CITA BIM Gathering 24th November 2017

Duncan Reed, Digital Construction Process Manager, Trimble Solutions (UK) Ltd

BIM - bespoke solutions from standard data

Introduction

Duncan Reed

- Chartered Civil Engineer
- Career to date
  - RM Douglas / Tilbury Douglas – Site Engineer > Chief Engineer
  - Clugston Construction – Site Manager > Design Coordinator
  - Balfour Beatty Construction – Design Manager > Divisional Design Manager
- Joined Trimble solutions (UK) in 2013
  - Digital Construction Process Manager
  - Chair, thinkBIM – home of the Yorkshire and Humberside BIM Region

BIM Definition

2011; Government Construction Strategy

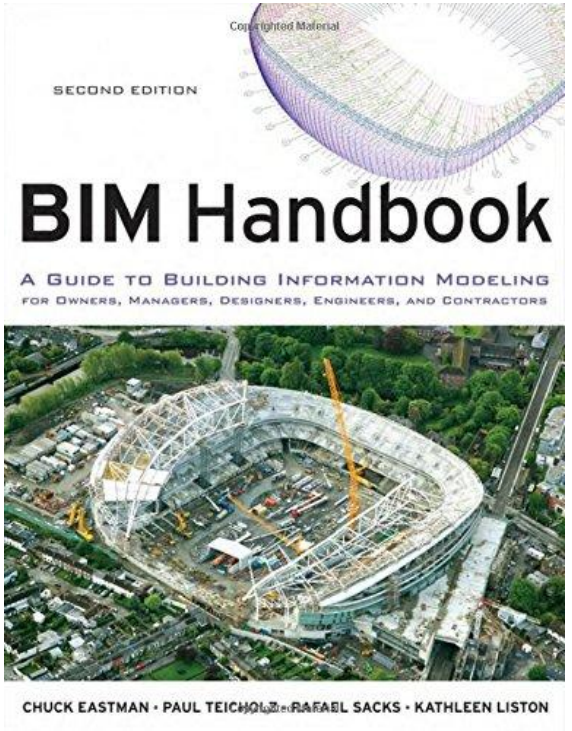
2.32 Government will require fully collaborative 3D BIM (with all project and asset information, documentation and data being electronic) as a minimum by 2016

A staged plan was published with mandated milestones showing measurable progress at the end of each year

The first BIM definition?

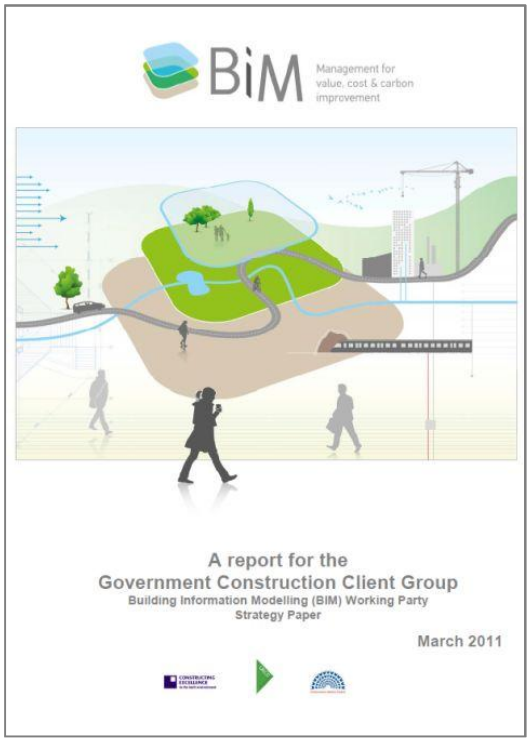
“BIM as a modelling technology and associated set of processes to produce, communicate, and analyse building models.”

- Building components
- Components that include data that describe how they behave
- Consistent and non-redundant data
- Coordinated data



2011; Government Construction Client Group

- What is BIM?
- BIM is a managed approach to the collection and exploitation of information across a project. At its heart is a computer-generated model containing graphical and tabular information about the design, construction and operation of the asset

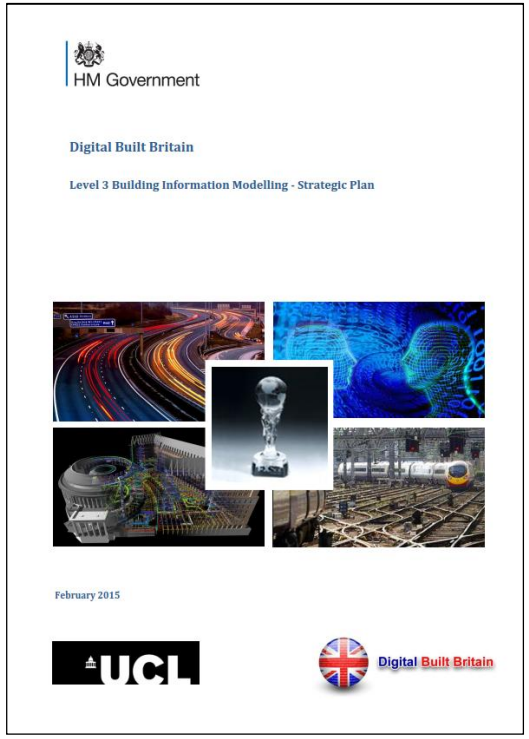


2014; Royal Institution of Chartered Surveyors

- Building information modelling (BIM) gets people and information working together **effectively and efficiently** through defined processes and technology

2015; Digital Built Britain

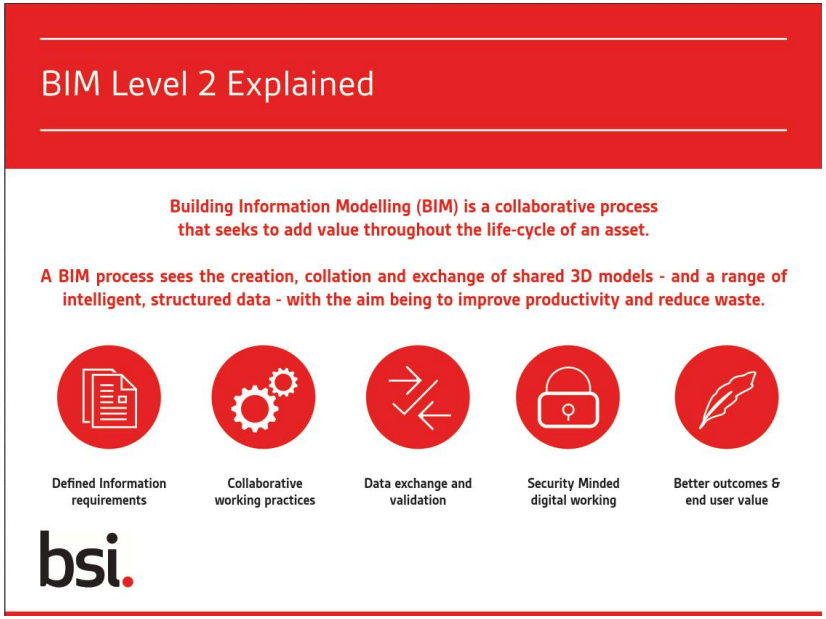
- ‘What is Building information modelling?’
- *Building Information Modelling (BIM) is a collaborative way of working, underpinned by the digital technologies which unlock more efficient methods of designing, delivering and maintaining physical built assets*



2016; BSI - British Standards Institution

In, created a BIM website to assist the industry and defined BIM as

"Building Information Modelling (BIM) is a collaborative way of working underpinned by digital technologies. These technologies allow for more efficient methods of designing, delivering and maintaining physical built assets throughout their entire lifecycle". [5]



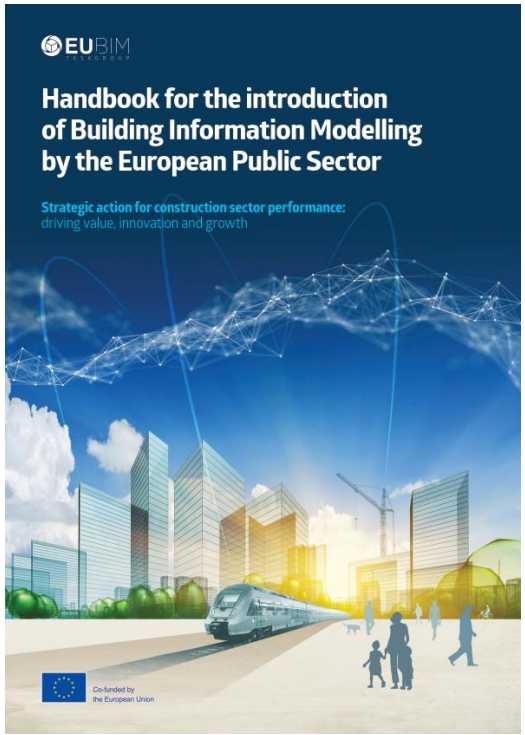
2016; National Building Specification

- BIM or Building Information Modelling is a process for creating and managing information on a construction project across the project lifecycle

2017; EU BIM Handbook

Probably the most recent, widely published, definition of BIM has come from the EU BIM Handbook

BIM is a digital form of construction and asset operations. It brings together technology, process improvements and digital information to radically improve client and project outcomes and asset operations. BIM is a strategic enabler for improving decision making for both buildings and public infrastructure assets across the whole lifecycle. It applies to new build projects; and crucially, BIM supports the renovation, refurbishment and maintenance of the built environment – the largest share of the sector.



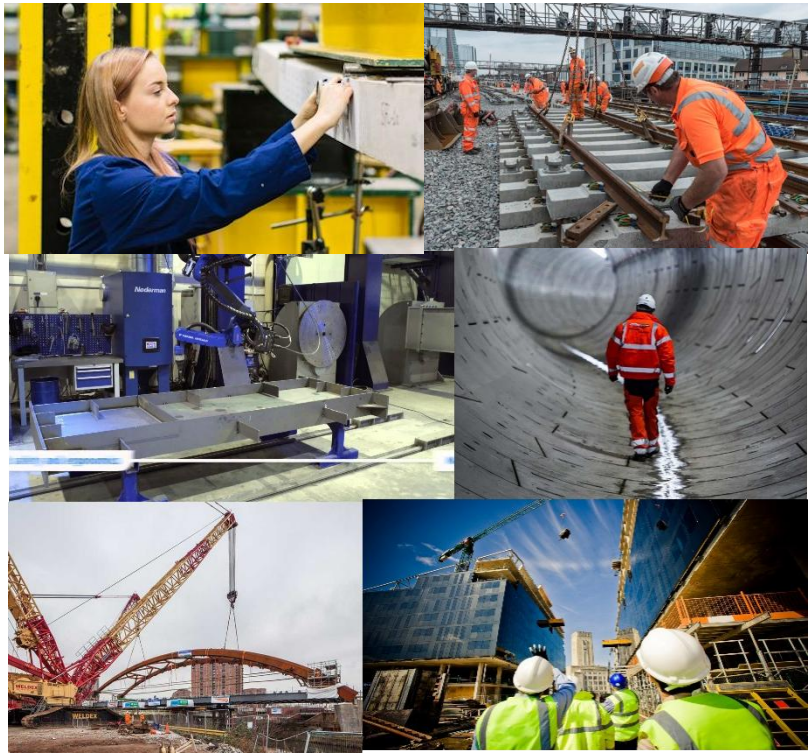
Summary from all these definitions

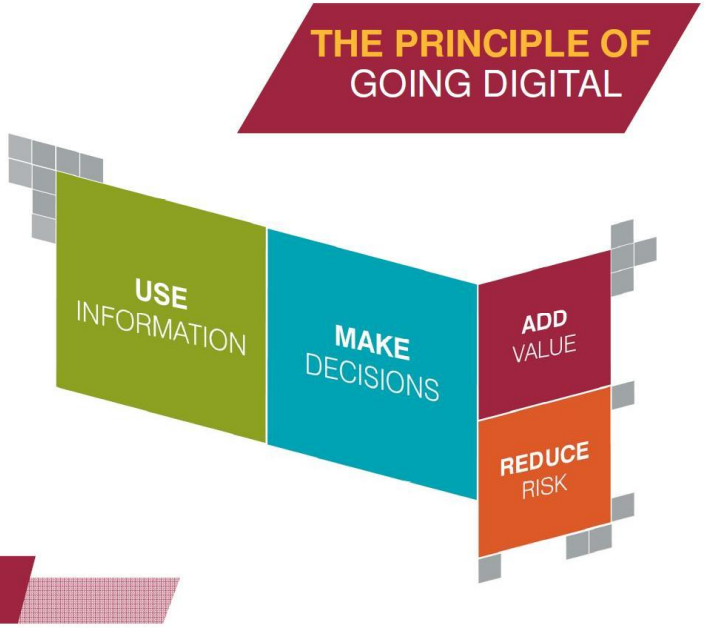
1. project
2. digital
3. construction
4. technologies
5. technology
6. lifecycle
7. working
8. across
9. assets
10. built
19. processes
24. process

Trimble

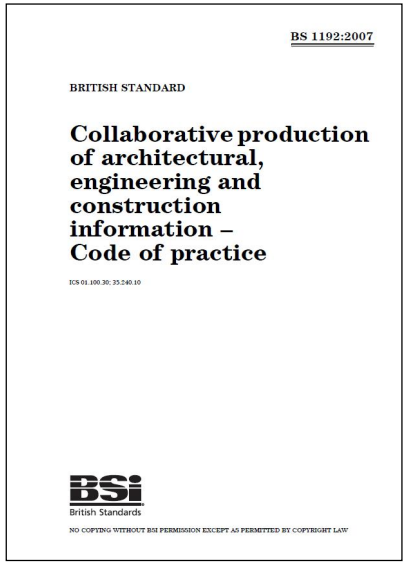
BIM Businesses

Relating BIM to a business





BIM basics - BS1192:2007


BS 1192:2007

BRITISH STANDARD

Collaborative production of architectural, engineering and construction information – Code of practice

ICS 01.100.30; 35.240.10

BSi
British Standards

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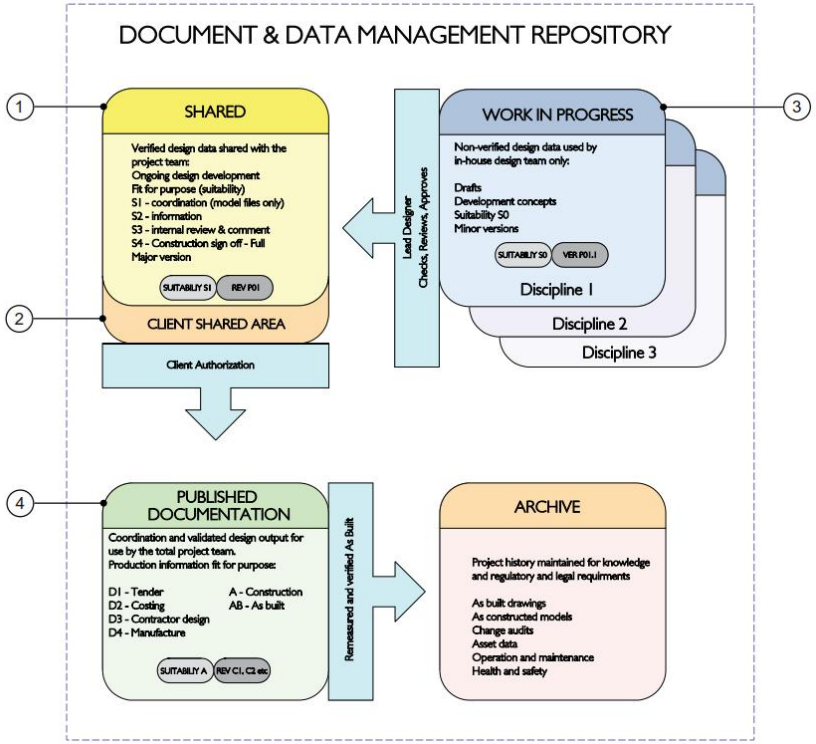
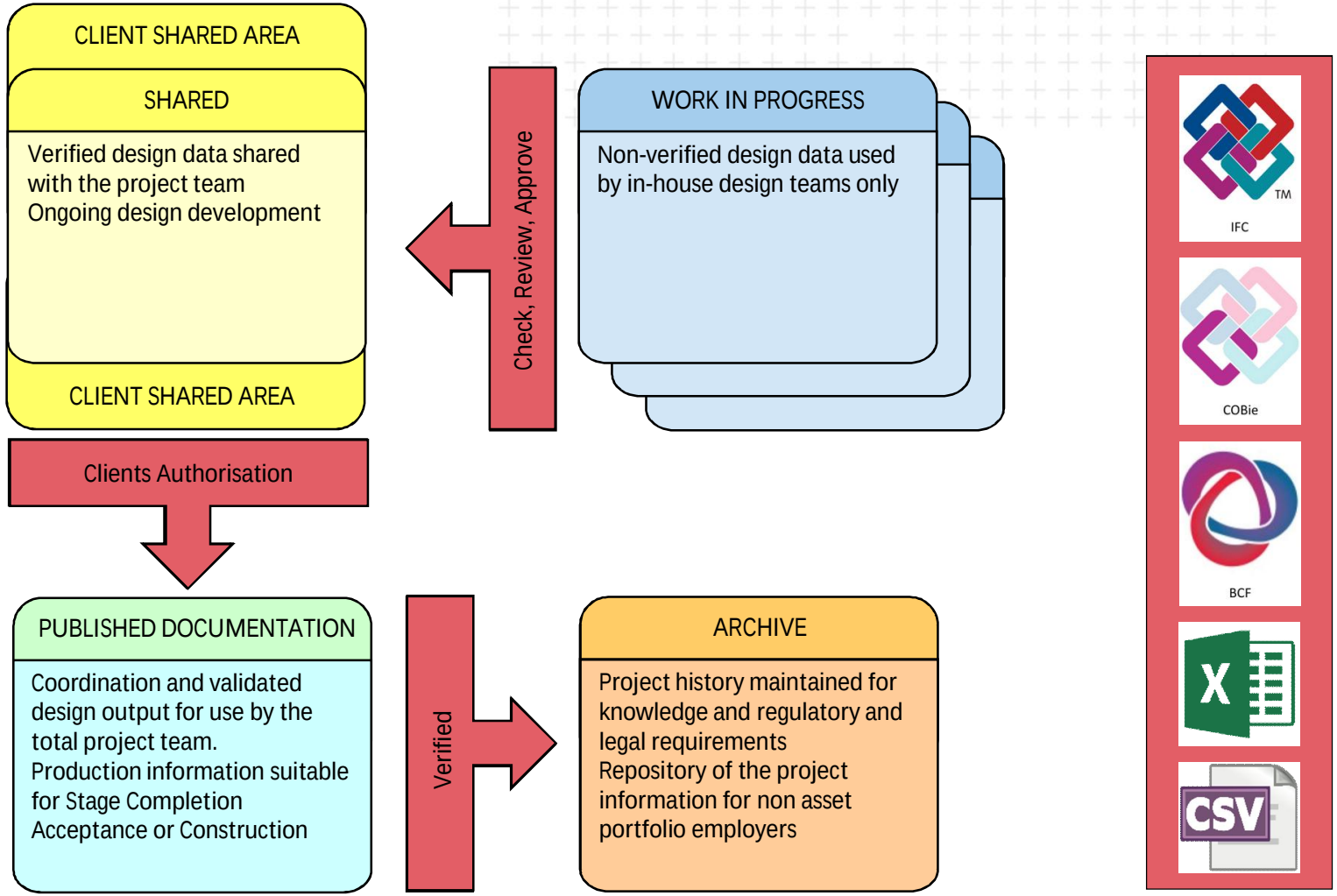
- Originally published in 2007, current version is A2 – 2016
- This standard is the bedrock of Level 1 and covers two main areas
  - Collaboration Management Processes
  - Naming of Containers

Create and share structured data




CLIENT SHARED AREA
SHARED
Verified design data shared with the project team
Ongoing design development
CLIENT SHARED AREA
Check, Review, Approve
WORK IN PROGRESS
Non-verified design data used by in-house design teams only
Clients Authorisation
PUBLISHED DOCUMENTATION
Coordination and validated design output for use by the total project team.
Production information suitable for Stage Completion Acceptance or Construction
Verified
ARCHIVE
Project history maintained for knowledge and regulatory and legal requirements
Repository of the project information for non asset portfolio employers
IFC
COBie
BCF
CSV

Defining BIM for a business

No ‘one size fits all’ solution to BIM

BiM regions
the home of digital construction

BIM4HERITAGE

BIM4DC

agi Special Interest Group
BIM4IUK
BIM 4 Infrastructure (UK)
Supported by
ice BiM Building Information Modelling (BIM) Task Group ci Construction Project Information

BIM4FitOut
AN AIS SPECIAL INTEREST GROUP

BIM 4 WATER

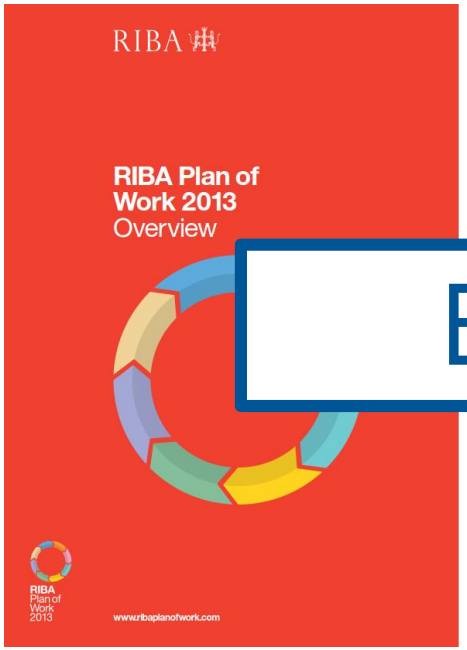
BIM4HOUSING

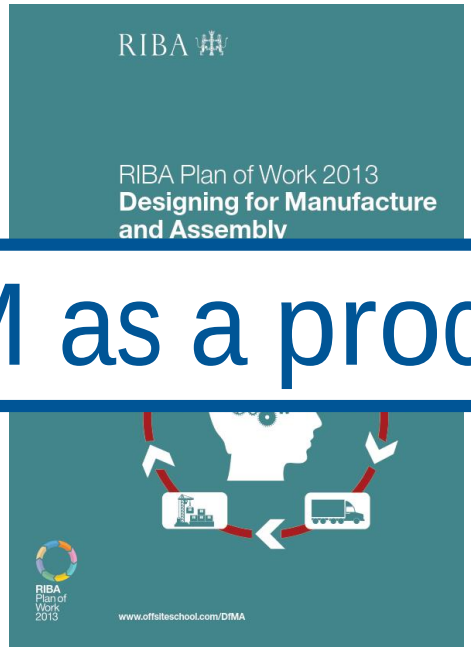
BIM4sme

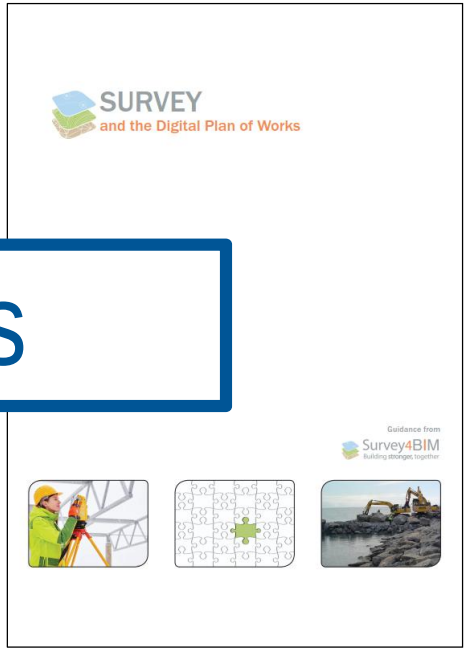
Survey4BIM
Building stronger, together

BIM4M2

Profession or trade specific solutions



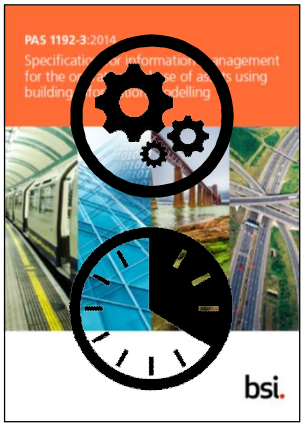


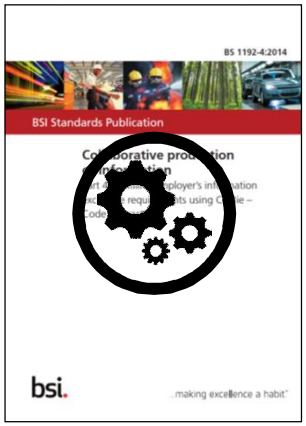


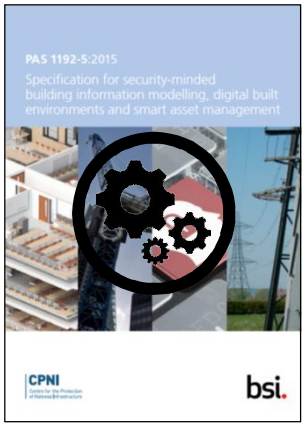
BIM as a process

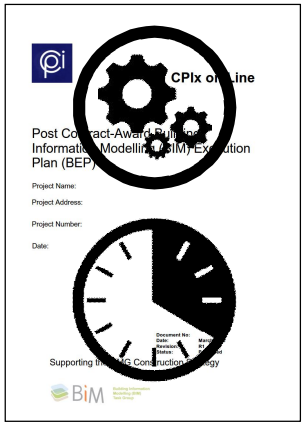
How Industry Delivers BIM

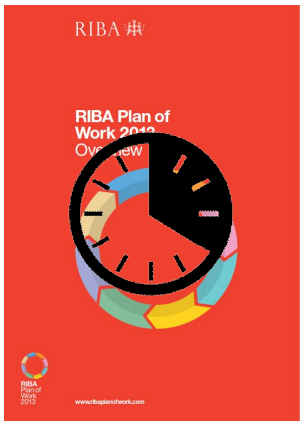
Delivering BIM needs processes

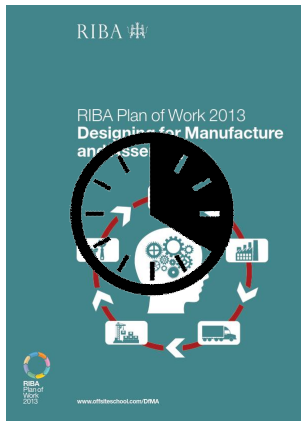






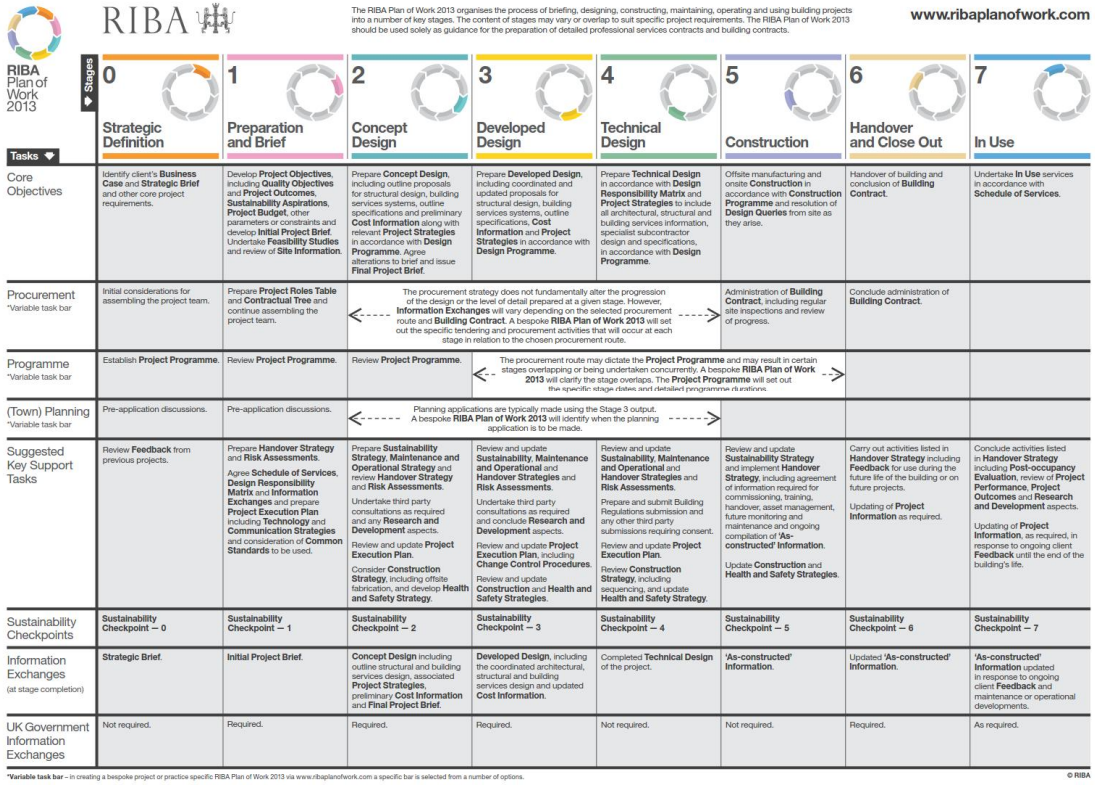






Trimble.

Delivering BIM needs a plan



RIBA

The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projects into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

www.ribaplanofwork.com

RIBA Plan of Work 2013

Tasks / Stages	0 Strategic Definition	1 Preparation and Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction	6 Handover and Close Out	7 In Use
Core Objectives	Identify client's **Business Case** and **Strategic Brief** and other core project requirements.	Develop **Project Objectives**, including **Quality Objectives** and **Project Outcomes**, **Sustainability Aspirations**, **Project Budget**, other parameters or constraints and develop **Initial Project Brief**. Undertake **Feasibility Studies** and review of **Site Information**.	Prepare **Concept Design**, including outline proposals for structural design, building services systems, outline specifications and preliminary **Cost Information** along with relevant **Project Strategies** in accordance with **Design Programme**. Agree alterations to brief and issue **Final Project Brief**.	Prepare **Developed Design**, including coordinated and updated proposals for structural design, building services systems, outline specifications, **Cost Information** and **Project Strategies** in accordance with **Design Programme**.	Prepare **Technical Design** in accordance with **Design Responsibility Matrix** and **Project Strategies** to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with **Design Programme**.	Offsite manufacturing and onsite **Construction** in accordance with **Construction Programme** and resolution of **Design Queries** from site as they arise.	Handover of building and conclusion of **Building Contract**.	Undertake **In Use** services in accordance with **Schedule of Services**.
Procurement *Variable task bar	Initial considerations for assembling the project team.	Prepare **Project Roles Table** and **Contractual Tree** and continue assembling the project team.	The procurement strategy does not fundamentally alter the progression of the design or the level of detail prepared at a given stage. However, **Information Exchanges** will vary depending on the selected procurement route and **Building Contract**. A bespoke **RIBA Plan of Work 2013** will set out the specific tendering and procurement activities that will occur at each stage in relation to the chosen procurement route.			Administration of **Building Contract**, including regular site inspections and review of progress.	Conclude administration of **Building Contract**.	
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(Town) Planning *Variable task bar	Pre-application discussions.	Pre-application discussions.	Planning applications are typically made using the Stage 3 output. A bespoke **RIBA Plan of Work 2013** will identify when the planning application is to be made.					
Suggested Key Support Tasks	Review **Feedback** from previous projects.	Prepare **Handover Strategy** and **Risk Assessments**. Agree **Schedule of Services**, **Design Responsibility Matrix** and **Information Exchanges** and prepare **Project Execution Plan** including **Technology** and **Communication Strategies** and consideration of **Common Standards** to be used.	Prepare **Sustainability Strategy**, **Maintenance and Operational Strategy** and review **Handover Strategy** and **Risk Assessments**. Undertake third party consultations as required and any **Research and Development** aspects. Review and update **Project Execution Plan**. Consider **Construction Strategy**, including offsite fabrication, and develop **Health and Safety Strategy**.	Review and update **Sustainability**, **Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Undertake third party consultations as required and conclude **Research and Development** aspects. Review and update **Project Execution Plan**, including **Change Control Procedures**. Review and update **Construction** and **Health and Safety Strategies**.	Review and update **Sustainability**, **Maintenance and Operational** and **Handover Strategies** and **Risk Assessments**. Prepare and submit Building Regulations submission and any other third party submissions requiring consent. Review and update **Project Execution Plan**. Review **Construction Strategy**, including sequencing, and update **Health and Safety Strategy**.	Review and update **Sustainability Strategy** and implement **Handover Strategy**, including agreement of information required for commissioning, training, handover, asset management, future monitoring and maintenance and ongoing compilation of **'As-constructed' Information**. Update **Construction** and **Health and Safety Strategies**.	Carry out activities listed in **Handover Strategy** including **Feedback** for use during the future life of the building or on future projects. Updating of **Project Information** as required.	Conclude activities listed in **Handover Strategy** including **Post-occupancy Evaluation**, review of **Project Performance**, **Project Outcomes** and **Research and Development** aspects. Updating of **Project Information**, as required, in response to ongoing client **Feedback** until the end of the building's life.
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UK Government Information Exchanges	Not required.	Required.	Required.	Required.	Not required.	Not required.	Required.	As required.

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© RIBA

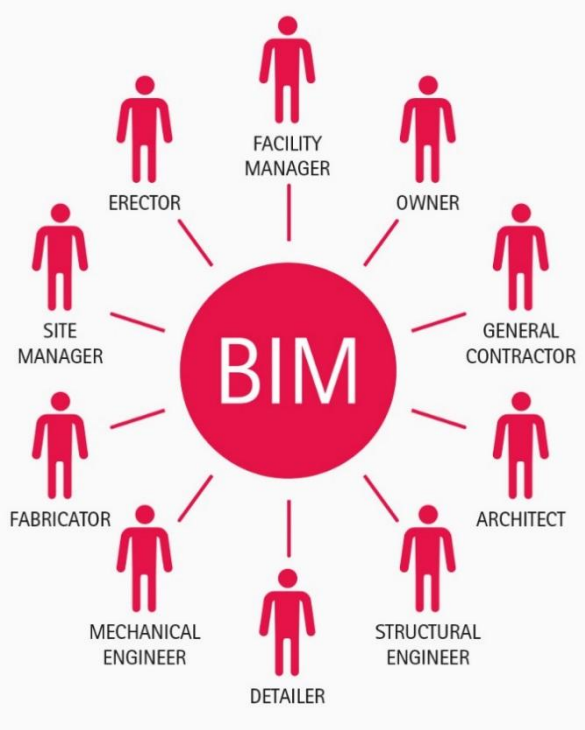
The Digital Plan of Work

0. Strategic Definition	1. Preparation and Brief	2. Concept Design	3. Developed Design
We have a problem with an asset	Do we build or refurbish?	We need to design a frame	The frame solution is – steel, concrete....

4. Technical Design	5. Construction	6. Handover and Close Out	7 In Use
Detailed design by engineer & fabricator	The design is delivered on site	Asset information handover – model and documents	Can I take this column out?

Creating Data with accurate 3D models

Create data once, use multiple times



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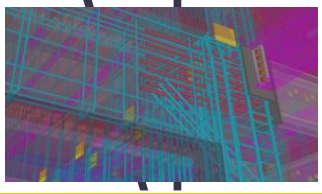
Model-based working supports the fabrication process


O'REILLY concrete
PRECAST CONCRETE SOLUTIONS

The model – created once
Supporting 16 Manufacturing Processes
Used by 9 Roles in the Business

MODEL | FABRICATE | ERECT

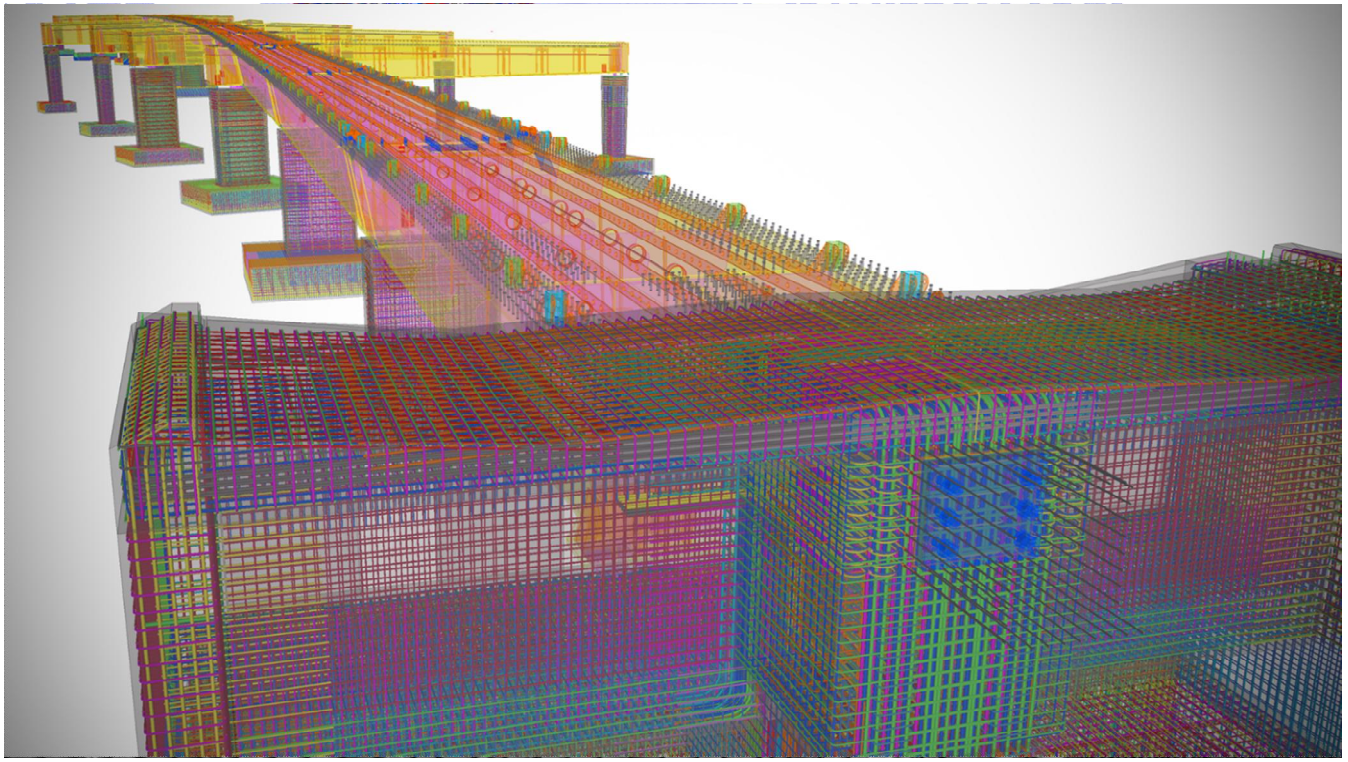
Estimator,
Sales manager

Detailer, Drafter

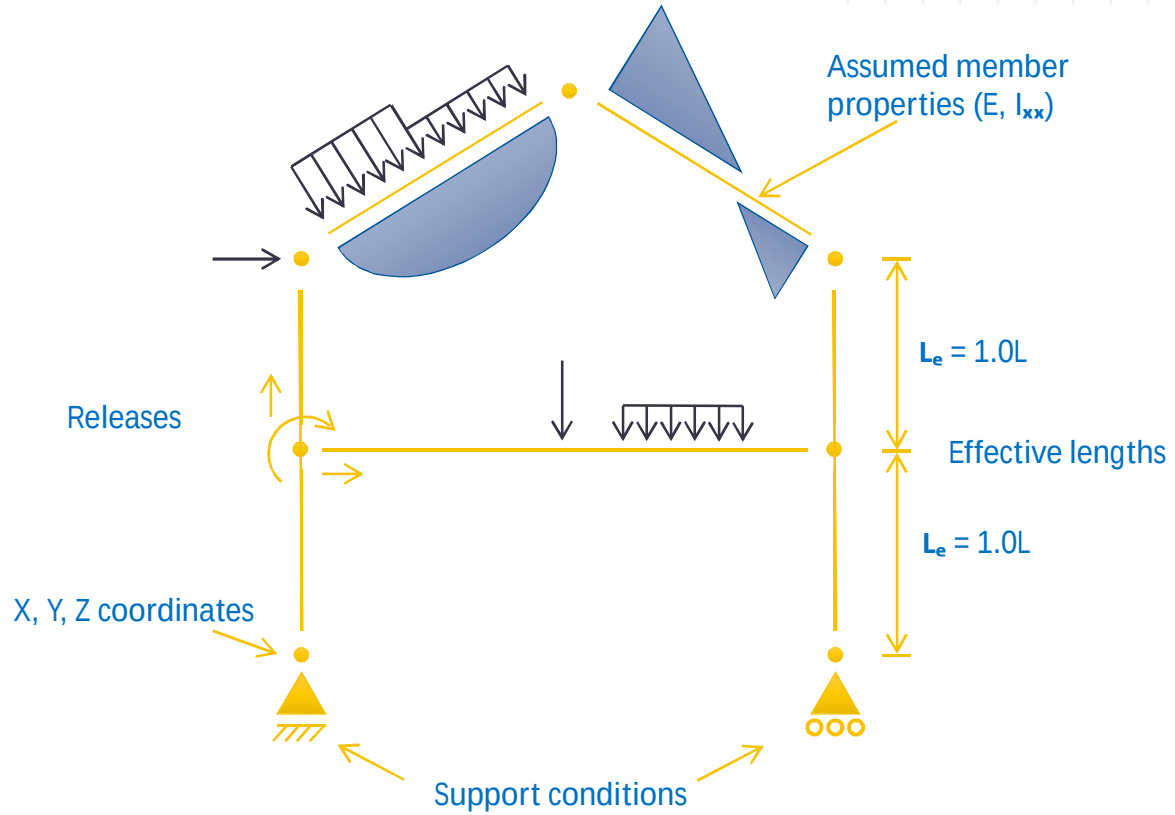
Production Planner, Purchaser
Delivery Coordinator

Installation Managers/
Coordinators

Geometrically accurate, appropriate data rich designs

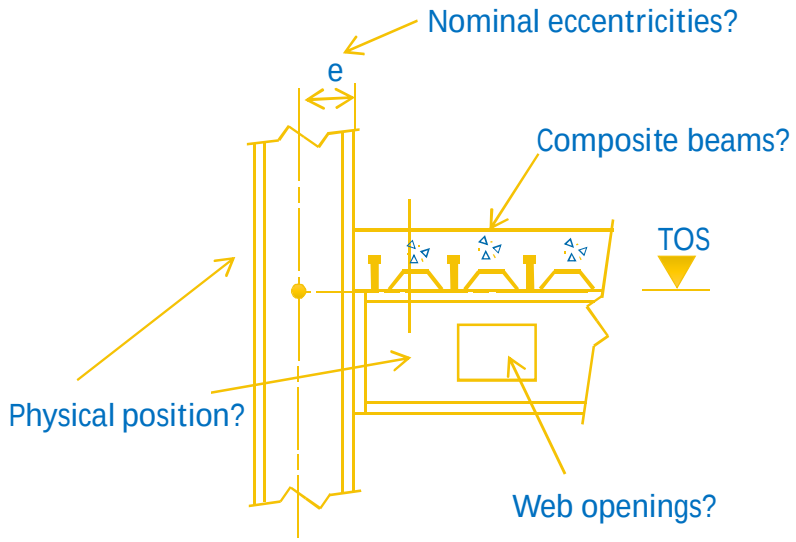


Traditional approach to analysis & design

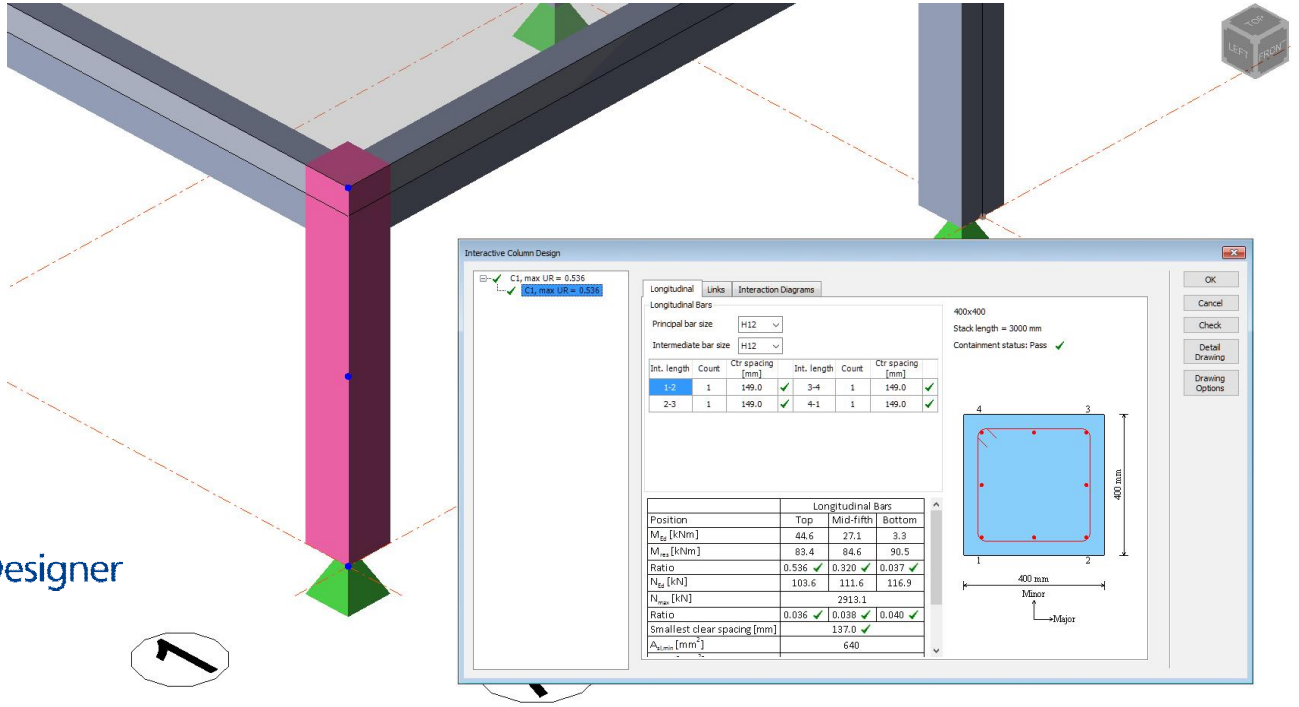


A New Approach – Why is TSD different ?

- Fully 3D – not 2.5D, allowing users to visualize and work with the model in 2D horizontal (Floors) and 2D vertical (Frames)
- Actual physical modelling of members. E.g. Beams, Columns, Braces, Composite, Non-composite elements
- This is important because?



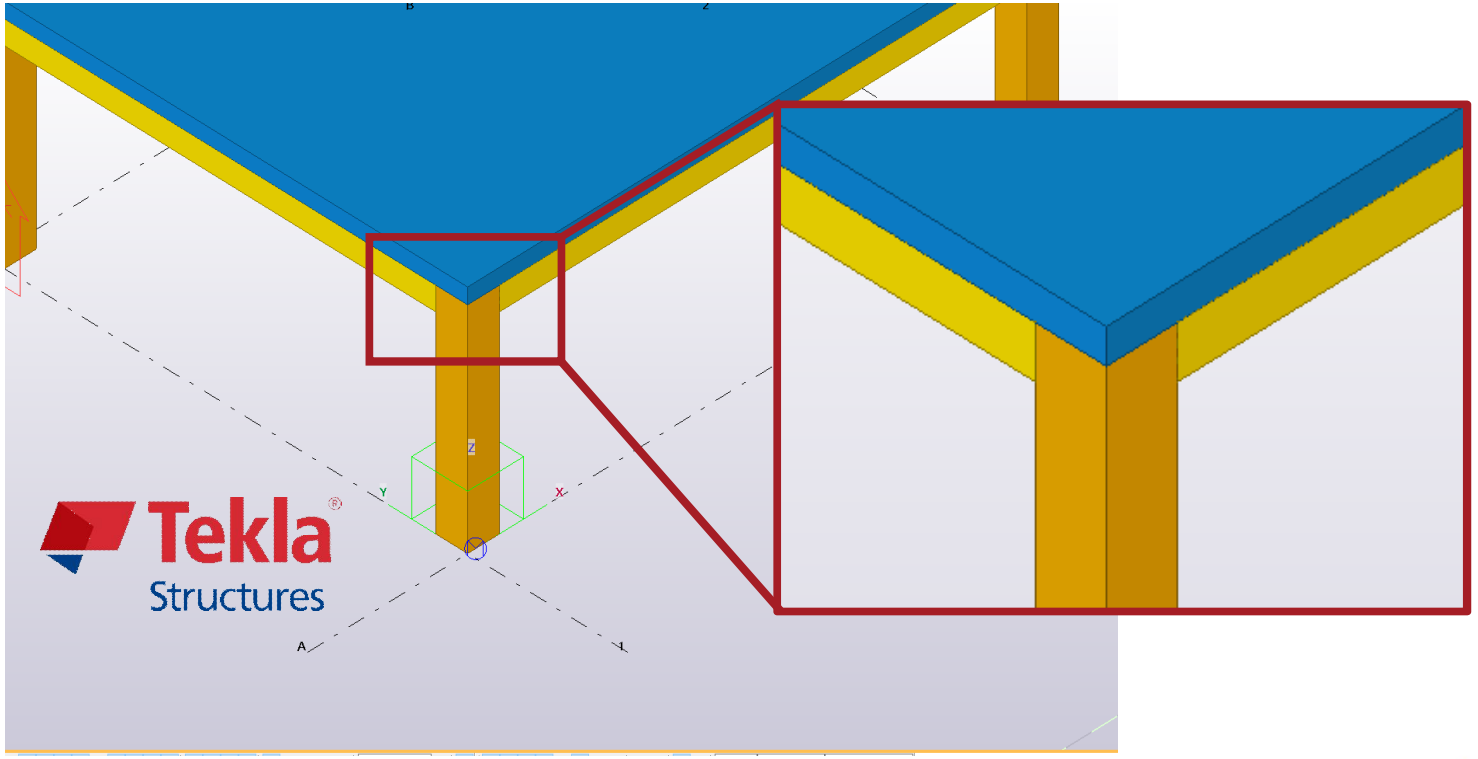
Stage 3 – Tekla Structural Designer



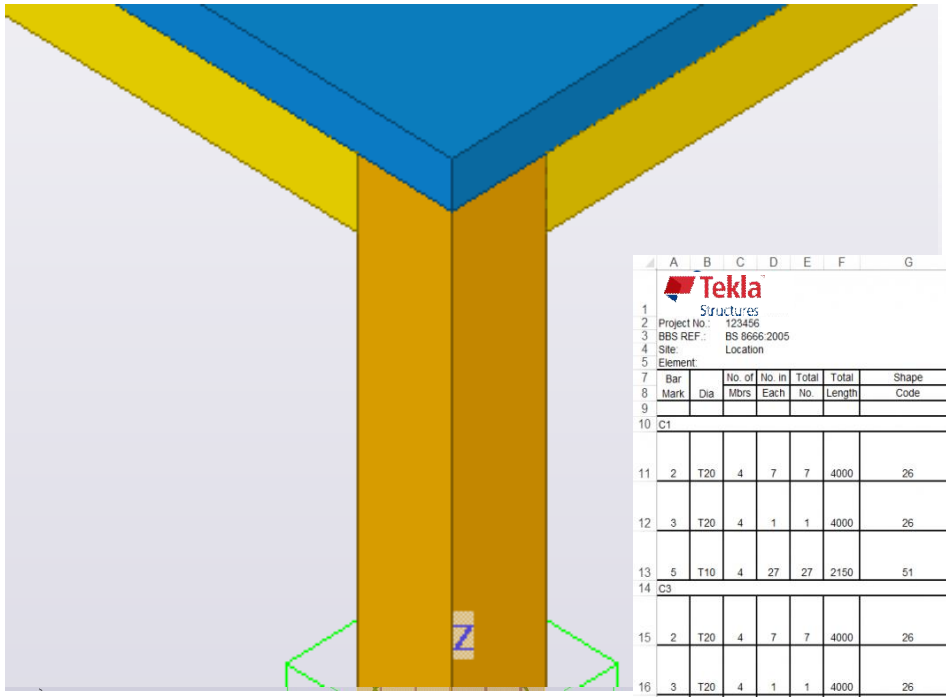
Tekla®
Structural Designer

Trimble.

Stage 4 – Tekla Structures



Stage 5 – Tekla Structures



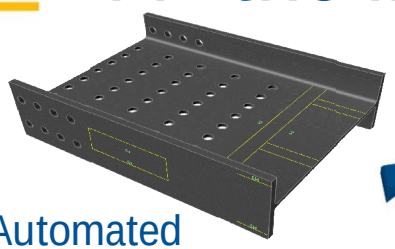
Tekla Structures

Project No.: 123456 | Dwg Ref: 123456
BBS REF.: BS 8666:2005 | REV.: 0 | DATE: 26.08.2014
Site: Location | Page No: 1
Element: | Created By:

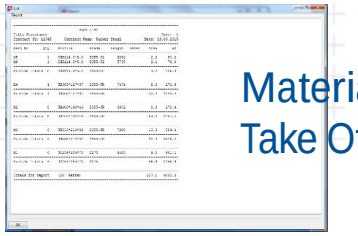
Bar Mark	Dia	No. of Mbrs	No. in Each	Total No.	Total Length	Shape Code	A (mm) F	B (mm) G	C (mm) H	D (mm) I	E/R (mm) J	SHAPE	Weight/Bar (kgs)	Weight (Kgs)	Remarks
C1															1
2	T20	4	7	7	4000	26	2735	260	1000	40		2735 260 4" 4" 1000	9.864	69.048	
3	T20	4	1	1	4000	26	2740	255	1000	40		2740 4" 4" 255 1000	9.864	9.864	
5	T10	4	27	27	2150	51	490	490	150	150		150 490 490	1.3244	35.7588	
C3															5
2	T20	4	7	7	4000	26	2735	260	1000	40		2735 260 4" 4" 1000	9.864	69.048	
3	T20	4	1	1	4000	26	2740	255	1000	40		2740 4" 4" 255 1000	9.864	9.864	
5	T10	4	27	27	2150	51	490	490	150	150		150 490 490	1.3244	35.7588	
						Total								229.3416	

Giving Greater Benefits

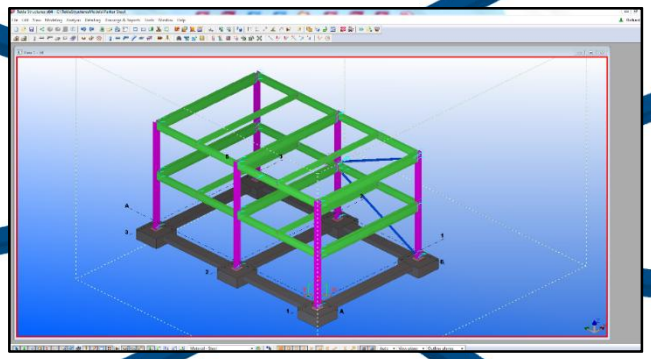
All the information in one place

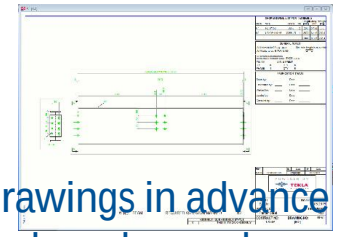


Automated fabrication



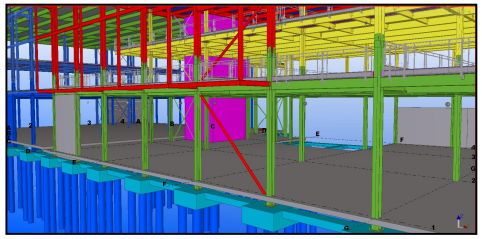
Material Take Off



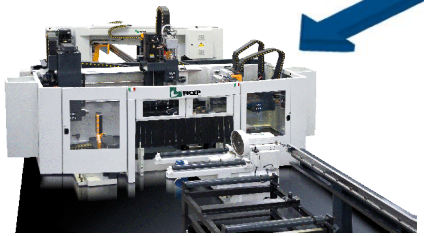


Drawings in advance and on-demand

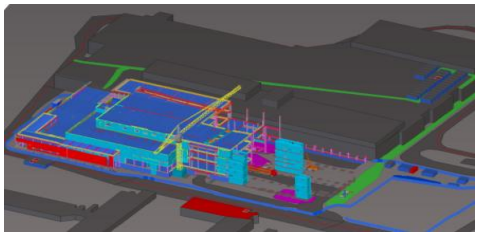
Model-based layout



Safety



Production Tracking & Management

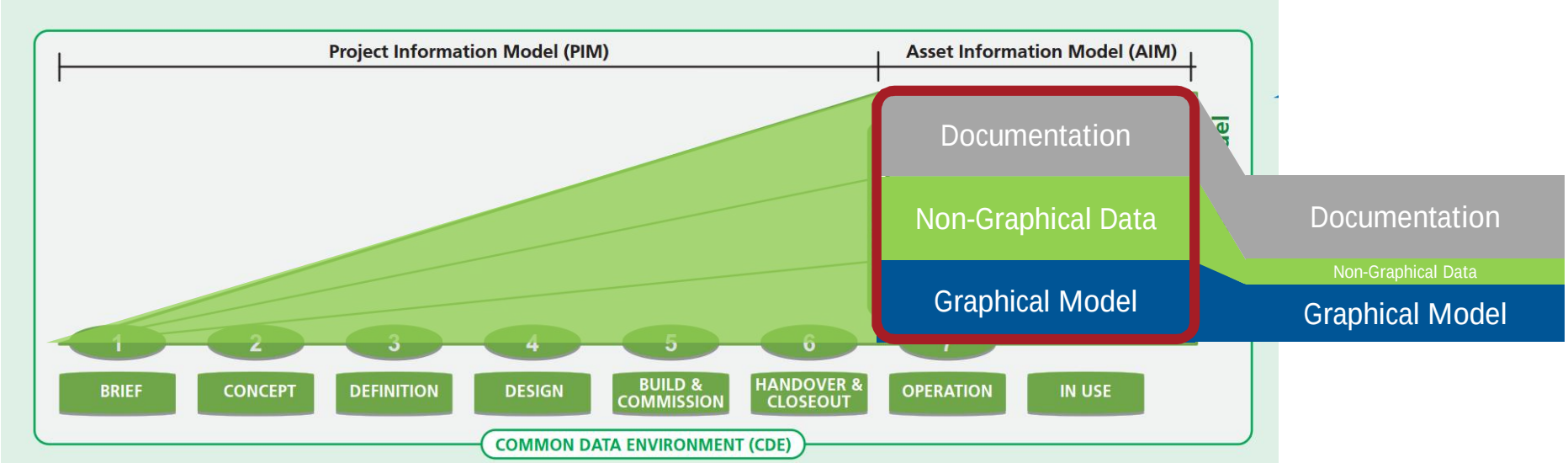


Logistics and Planning

Trimble

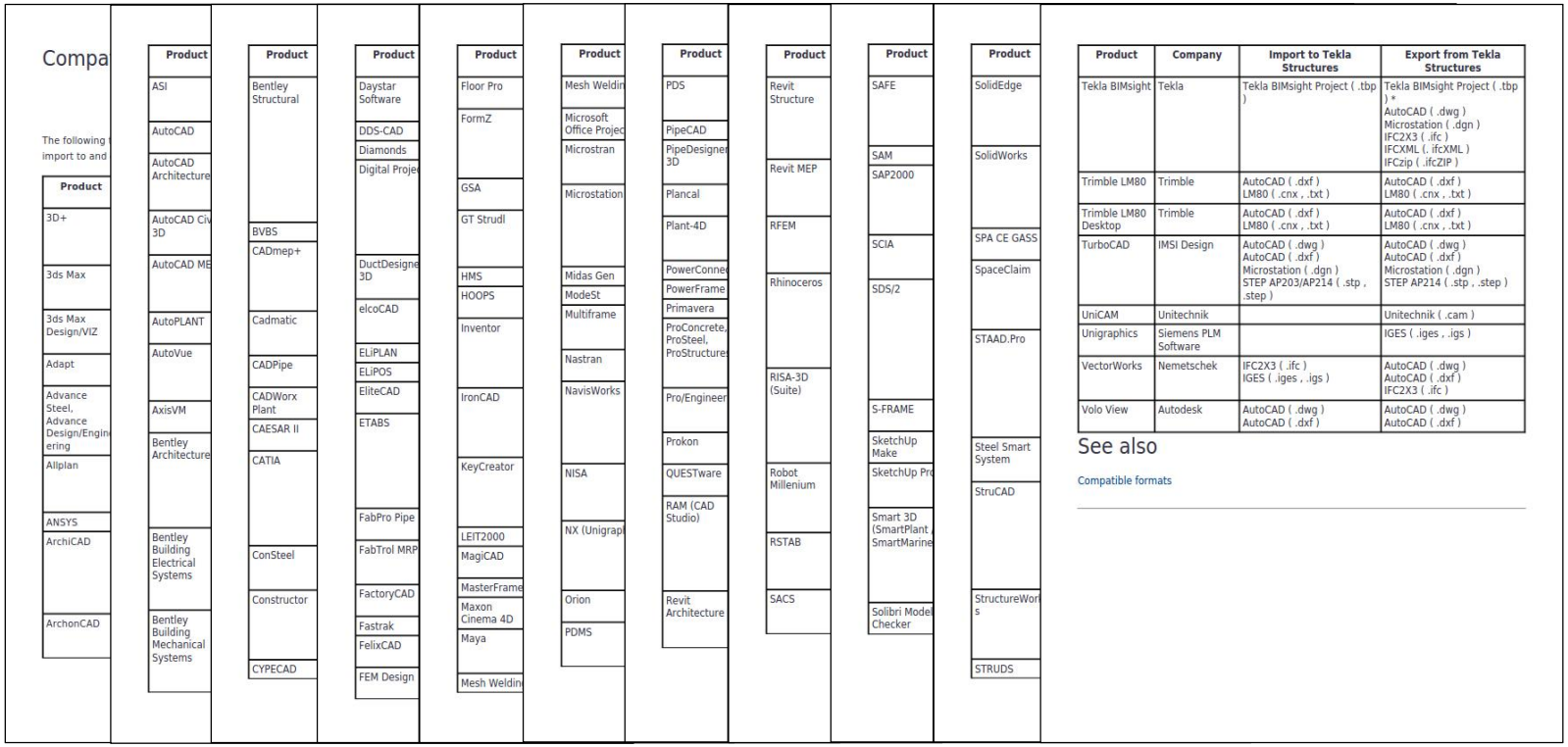
Information through the life of the asset

- Think about peaks and troughs of information flow but don’t lose the data!!



Create Standardised Data

Creating standardised data



Compa

The following
import to and

Product
3D+
3ds Max
3ds Max Design/VIZ
Adapt
Advance Steel, Advance Design/Engineering
Allplan
ANSYS
ArchiCAD
ArchonCAD

Product
ASI
AutoCAD
AutoCAD Architecture
AutoCAD Civil 3D
AutoCAD ME
AutoPLANT
AutoVue
AxisVM
Bentley Architecture
Bentley Building Electrical Systems
Bentley Building Mechanical Systems

Product
Bentley Structural
BVBS
CADmep+
Cadmatic
CADPipe
CADWorx Plant
CAESAR II
CATIA
ConSteel
Constructor
CYPECAD

Product
Daystar Software
DDS-CAD
Diamonds
Digital Proje
DuctDesigne 3D
elcoCAD
ELiPLAN
ELiPOS
EliteCAD
ETABS
FabPro Pipe
FabTrol MRP
FactoryCAD
Fastrak
FelixCAD
FEM Design

Product
Floor Pro
FormZ
GSA
GT Strudl
HMS
HOOPS
Inventor
IronCAD
KeyCreator
LEIT2000
MagiCAD
MasterFrame
Maxon Cinema 4D
Maya
Mesh Weldin

Product
Mesh Weldin
Microsoft Office Projec
Microstran
Microstation
Midas Gen
ModeSt
Multiframe
Nastran
NavisWorks
NISA
NX (Unigrap
Orion
PDMS

Product
PDS
PipeCAD
PipeDesigner 3D
Plancal
Plant-4D
PowerConne
PowerFrame
Primavera
ProConcrete, ProSteel, ProStructures
Pro/Engineer
Prokon
QUESTware
RAM (CAD Studio)
Revit Architecture

Product
Revit Structure
Revit MEP
RFEM
Rhinoceros
RISA-3D (Suite)
Robot Millenium
RSTAB
SACS

Product
SAFE
SAM
SAP2000
SCIA
SDS/2
S-FRAME
SketchUp Make
SketchUp Pro
Smart 3D (SmartPlant / SmartMarine
Solibri Model Checker

Product
SolidEdge
SolidWorks
SPA CE GASS
SpaceClaim
STAAD.Pro
Steel Smart System
StruCAD
StructureWor s
STRUDS

Product	Company	Import to Tekla Structures	Export from Tekla Structures
Tekla BIMsight	Tekla	Tekla BIMsight Project (.tbp)	Tekla BIMsight Project (.tbp) + AutoCAD (.dwg) Microstation (.dgn) IFC2X3 (.ifc) IFCXML (.ifcXML) IFCzip (.ifcZIP)
Trimble LM80	Trimble	AutoCAD (.dxf) LM80 (.cnx , .txt)	AutoCAD (.dxf) LM80 (.cnx , .txt)
Trimble LM80 Desktop	Trimble	AutoCAD (.dxf) LM80 (.cnx , .txt)	AutoCAD (.dxf) LM80 (.cnx , .txt)
TurboCAD	IMSI Design	AutoCAD (.dwg) AutoCAD (.dxf) Microstation (.dgn) STEP AP203/AP214 (.stp , .step)	AutoCAD (.dwg) AutoCAD (.dxf) Microstation (.dgn) STEP AP214 (.stp , .step)
UniCAM	Unitechnik		Unitechnik (.cam)
Unigraphics	Siemens PLM Software		IGES (.iges , .igs)
VectorWorks	Nemetschek	IFC2X3 (.ifc) IGES (.iges , .igs)	AutoCAD (.dwg) AutoCAD (.dxf) IFC2X3 (.ifc)
Volo View	Autodesk	AutoCAD (.dwg) AutoCAD (.dxf)	AutoCAD (.dwg) AutoCAD (.dxf)

See also

Compatible formats

Why standardised data?

- Create data once, use it multiple times
- Agree what data is really important when, and why
- Define these requirements in the BIM procedures
- Increase outreach for BIM as transformation from human readable documents to machine readable structured data (information production → information consumption via CDE)
- Accelerate efforts on promoting and supporting implementation of MVDxml and MVDs to support smooth workflow in real projects

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Thank You