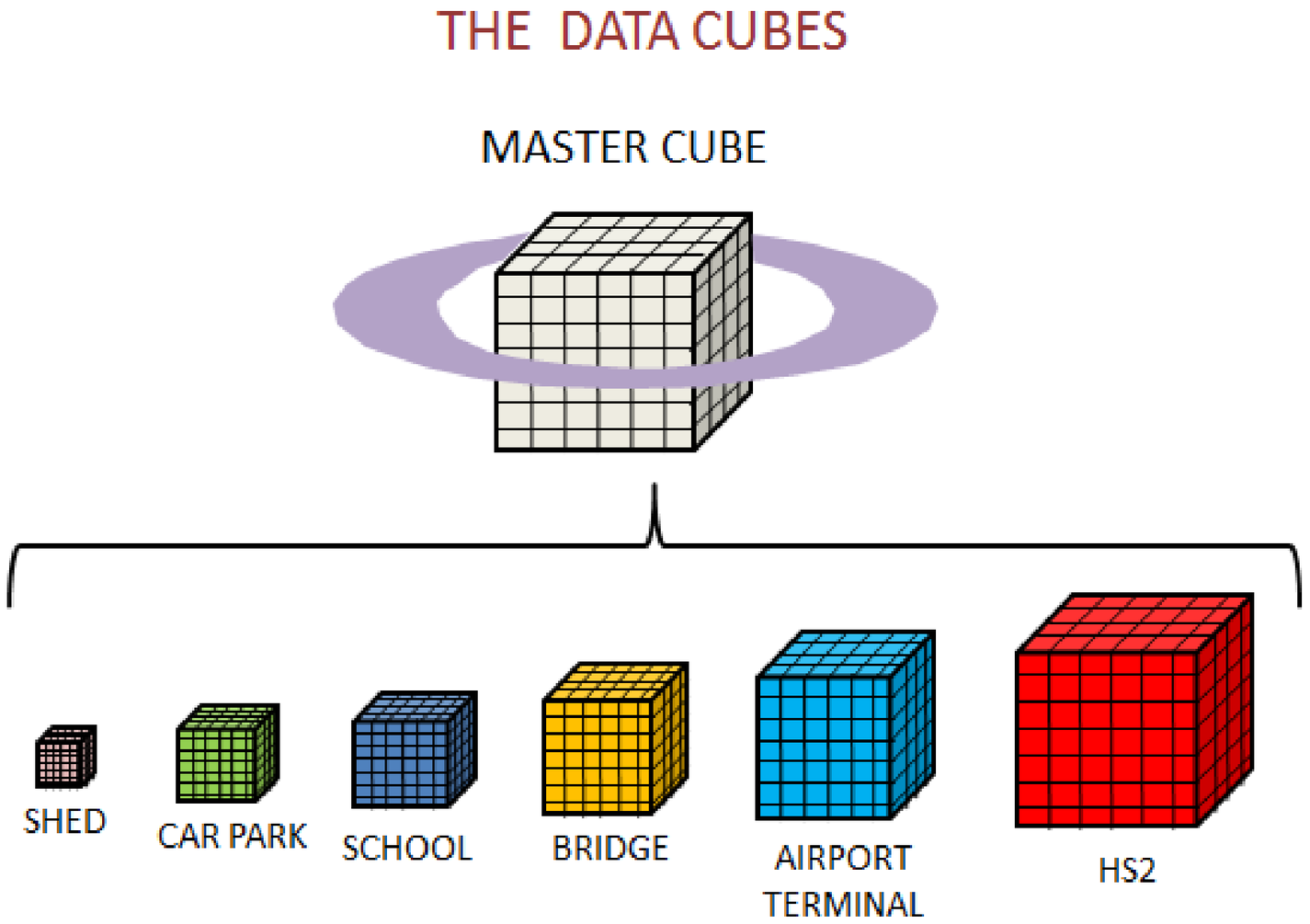

Tha data cube

The C8 data cube

Getting the data in

Selecting a sector cube

Selecting a project cube

Getting the data out

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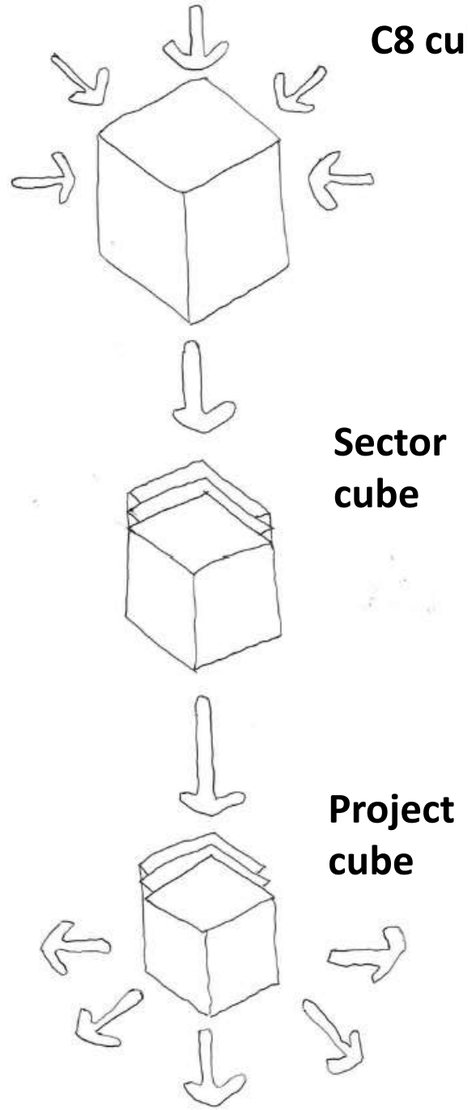

Getting the data out?

who

what

when

- Links to BIM model
  - - for what?
  - NOTE: 4D/5D from BIM not cube
- Contracts
  - Professional Services Contracts
  - Building Contract
- Validation
- Specification
- Management
  - Programme tools
  - EVA
- Operational tools
  - CAFM/Asset management

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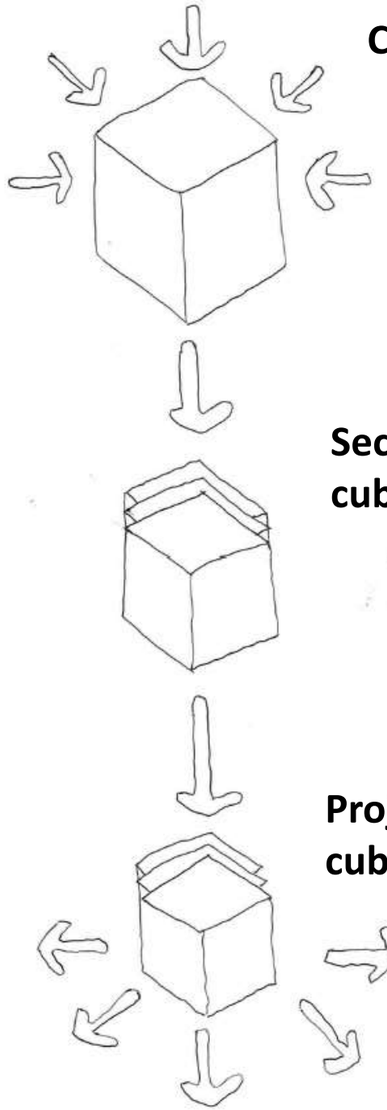

Winners!

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1. BIMTaskGroup.org
2. theNBS.com/BIMToolkit
3. Social Media - #BIMToolkit

Classification and object templates

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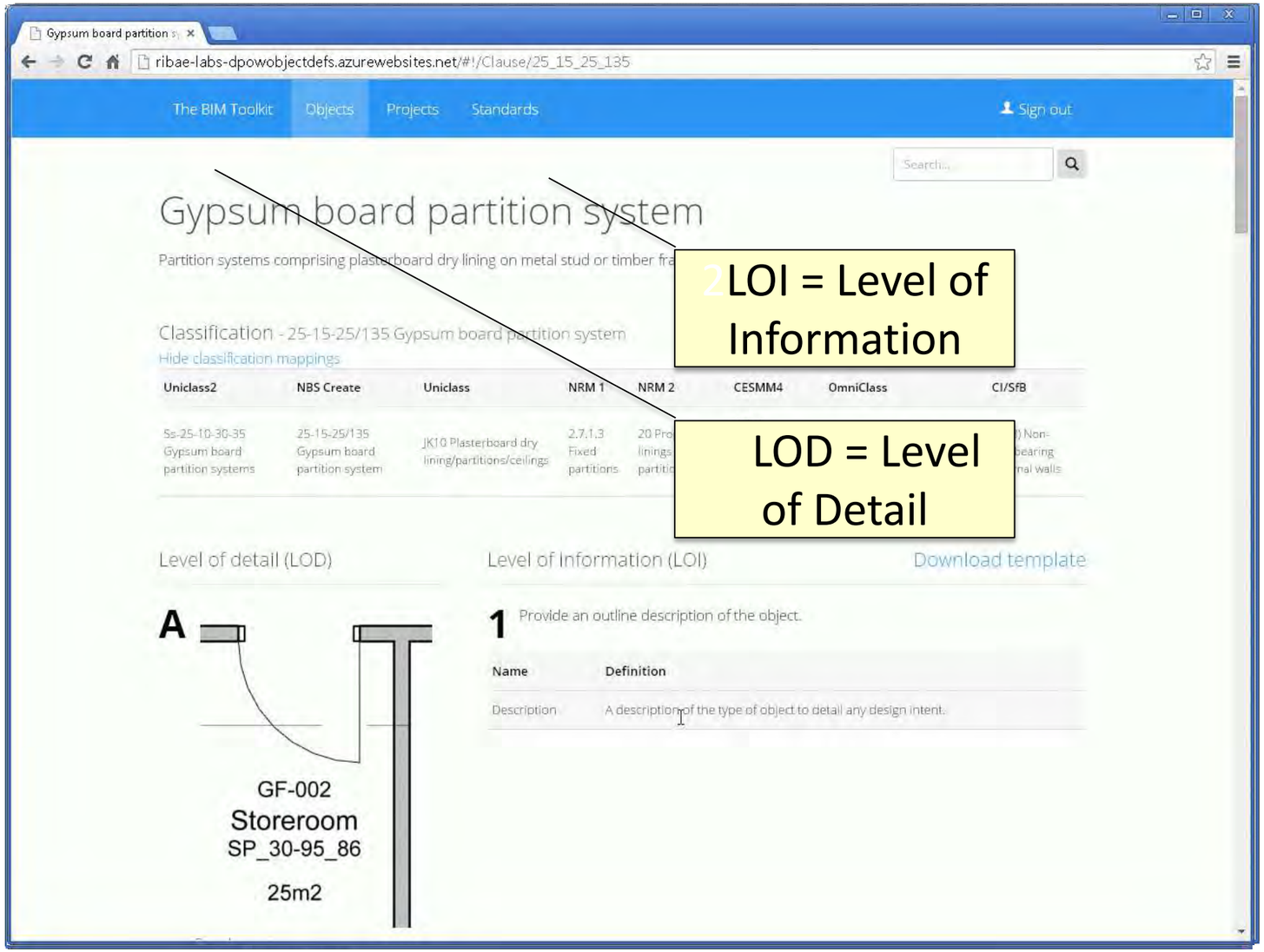
Uniclass2 – the core classification

BIM Innovate UK Technology Strategy Board NBS

#BIMToolkit

Classification and object templates



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#BIMToolkit

Classification and object templates

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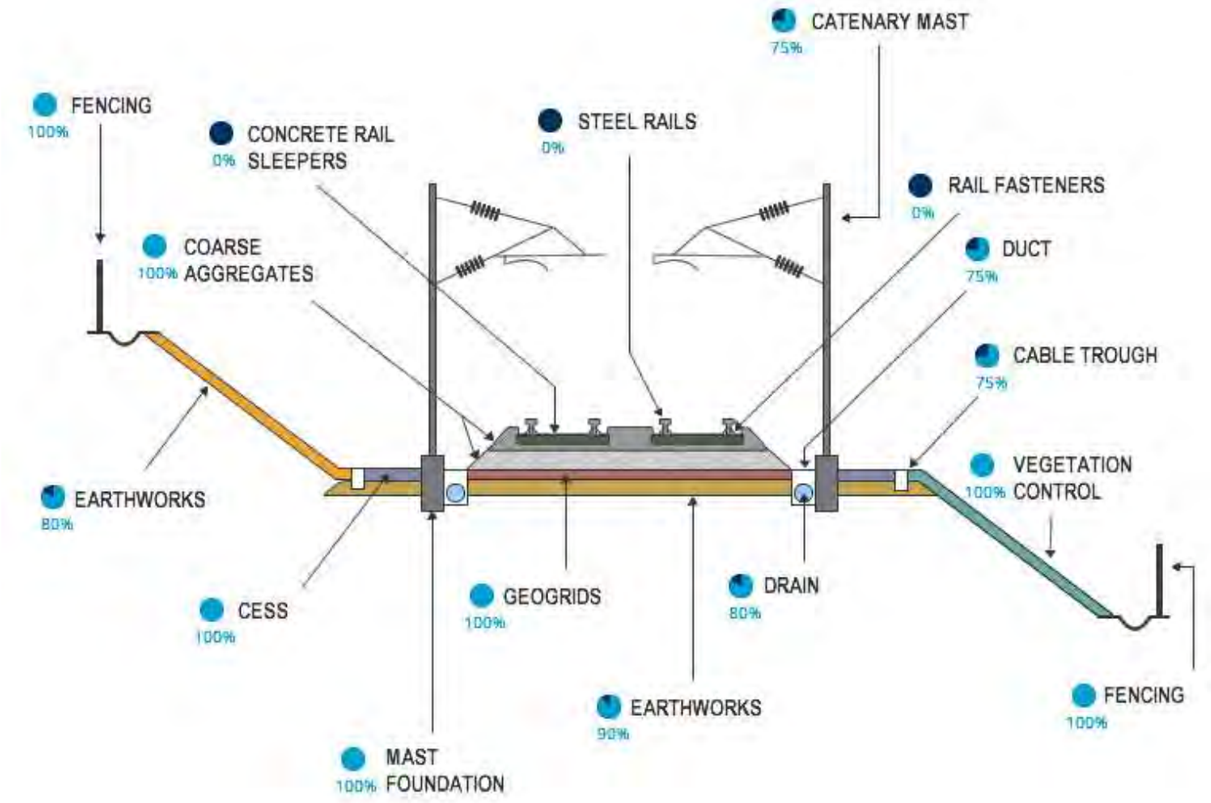
A toolkit for all – buildings, linear networks and geographical



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#BIMToolkit

Classification and object templates

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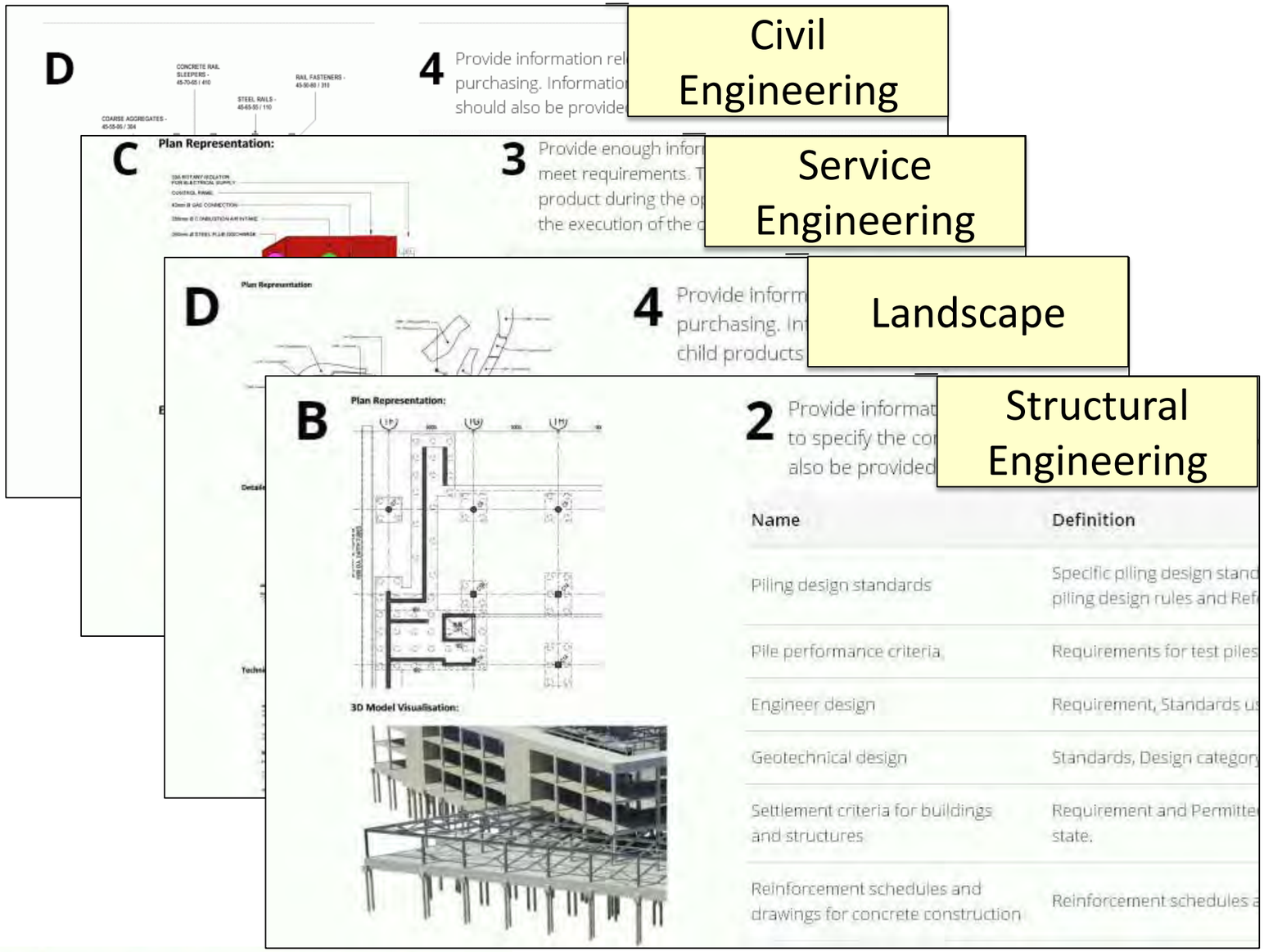

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Digital Plan of Work

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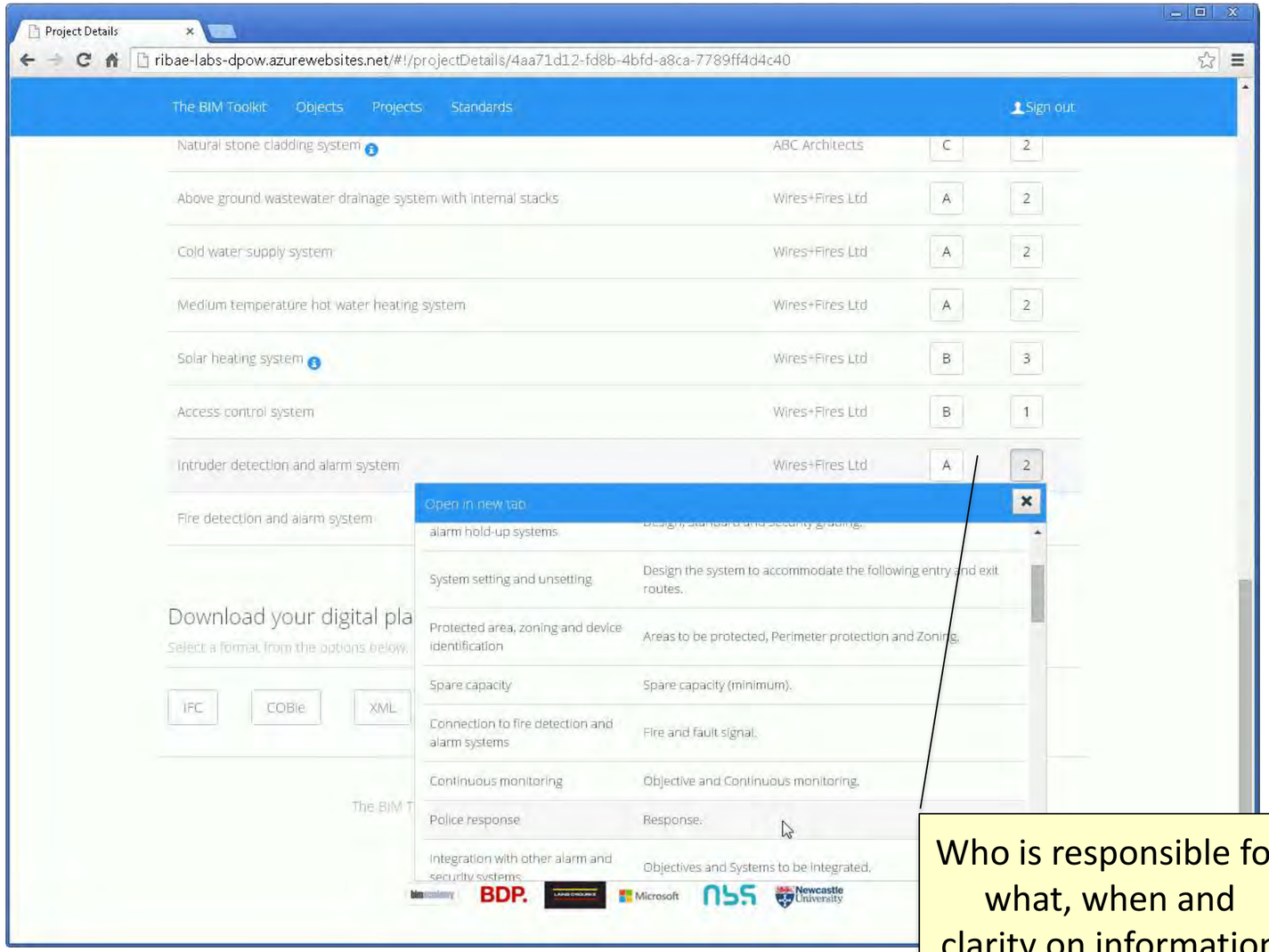

Who is responsible for what, when and clarity on information requirements

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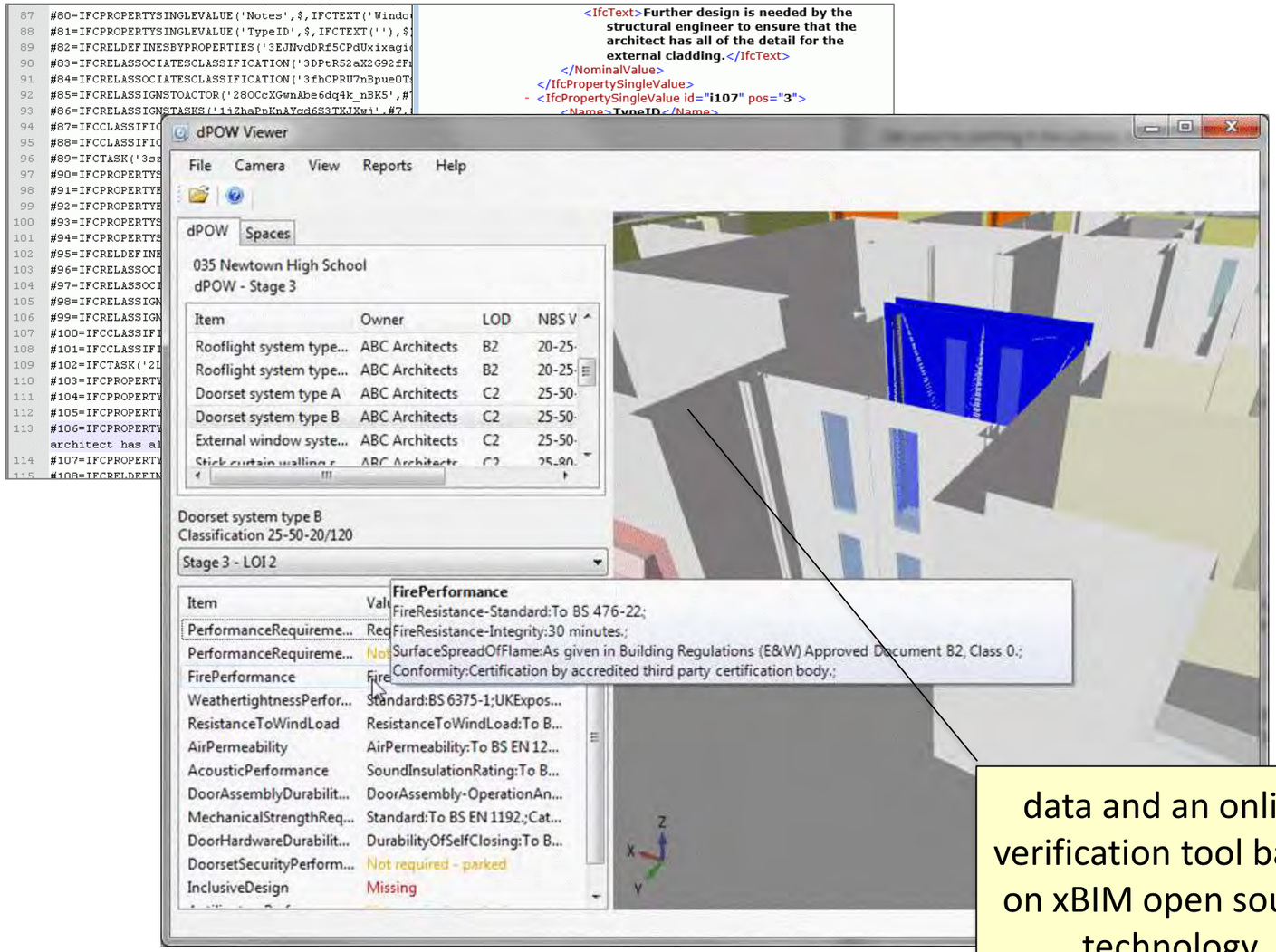
#BIMToolkit

Digital Plan of Work

RIBA Plan of Work 2013



data and an online verification tool based on xBIM open source technology

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#BIMToolkit

Design Responsibility Matrix

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A completed Stage 2 Design Responsibility Matrix

Element	Design responsibility	Level of detail	Level of information	
Substructure	C&S engineer	2	2	
Frame/upper slabs - steel	C&S engineer	2	2	
Fire protection	Architect	2	2	
Stairs (precast)	C&S engineer	2	2	
Brickwork/blockwork	Architect	2	2	
Masonry support	C&S engineer	2	2	
Curtain walling	Architect	3	2	
Insulated render	Architect	2	2	
Stone cladding	Architect	3	2	
Louvres	Architect	2	2	
Ceiling systems	Architect	2	2	
Hot and cold water services	M&E engineer	2	2	
Ventilation (natural and a/c)	M&E engineer	3	2	
Sprinklers	M&E engineer	2	2	
Electrical services	M&E engineer	2	2	
Lifts	M&E engineer	2	2	

RIBA Plan of Work 2013: analogue to digital

RIBA Plan of Work 2013

Stage 2

Concept Design

Project role	Tasks to be undertaken
All roles	• Contribute to Health and Safety Strategy as required • Provide information for and contribute to contents of Project Execution Plan as required • Contribute to development of Final Project Brief
Client and/or client advisor	• Comment on Concept Design proposals as they progress • Sign off Concept Design and Final Brief • Comment on Project Strategies as requested
Project lead	• Monitor progress of Concept Design • Collate and agree changes to initial Project Brief and issue Final Project Brief • Review Handover Strategy and Risk Assessments with project team • Review and update Project Execution Plan • Review Project Programme and agree any changes with project team • Comment on stage Design Programme and Cost Information • Monitor and review progress and performance of project team
Lead designer	• Comment on design proposals and Project Strategies of design team members • Prepare Sustainability Strategy and Maintenance and Operational Strategy with inputs from project team as required • Prepare stage Design Programme with input from other design team members • Comment on Cost Information • Monitor and review progress and performance of design team
Architect	• Prepare architectural Concept Design in accordance with the Initial Project Brief, Design Responsibility Matrix incorporating Information Exchanges and Design Programme • Liaise with planning authorities as required • Submit planning application (recommended at Stage 3) • Undertake third party consultations and any Research and Development aspects as required • Assist lead designer with preparation of stage Design Programme • Provide information for preparation of Cost Information and Project Strategies
Building services engineer	• Prepare Concept Design for building services design in accordance with the Initial Project Brief, Design Responsibility Matrix incorporating Information Exchanges and Design Programme • Undertake third party consultations as required and any Research and Development aspects • Assist lead designer with preparation of stage Design Programme • Provide information for preparation of Cost Information and Project Strategies
Civil and structural engineer	• Prepare Concept Design for structural design in accordance with the Initial Project Brief, Design Responsibility Matrix incorporating Information Exchanges and Design Programme • Undertake third party consultations as required and any Research and Development aspects • Assist lead designer with preparation of stage Design Programme • Provide information for preparation of Cost Information and Project Strategies
Cost consultant	• Prepare preliminary Cost Information • Assist lead designer with preparation of stage Design Programme
Construction lead	• Prepare Construction Strategy
Contract administrator	N/A
Health and safety adviser	• Develop Health and Safety Strategy, including statutory requirements
All additional project roles	• Liaise with project lead and lead designer as required • Provide information as set out in the Design Responsibility Matrix incorporating Information Exchanges in accordance with Design Programme

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Stage 3

Developed Design

Project role	Tasks to be undertaken
All roles	• Contribute to Health and Safety Strategy as required • Provide information for and contribute to contents of Project Execution Plan as required
Client and/or client advisor	• Comment on Developed Design proposals as they progress • Sign off Developed Design • Comment on updated Project Strategies as requested
Project lead	• Monitor progress of developing design • Review updated Handover Strategy and Risk Assessments with project team • Review and update Project Execution Plan • Review Project Programme and agree any changes with project team • Comment on stage Design Programme and Cost Information • Manage change control progress • Monitor and review progress and performance of project team
Lead designer	• Coordinate and comment on design proposals and Project Strategies as they progress • Update Sustainability Strategy and Maintenance and Operational Strategy with input from project team as required • Prepare stage Design Programme in conjunction with other design team members • Comment on Cost Information • Monitor and review progress and performance of design team
Architect	• Prepare architectural Developed Design in accordance with the Design Responsibility Matrix incorporating Information Exchanges, Design Programme and coordination comments from lead designer • Liaise with planning authorities as required • Submit planning application • Undertake third party consultations as required and conclude any Research and Development aspects • Assist lead designer with preparation of stage Design Programme • Provide information for updated Cost Information and Project Strategies
Building services engineer	• Prepare building services Developed Design in accordance with the Design Responsibility Matrix incorporating Information Exchanges, Design Programme and coordination comments from lead designer • Undertake third party consultations and any Research and Development aspects as required • Assist lead designer with preparation of stage Design Programme • Provide information for preparation of Cost Information and Project Strategies
Civil and structural engineer	• Prepare coordinated and updated proposals for structural design in accordance with the Design Responsibility Matrix incorporating Information Exchanges and Design Programme • Undertake third party consultations as required and any Research and Development aspects • Assist lead designer with preparation of stage Design Programme • Provide information for preparation of Cost Information and Project Strategies
Cost consultant	• Update preliminary Cost Information • Assist lead designer with preparation of stage Design Programme
Construction lead	• Update Construction Strategy
Contract administrator	N/A
Health and safety advisor	• Update Health and Safety Strategy
All additional project roles	• Liaise with project lead and lead designer as required • Provide information as set out in the Design Responsibility Matrix incorporating Information Exchanges in accordance with Design Programme

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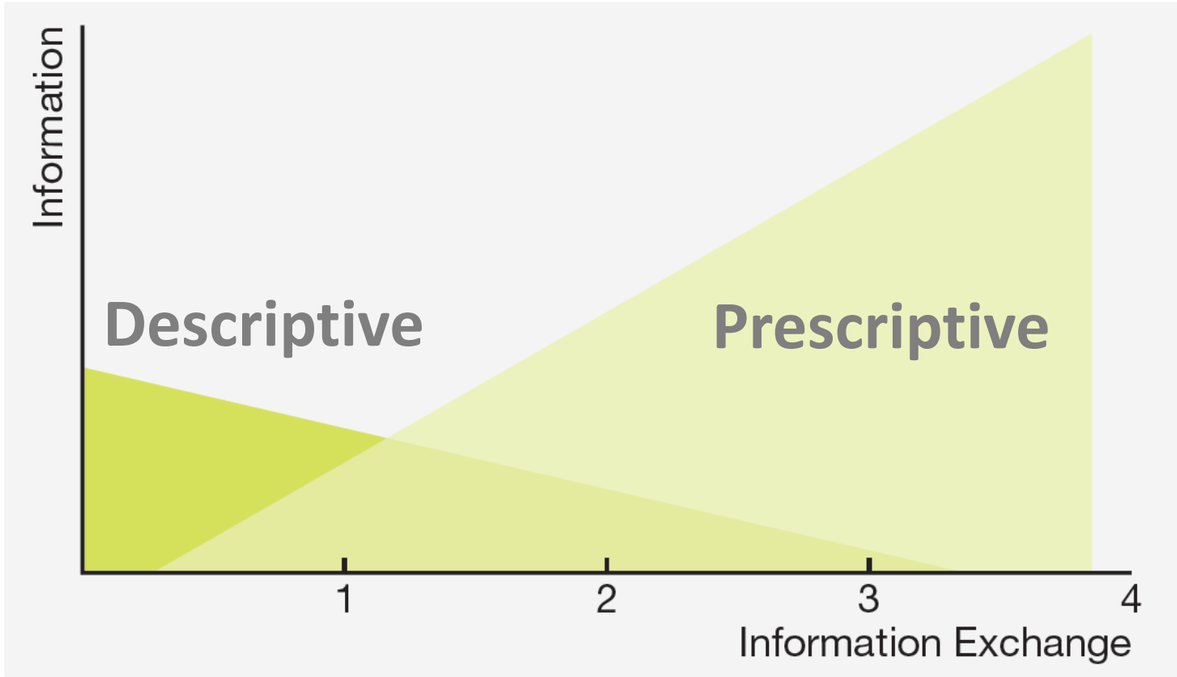
Multi-disciplinary **Schedules of Services**

Descriptive to Prescriptive journey

Google + nest



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Level of Development

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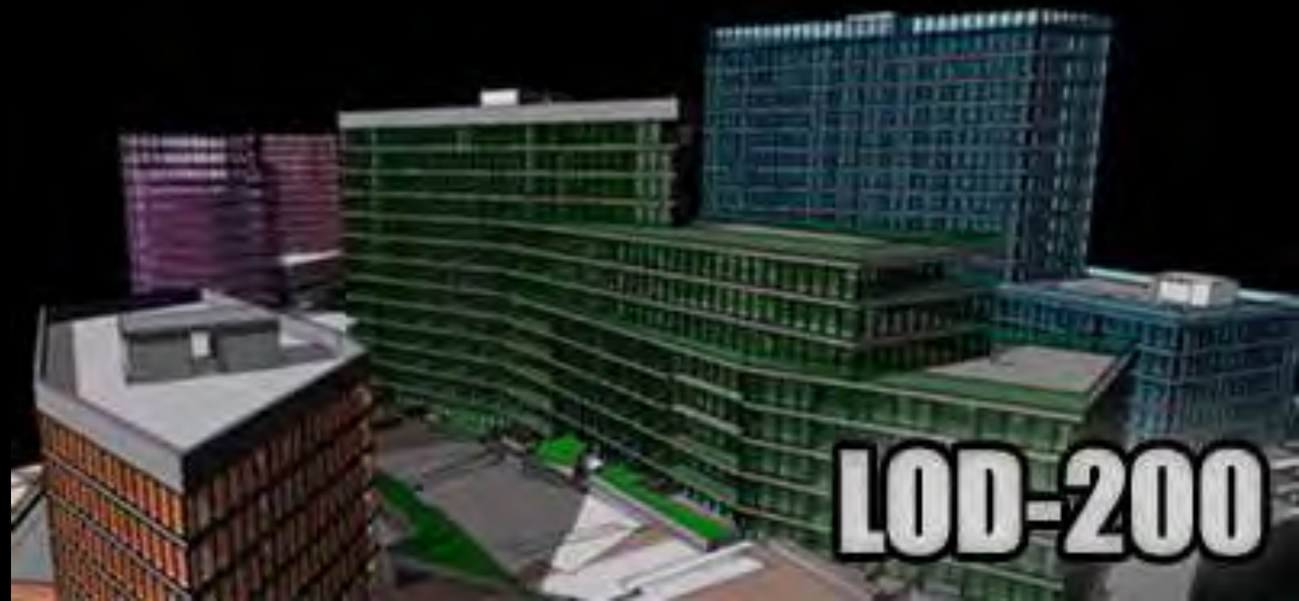
Work
2013



What else?

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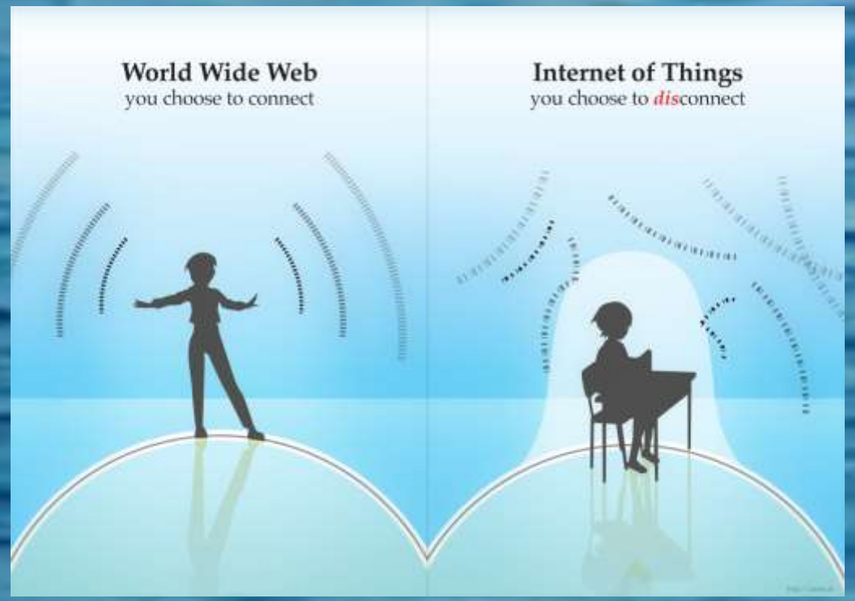

Professional Maturity

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Clients

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Estates V One-Off

Project Outcomes

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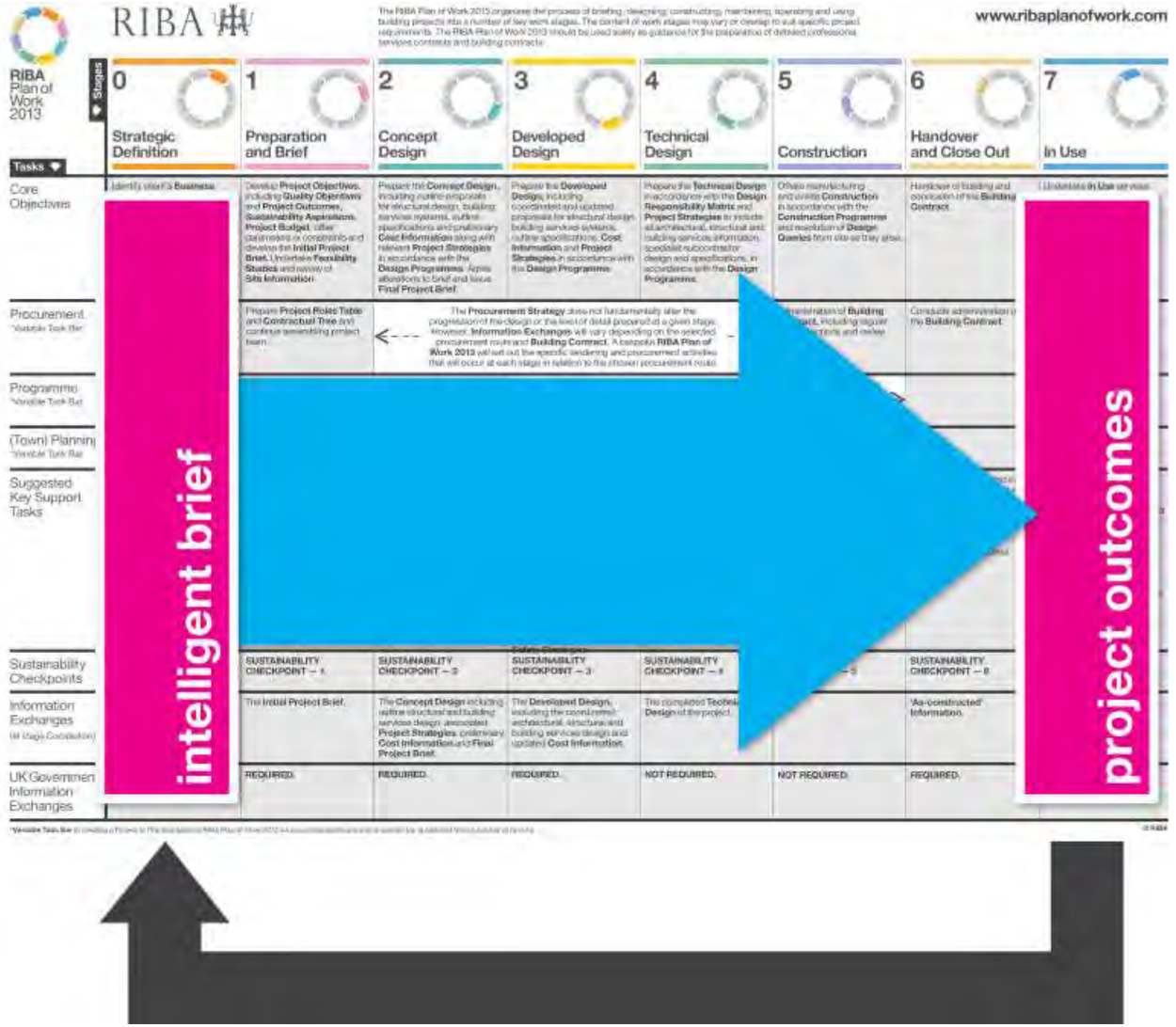

Project Outcomes

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The design stages

geometry

data

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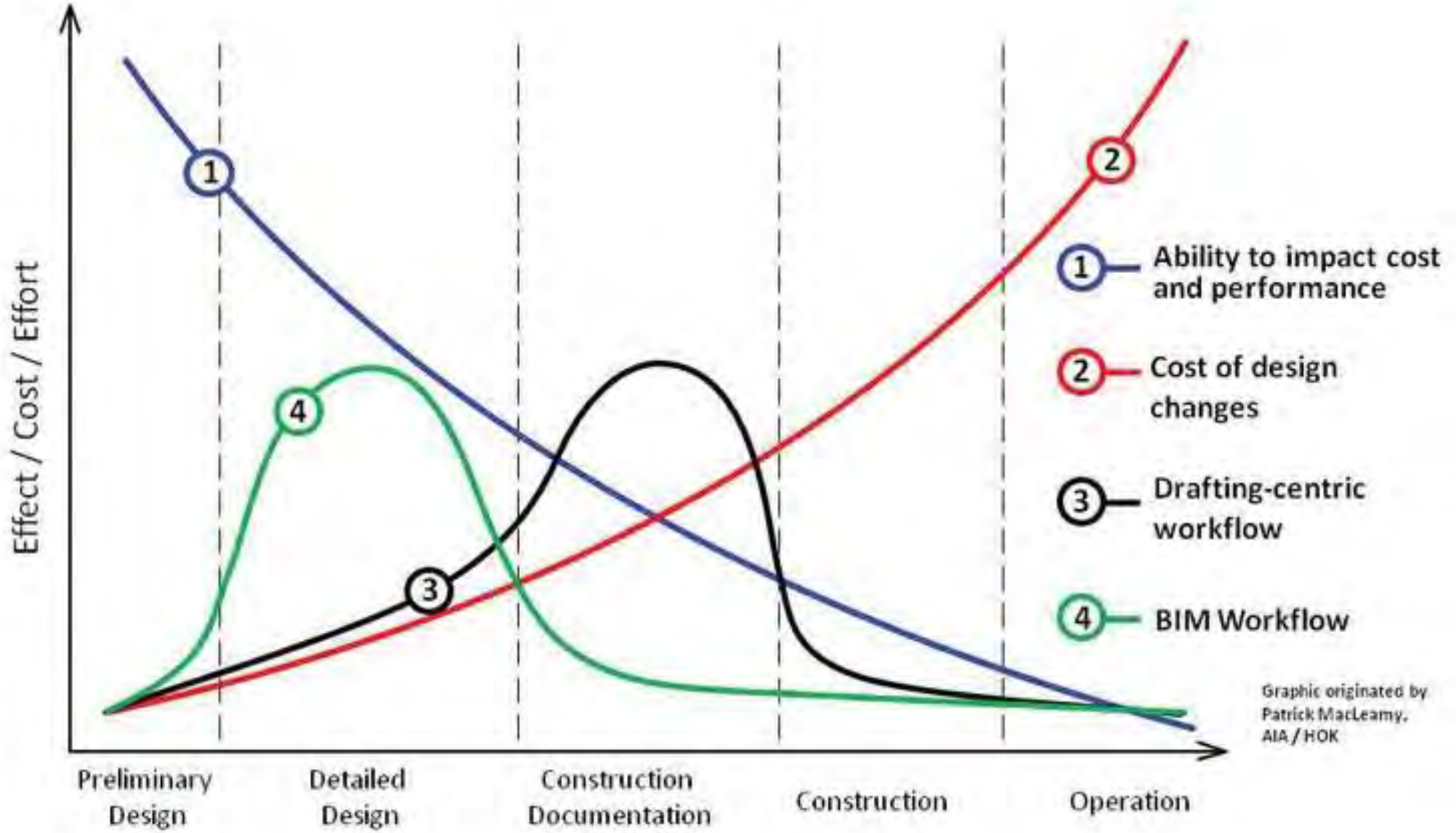
Stage 2
PLQs



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The Lead Designer

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Briefing to **Design** to **Construction**

Briefing to **Design** to **Construction**

Stage 4: analogue to digital

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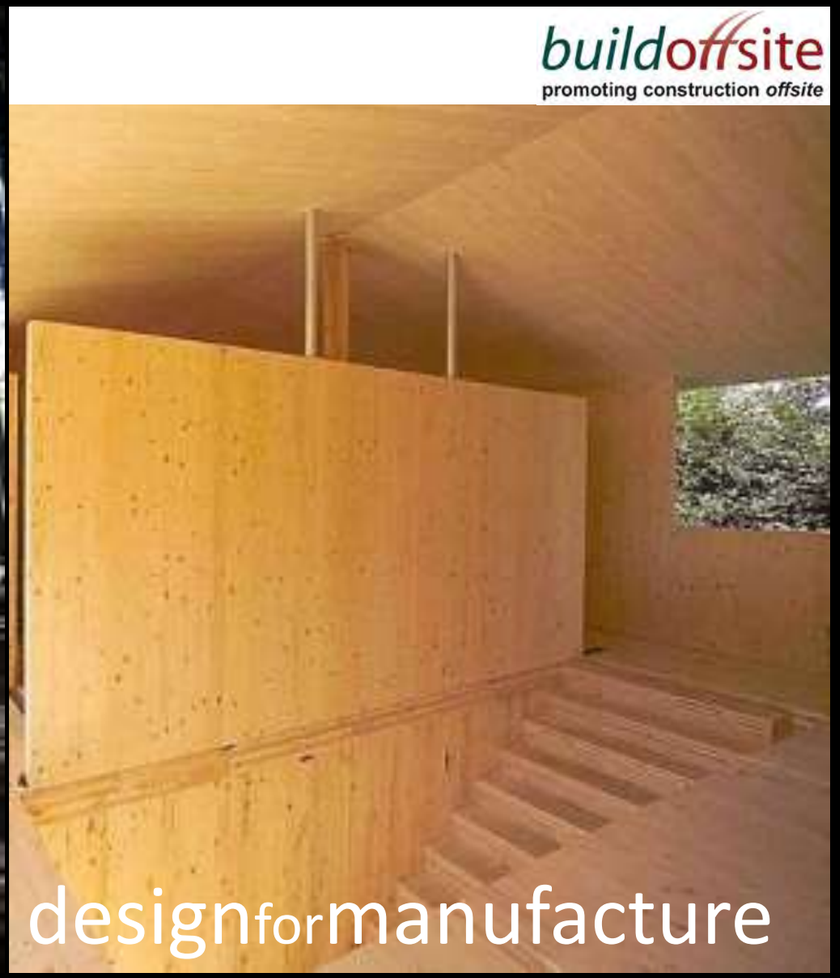
Stage 4: digital



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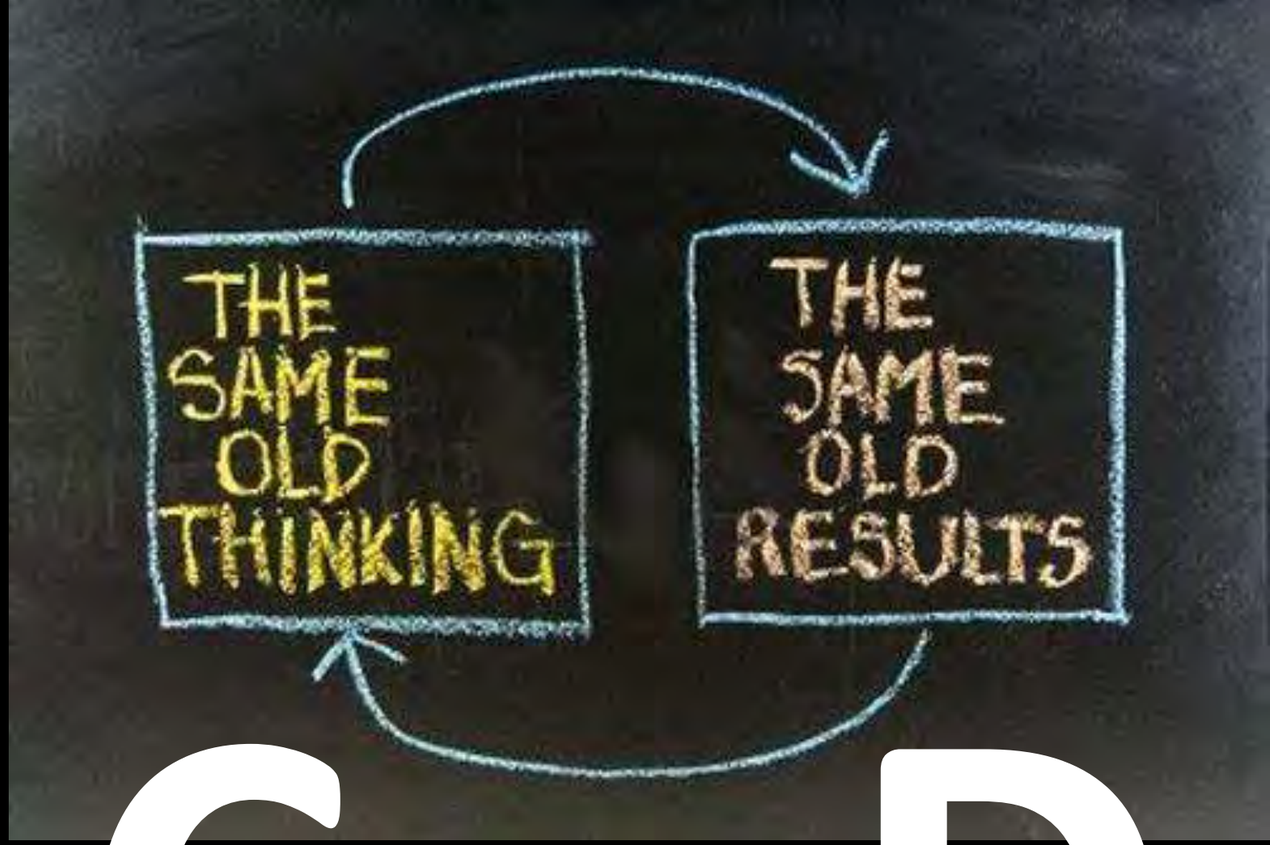
Future Design Processes



A+B+C = D

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AECOM

Thank you!

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