AIMCH

TRANSFORMING HOW WE BUILD HOMES

Work package 5:
Guide to Creating a BIM Housing Manual

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EXECUTIVE SUMMARY

A Guide to Creating a BIM Housing Manual

Building Information Modelling (BIM) is a process which can bring benefits to any construction project, but it brings new challenges to the way we work. In housebuilding it will require developers to adopt new design standards and processes, which have been historically developed with bespoke commercial projects in mind. This requires an understanding of those standards and processes, and how they can be applied in a practical way within the house building community.

BIM brings many new terms and vocabulary into the working environment and navigating through them can be daunting. There are many forums and guides to help industry transition over from 2D to BIM enabled 3D design processes and collaborative working practises. However, these tend to reflect bespoke one-off commercial projects, where uptake has been greatest. They do not fully reflect the house building industries processes, from land identification through to after care.

The housing industry differs to general construction, in the use of standard house types and repetitive regulatory processes, design, procurement, construction and sales stages, which are generally internally governed by developers and house builders. This is well suited to BIM adoption, where the benefits of a standardised designs, collaborative procurement and repeatable processes are inherently built into the housebuilding delivery process.

BIM brings many new documents, practises and forms of information, these are intended to help people to work more efficiently and in a collaborative way, moving away from individual silos where we are disconnected from others, and decisions often taken in isolation.

The UK and Scottish governments have mandated within public procurement the adoption of BIM industry standards, to help cross sector and international collaboration while driving efficiency into the construction industry, which has been lagging in adopting digital practices.

For the housebuilding community to navigate the transition from 2D paper based design into BIM enabled 3D digital design, AIMCH has created this Guide to Creating a BIM Housing Manual. This manual provides a framework for those developers, housebuilders and stakeholders whom are thinking of adopting BIM within there working practises, so they can better consider and tailor their BIM adoption and transition approach, to suit their own business drivers, needs and systems.

There is no single perfect fit. The transition to BIM collaborative design practises, will be a combination of many things and specific detail relevant to the business. This guide sets out the types of things people/businesses should consider when committing to BIM. There are many technical and people related elements to consider and to be put into place. This guide aims to identify these and guide developers in creating their own tailored approach to adopting BIM workflow's and processes, that suits their business and housing developments.

CONTENTS

1. SCOPE

The intention of this document is to ensure a housing designer's BIM manual for model content development is created in alignment with BS EN ISO 19650, the main standard put forward by the UK and Scottish Governments in their recommendation for BIM compliance, while utilising component standardisation, BIM workflows and procedures to ensure consistency and efficiency within the process.

The guide also covers the softer non-technical aspects, relating to people such as knowledge, competency and training, as well as cultural and organisational development. These aspects are very important to consider in conjunction with the technical aspects outlined within this guide.

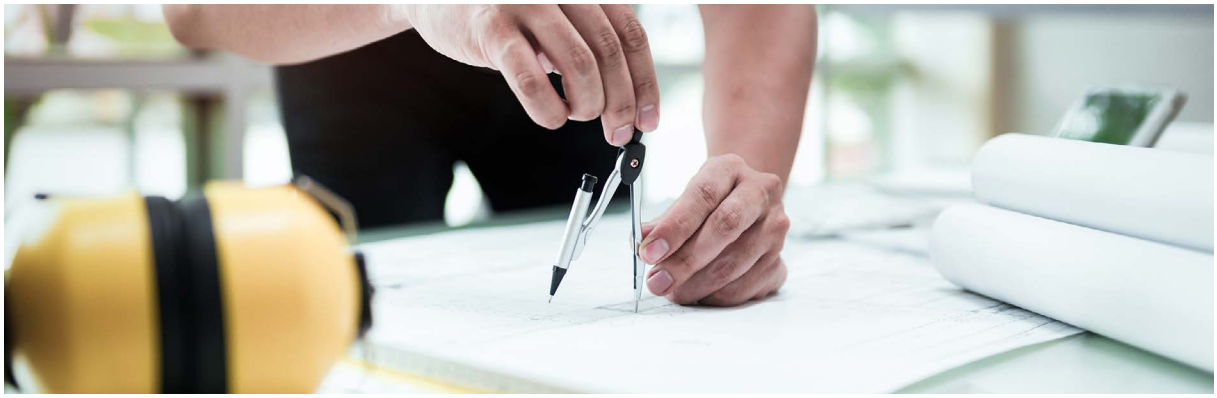
Adoption of these procedures will lead to more efficient methods of working and a unified approach to the creation of both graphic and technical outputs. The intention is that these procedures are transferrable across projects and follow a logical set of rules that can be easily understood by all BIM model software users with a range of experience and knowledge.

It is recognised that housing projects will vary in scale, use and form. Contractual requirements and collaboration internally between department or with consultants externally, will dictate the level of input to a model and the resultant output will vary, hence the procedures within the guide will be stringent enough to ensure consistency and maximise productivity yet allow enough flexibility to accommodate a variety of housing solutions.

The key objective of this BIM Housing Guide is to:

- Set out the expected standards that should be applied to the creation of a Project Information Model (PIM) created using 3D modelling software to ensure alignment with BS EN ISO 19650.
- Address the need for a collective and consistent approach across all housing designer work steams, projects and offices.
- Enable modern working methods to develop in the workstream, ensuring data capture for key tasks and processes to engender efficiencies.
- Be a source of information for staff to adopt a consistent approach to model and information production

Note: There are many suppliers of 3D modelling software available, the examples and content of this manual are based on use within Autodesk Revit software, but this is not intended as an endorsement or recommendation. Software should be researched and the best fit for a company needs be put in place.



2. ABBREVIATIONS

2D	2 Dimensional
3D	3 Dimensional
AIR	Asset Information Requirements
BEP	BIM Execution Plan
BIM	Building Information Modelling
BIM(M)	BIM Information Management
BSi	British Standards Institution
CAD	Computer aided drafting (or design)
CDE	Common Data Environment
CGI	Computer generated Image
COBie	Construction Operations Building information exchange
EIR	Exchange Information Requirements
FM	Facilities Management
IFC	Industry Foundation Class
IM	Information Manager
MIDP	Master Information Delivery Plan
NBS	National Building Specification
PIM	Project Information Model
QA	Quality Assurance
SFT	Scottish Futures Trust
TBC	To be confirmed
TIDP	Task Information Delivery Plan
UK	United Kingdom
VR	Virtual reality

3. PREFACE

3.1 The case for BIM & What does BIM Mean?

The business case for BIM is often a combination of facts and believes into the actual and/or perceived benefits that BIM working can realise. Within housebuilding there is a clear trend towards BIM enabled 3D digital working, with many national, regional and local house builders/developers either well on the way or at the start of the journey, with many thinking of transitioning to BIM.

BIM is strategic decision and needs to be fully considered. It is likely to be a minimum of 5 year transition period, so robust planning and stamina to embed BIM working practises and commercially realise the business benefits will be required. The case for BIM is not clear cut and difficult to commercially evaluate. Some of the potential benefits within house building are as follows:

BIM IMPLEMENTATION

Planning	Design	Sales	Construction	Customer Care
▪ Realistic and Accurate Site Flythrough ▪ Views of Site Impact Created from Models ▪ Reduced Time Spent on 2D CAD Drawings ▪ Adaptive and Efficient Site Design ▪ Vegetation Visualisations from Construction- 6 Months- 1 Year etc..	▪ Effective Communication of Design Decisions & Changes ▪ Utilising 3D Models to Identify & Design Solutions to Potential Site Issues ▪ Reduced Time Spent on 2D CAD Drawings ▪ Drawings Issued Via Share File Direct to Site Team & Sub Contractors	▪ Artistic Images taken from 3D Models = Reduces Timescales for Brochure Production ▪ Utilising 3D Models to Visualise Designs Off-Plan Increasing Earlier Sales ▪ Accurate 2D Drawings of Every House Type ▪ Various Client Options can be Effectively Visualised & Modified in 3D	▪ Reduced Issues On Site = Accurate and Reduced Timelines ▪ Utilising 3D Models to Visualise Construction Processes ▪ Accurate 2D Drawings Issued on Share Files Ensures Correct Revisions ▪ Reduced Possibility of Construction Mistakes & Health & Safety Issues	▪ Provision of Accurate Handover Dates ▪ Snag Lists Recorded by Team on Tablet- Imported to 3D Model- Communicated to Team ▪ Accurate 3D Model & Drawings Ensure Replacement Materials and Products Easily Sourced ▪ Recurring Issues are Logged and Fed Back to Design Teams
				
• Reduce planning cycle by 30% • 50% increase in the likelihood of securing planning • 25% increased support for community consultations • 100% sites consented in Y1 • £600/plot saving in cost securing planning	• £500/plot saving in abnormal costs through 3D land design • 30% reduction in site architectural design time • 35% productivity gain for technical users • £300/plot saving in RFI	• £250/plot saving in marketing costs • 20% increase in sales rates 0.84/ week to 1.1/week • £600/plot saving in development finance costs • Move towards a build to order business model • £500/plot premium for early sales interaction & home personalization	• £250/plot saving in defects and snagging • 20% increase in handovers on time • £350/plot saving in cost of missed handovers & NHBC resolutions • £150/plot saving in reworks and making good, due to early clash detection • 30% improvement in safety performance	• 30% increase in recommendations and referrals, retention of 5 * • OTIF handovers & digital move in packs & aftercare • Higher likelihood of customers buying off plan • Brand differentiation due to visualization and potential personalization • Potential for early deposits, easing cash flow

Housebuilding Business Benefits of BIM

Business Case for BIM: Potential Return on Investment Outcomes

The definition of BIM is often confused, but can be linked back to the following three aspects:

BIM (Building Information Modelling): What is it?

- Collaborative working, using digital information to streamline design, construction and sales processes, as well as supply chain interfaces, in a more effective integrated way, reducing waste, downtime, errors and re-working
- It's a potential smart way, to add value to customers, businesses and roles, bringing differentiation and competitive advantages
- It's an integrated business process, driven by new parametric software systems, that embeds information in to 3D building models, that simplifies the work flows and information, improving efficiency

From a standards perspective there two definitions of the acronym BIM:

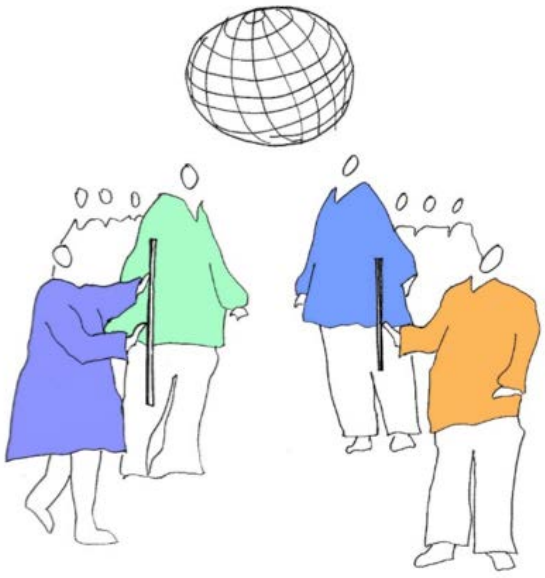
BUILDING INFORMATION MODEL	**This refers to the 3D model produced**
BUILDING INFORMATION MODELLING	**This refers to the process of working with one of, or a series of linked building information models and related to a series of standards in a collaborative process with all other members of the design team and supply train**

For the purposes of this document the acronym BIM will refer to the latter, BUILDING INFORMATION MODELLING.

Note: BS EN ISO19650 refers to BIM Information Management, which will be denoted as BIM(M)

The acronym PIM will refer to the Project Information Model, i.e. the 3D model.

3.2 The BIM Process



BIM is a collaborative way of working where the whole delivery team work together, sharing all construction information through one location, the Common Data Environment (CDE), which is used to file, manage and distribute all project data.

It combines 3D model geometry with construction and maintenance information through parametric software while following a set of industry standards, across the whole supply chain and project team to simplify work flows and improve efficiency.

Both the UK and Scottish governments have mandated that public works projects over a contract cost threshold be delivered with BIM to gain efficiencies and cost savings.

Private sector clients are following into the BIM process as it reduces waste, downtime, potential errors on site and continues into operation and management of completed buildings.

The housing sector is in the early stages of adoption, and this guide aims to help introduce BIM methods to aid that adoption.

An important aspect of any business considering BIM adoption, to fully understand the process and implications of change. BIM is a collaborative process and requires working practises which engage and support this style of working. This may mean organisation change and new engagement processes with third parties, driving collaborate working and long term relationships with suppliers, sub-contractors and consultants involved in the process.

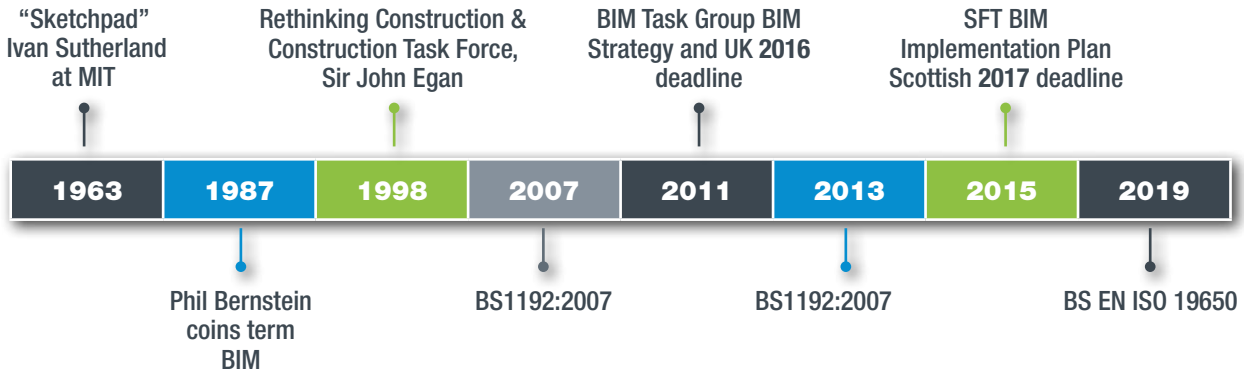
3.3 How has BIM developed?

BIM roots lie in the development of computer aided design software in the late 1970's and early 1980's developing from 2D paper based design into 3D digital modelling. The development of data input through parameters within 3D modelling in those years was the shift which brought the beginnings of BIM standards and processes. The timeline shown in Figure 3.2 below outlines some salient moments in the development of BIM over the years since then.

In 2013 the release of the first documents in the PAS1192 series of standards set out how to work within BIM processes at all levels of BIM adoption, and this series of standards became the benchmark for achieving BIM Level 2, and in the same year the RIBA produced their Plan of Works BIM overlay.

In early 2019 BS EN ISO 19650, an international standard was released, replacing PAS 1192, with regional annexes to provide clarify for different nations which adopt it. The UK annexe contains clarification on UK specific naming conventions, metadata, information model exchange and information requirements. This standard was recommended for use on all new projects from April 2019.

Figure 3.2 History of BIM



3.4 The Elements of BIM

To deliver a BIM project requires that the design team work to industry standards and that key BIM elements are integrated into the project, working to BS EN ISO 19650 the key BIM elements are shown opposite:

Important BIM elements to be anchored into BIM adoption strategies

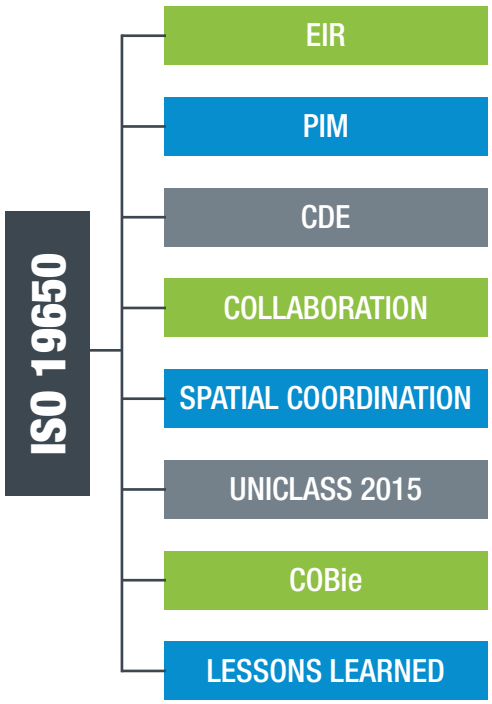
EIR - Exchange Information requirements

PIM - Project Information Model

CDE - Common Data Environment

COBie - Construction Operations Building information exchange

Uniclass 2015 – a coding system used to classify construction objects



3.5 The standards of BIM

The current UK and Scottish standard for BIM delivery is BS EN ISO 19650, parts 1 and 2. This replaces PAS1192 parts 1 and 2, and BS1192:2007+A2 and there will be further ISO 19650 document releases to supersede further parts of PAS1992.

Until such time as these are available the current standards as of March 2020 are:

BS EN ISO19650-1 Organisation of information about construction works – Information management using building information modelling – Part 1

BS EN ISO19650-2 Organisation of information about construction works – Information management using building information modelling – Part 2

BS EN ISO19650-5 Part 5: Security-minded approach to information management

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

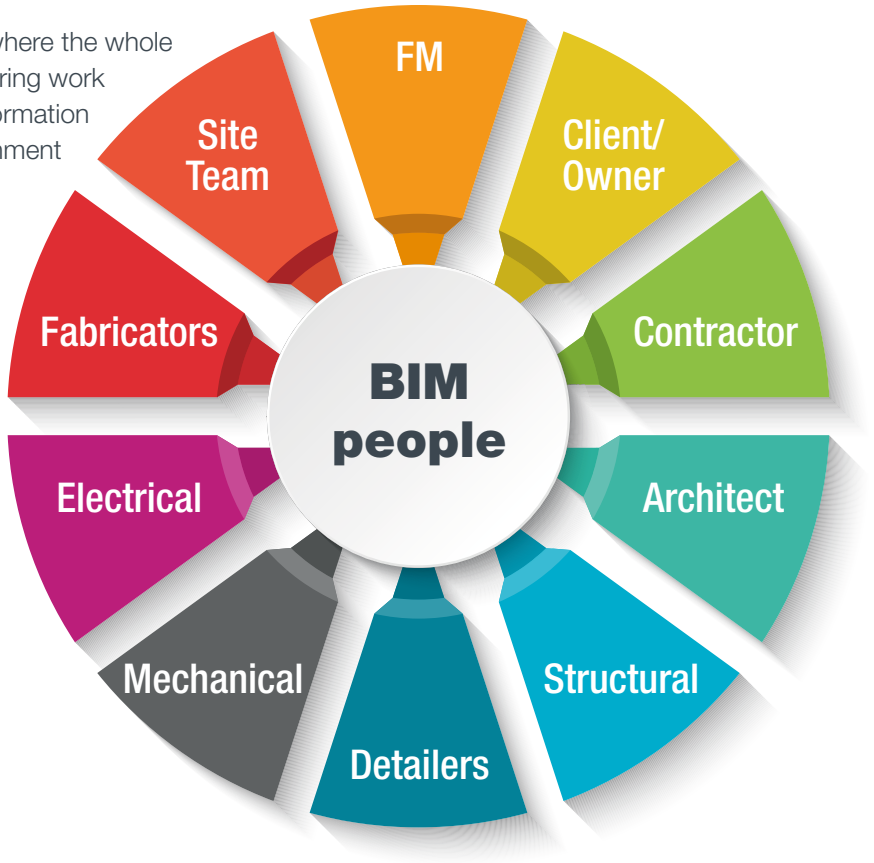
BS 1192-4:2014 Collaborative production of information. Fulfilling employer's information exchange requirements using COBie

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

BS 8536-2:2016 Briefing for design and construction. Code of practice for asset management

3.6 Collaboration of BIM

BIM is a collaborative process, where the whole delivery team work together, sharing work in progress and construction information through a Common Data Environment (CDE). This brings a change in workflow since individual teams no longer work alone, or in silos, and contribute to the flow of information with the wider team at regularly planned information exchange points. The agreed standards, responsibilities and workflows to ensure a collaborative process will be agreed by the project team through a BIM Execution Plan.



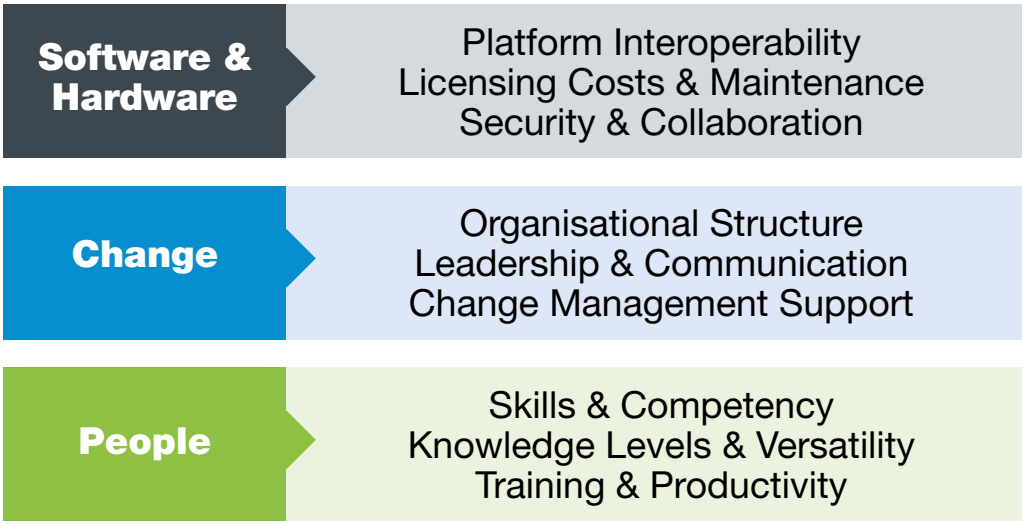
3.7 Transition from 2D to 3D Project Information Models (PIM) and BIM

Any transition can be challenging. When the construction industry moved from the drawing board to the computer and then to 2D CAD many people struggled to adapt, and took a long time to cross over into the digital environment, but once they made the step the realised the benefits it brought with it, e.g. no need to scrape away layers of paper or film when a drafting mistake was made and redraw on top.

Similarly, moving to 3D Modelling and BIM can be daunting. New software to learn, new processes to consider and a new workflow to fit into. In the first instance there should be an acknowledgement that staff who can work quickly and efficiently in their existing software and working methods are going to be a lot slower for some time, until they become conversant and confident with the new software. This time will vary dependant on the individual, but most people will find a moment when going back to the previous software would seem unreasonable.

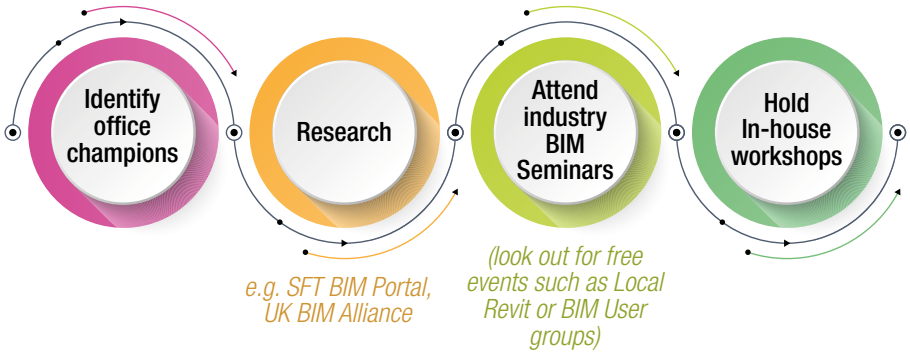
Note: Remember that good BIM skills require to be matched with good technical skills to ensure product quality.

Implementing BIM is a step which needs thorough consideration and strategic/operational planning, some of the key considerations are outlined below:



This can be further broken into steps with some helpful ways of helping staff to overcome the challenges at the early stages are identified in the following diagrams:

Awareness



Software

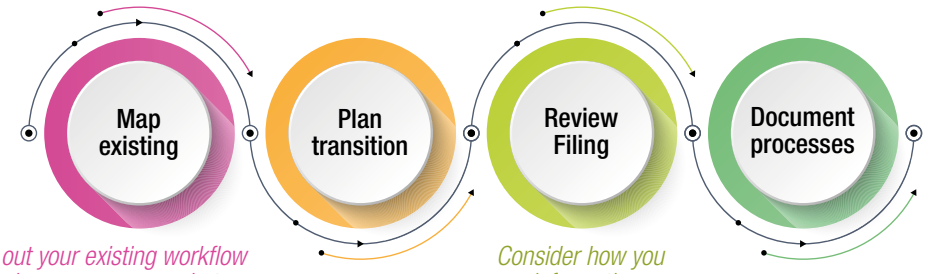
Arrange Demonstrations

Ask industry contacts

Get trial versions for testing

Consult with software suppliers on integration
Plan a software workflow to match your processes

Processes



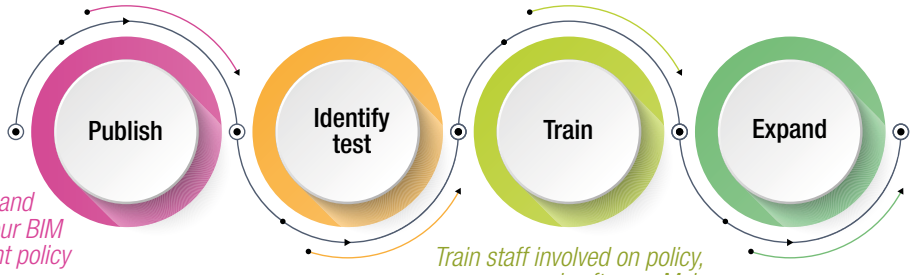
Map out your existing workflow and processes, e.g. what software is being used, what info gets exported for use in another software

Plan how this can transition to the software you've identified

Consider how you save information, e.g is there a consistent folder structure and naming conventions

Review the above and document how you want staff to work, including permissions, e.g. will every user be allowed to set up models

Implement



Publish and promote your BIM management policy

Choose a test project/ team, develop super users and BIM knowledge levels appropriate for differing roles.

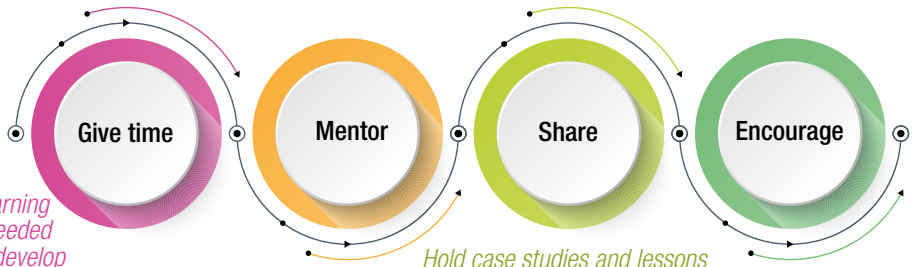
Train staff involved on policy, processes and software. Make them aware of expectations and consequences of not following the processes agreed but be open to making changes if the test shows that some aren't efficient.

Use staff from your test project as mentors to roll out to all projects/ teams.

Have clear communications plan. Ensure leadership are committed and demonstrate correct behaviours

Invest in change management & support mechanisms

Practice



Acknowledge the learning curve, time will be needed for staff to transition, develop skills and "get up to speed", one way to help during this is to set up practice, or training models where staff feel safe if they make mistakes.

Continue mentor activity between staff groups, with in house presentations, learning and training sessions

Hold case studies and lessons learned sessions across projects, teams, departments. It will pay dividends within the learning curve time and with increased quality and consistency.

Encourage progress, ways to do this could include rewarding advancement of skills, praising effort, communicating positive achievements

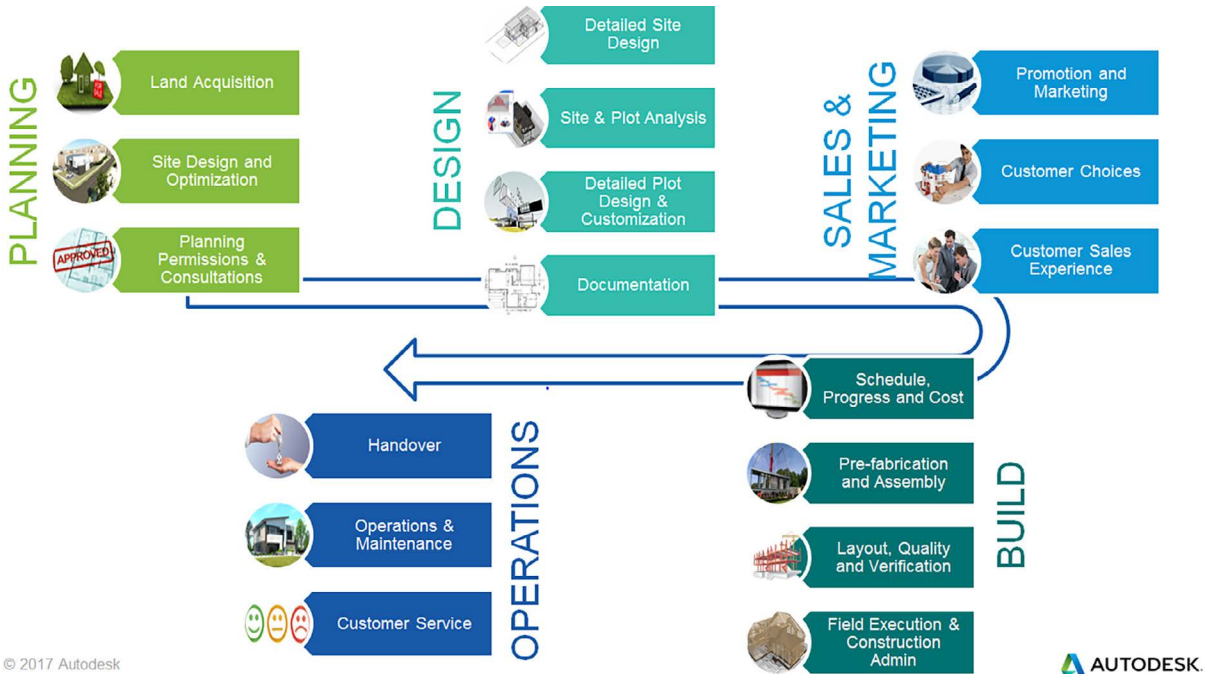
4. WORKING TO UK STANDARDS

To fully implement BIM means working to the standards governing the production of BIM information within the UK and adopting them in a way suited to the workflow in your organisation, or where necessary, altering your workflow to suit the standards.

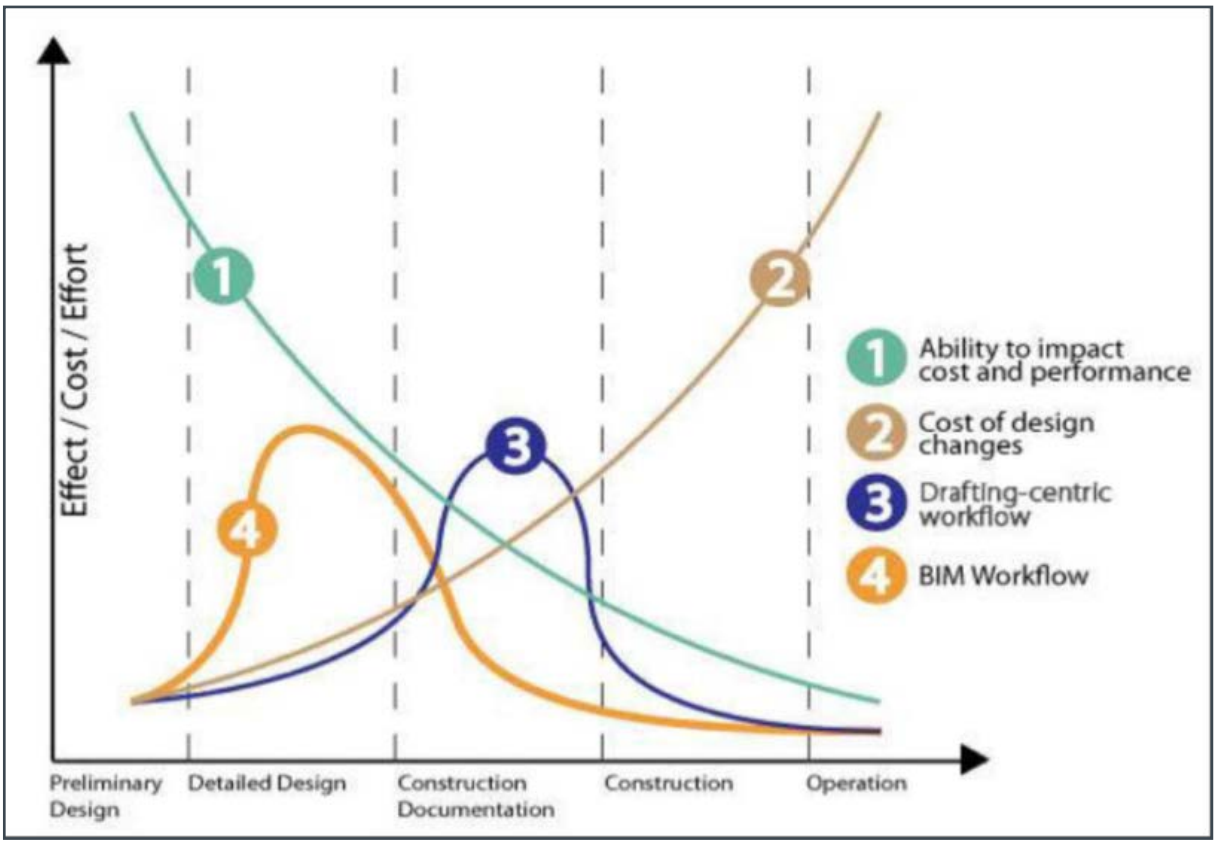
The UK standards governing the production of BIM information, listed in 3.5, are available to download from the BSI website, while these documents are referenced copyright exists, so contents have not been reproduced within the content of this manual, it is therefore recommended that they are downloaded and read in conjunction with this document.

4.1 BIM Workflow

BIM use can bring many benefits to a workflow, and there are many different interoperable add ins and tools to get benefit from at all stages of a project. The flow of information proposed in ISO 19650 is broken into 8 stages, as below, but these stages can be mapped to the housing industry as shown in the diagram below which also outlines some of the tools which can be used during the different stages of a housing development workflow:



Work Flow Map for Private Housing Building (courtesy Autodesk)

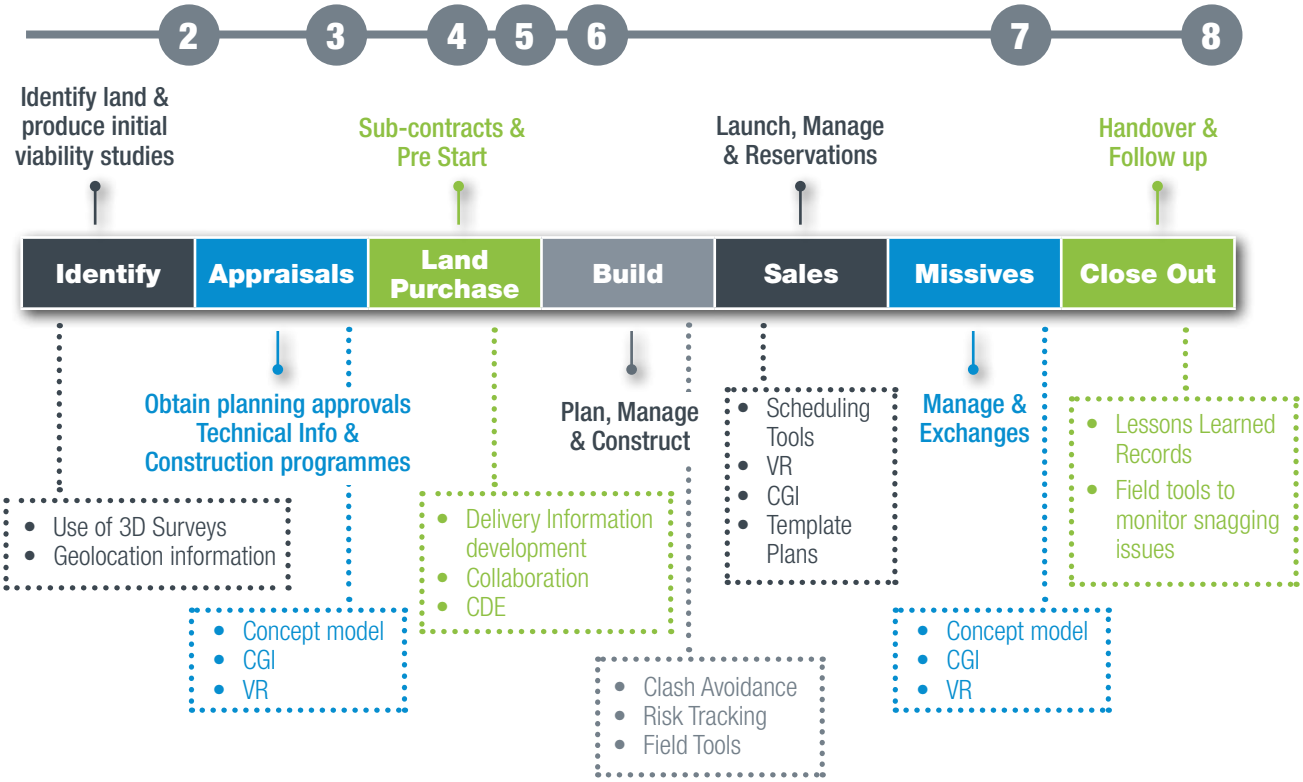


Typical Private Developer House Building Process - Land to Customer Care

The flow of information proposed in ISO 19650 is broken into 8 stages, as below, but these stages can be mapped to the housing industry as shown in the diagram below:

BIM Work Flow Stages of a Housing Development – as set out in ISO 19650

1. Land Assessment and Need
2. Invitation to Tender
3. Tender Response
4. Appointment
5. Mobilisation
6. Collaborative Production of Information
7. Information Model delivery
8. Project Close Out



4.2 BIM Elements

Within the standards are key elements of BIM which inform the working process, these are as listed in section 3.4, and noted below:

Important BIM elements to be anchored into BIM adoption strategies

EIR - Exchange Information requirements

PIM - Project Information Model

CDE - Common Data Environment

COBie - Construction Operations Building information exchange

Uniclass 2015 - a coding system used to classify construction objects

Collaboration - Means to drive effective collective working

Spatial Coordination - Means to coordinate information via a shared model

Lessons Learned - Means to capture learning and improve

4.2.1 EIR - Receipt & Response

The Exchange Information Requirements (EIR) documents (sometimes known as Employers Information Requirements) sets out managerial, commercial and technical aspects of producing project information, and should be in place for every development and appointment.

The technical requirements will detail the information requirements, while the managerial and commercial requirements will include aspects related to production methods and procedures to be used by the delivery team.

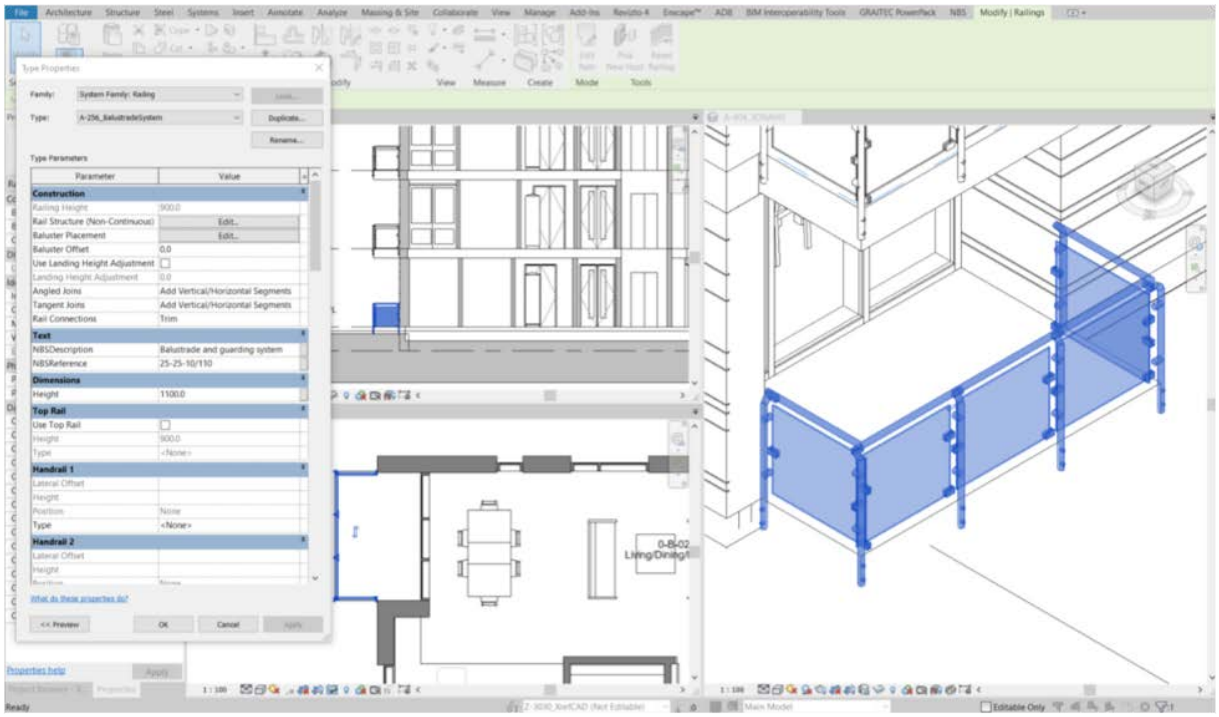
The EIR requirements will be answered in the project BIM Execution Plan (BEP) and a response map to find the EIR items in the BEP is an ideal way to ensure visibility of delivery team EIR implementation.

For further information refer to:

BS EN ISO 19650-1:2018 5.5 Exchange information requirements (EIR)

BS EN ISO 19650-2:2018 5.2.1 Establish the appointing party's exchange information requirements

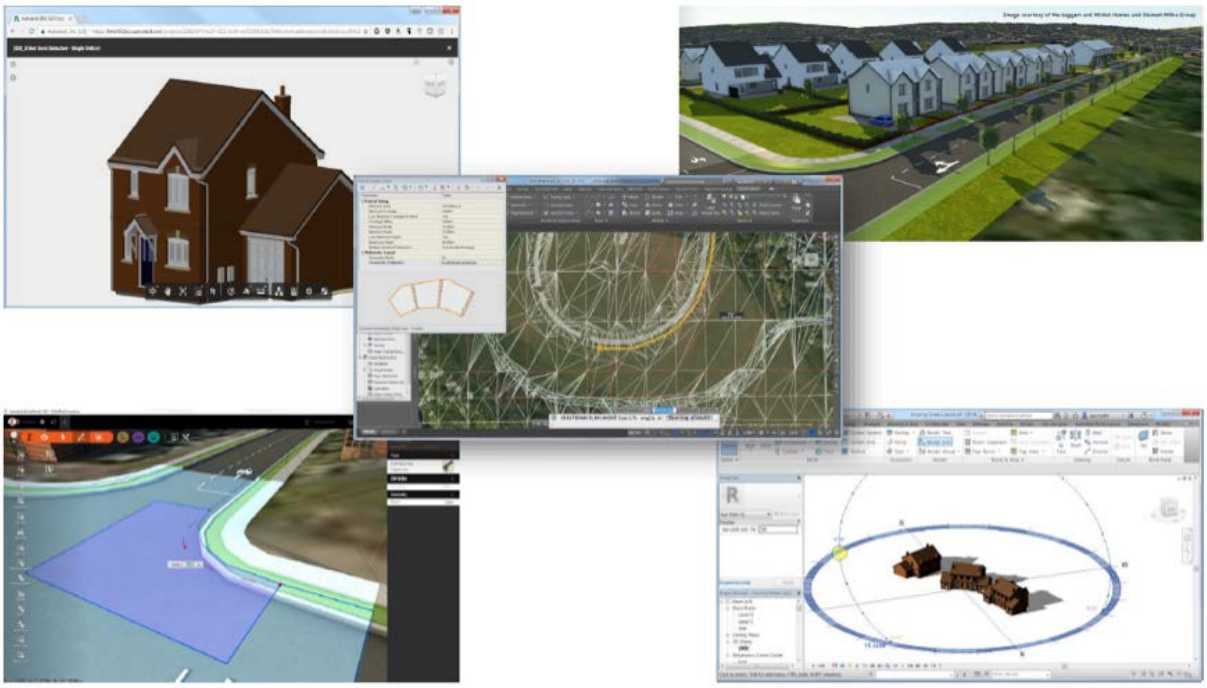
4.2.2 PIM – Project Information Model



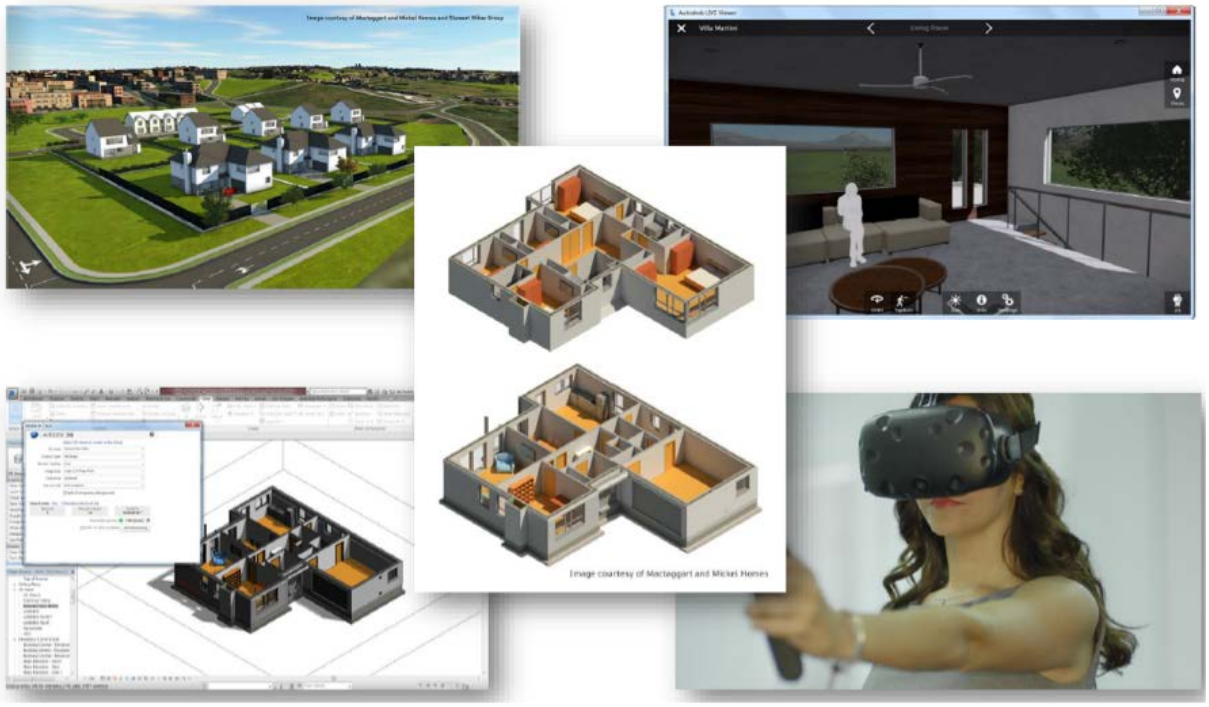
Example of PIM

The project information model combines 3D geometry representing construction elements with parameters, or data, relating to both the geometry and function of the element, to form a digital representation of the construction project or house type/development.

There are multiple suppliers of software to achieve this process, with many add ins or plug in software's to add to, analyse and enhance the final model.



Examples 3D software Applications for Roads and Development Layout Designs



Examples of 3D software applications for use in Housing Design & Sales and Marketing

Examples of 3D Software Applications for Construction Delivery and Quality Assurance

Example of 3D Software for Development Design and Planning Engagement

4.2.3 Common Data Environment

A common data environment (CDE) solution and workflow is required to collate and distribute all project information to all project participants, supporting the collaborative development of project information. The "solution" is the storage area where all project data is issued to by all project participants, and the workflow is as shown in the diagram opposite.

The CDE solution is generally a cloud based service, and commonly used UK providers include, but are not limited to:

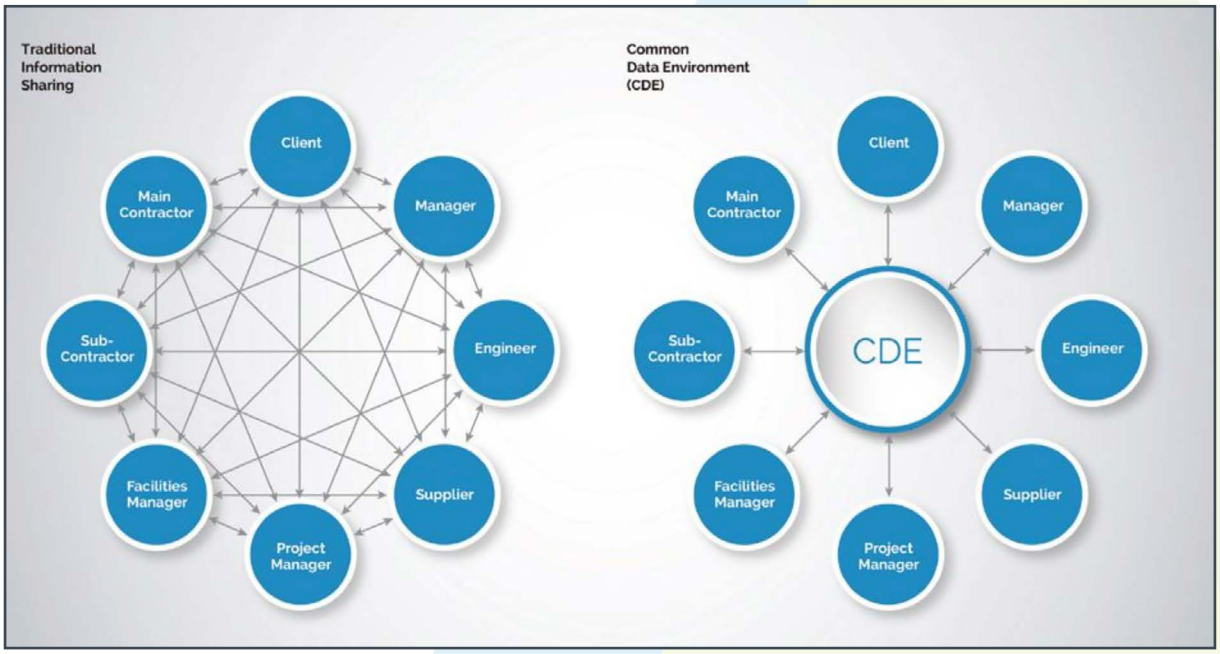
ASITE, Conject, Viewpoint, Zutech and others.

Autodesk BIM 360 Docs is also becoming used to provide a CDE environment.

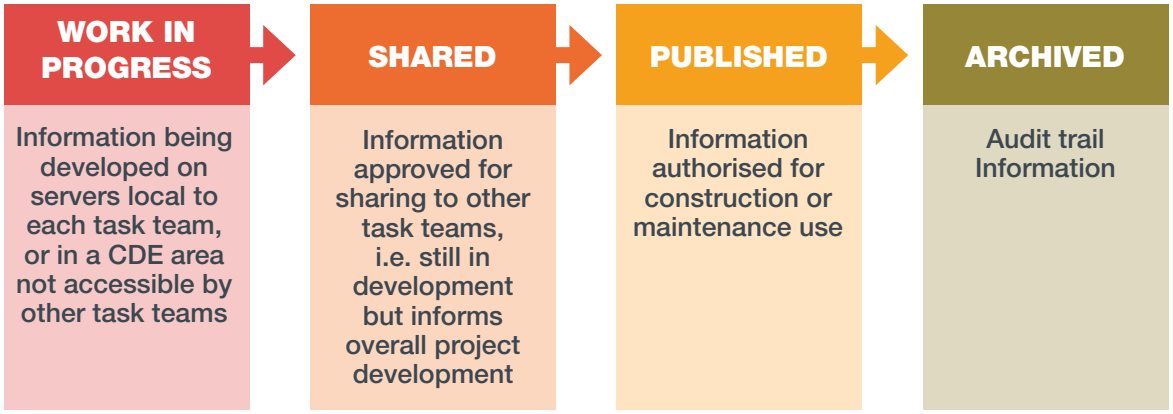
The CDE environment should contain a folder structure which will support the workflow of information through the stages

Project task teams will identify individuals within the organisation with authority to upload, download and manage information within the CDE.

Further information is available within the BS EN ISO 19650 series documents, with a workflow diagram within BS EN ISO 19650-1:2018, section 12.1, Figure 10.



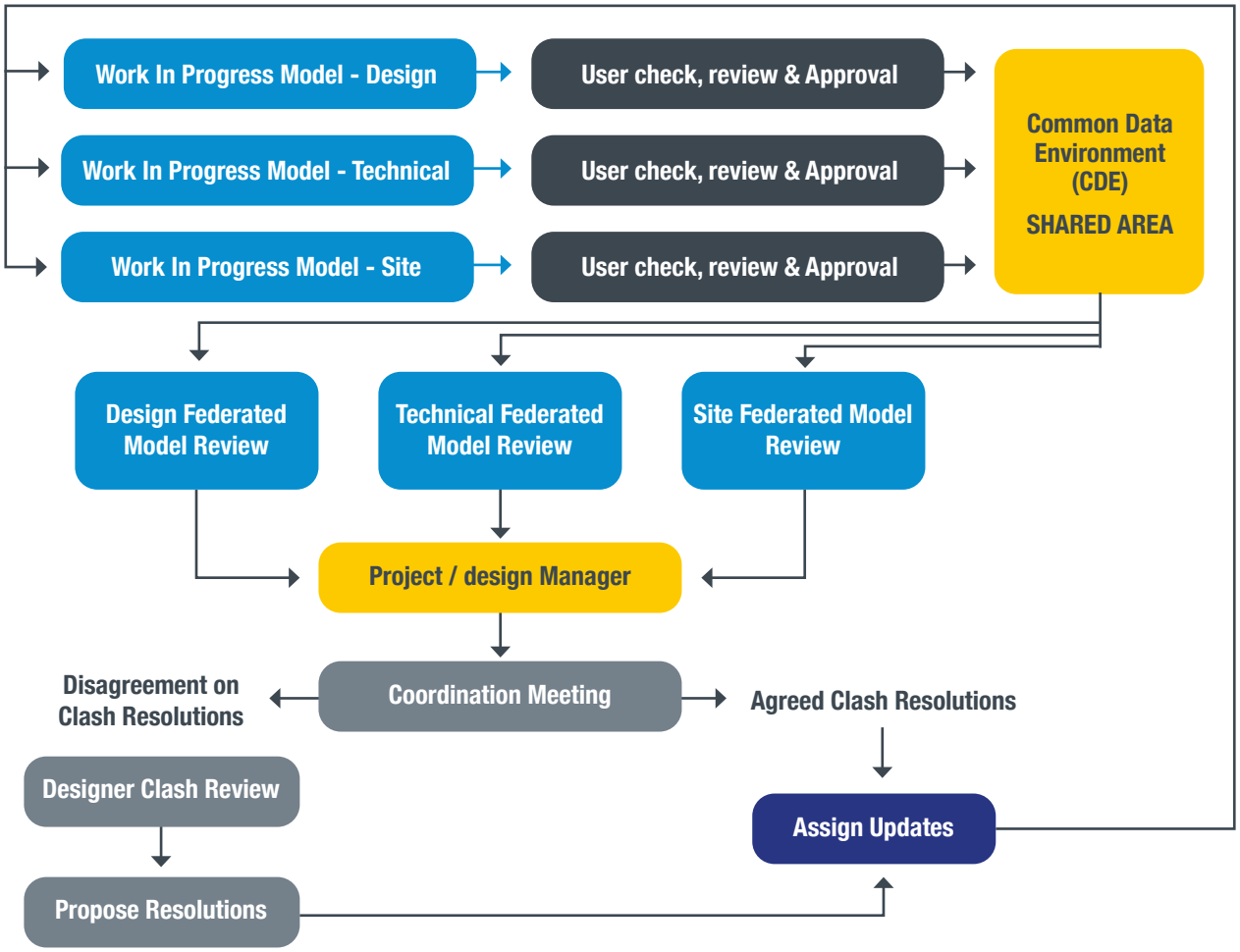
Comparison - 2D silo design working v 3D modelling working with Common Data Environment



4.2.4 Collaboration

Working within the one source of truth in the project information model allows for all parties to the development of a design scheme to work together, and to achieve efficiencies in the process, such as a minimum of interference or clashing between elements, information development within the one time frame, with all parties working simultaneously rather than sequentially, and control over the quality during development.

An example workflow of design development is shown below.



4.2.5 Spatial Coordination

Working within BIM processes allow for enhanced spatial coordination of designs before reaching site. There are many software tools available to achieve this, all of which run a set of checks on the model elements to look for areas where they clash, allowing for those clashes to be designed out before any redesign/rebuild/ rework on site is needed and costs both time and money.

Running software checks doesn't negate the need to visually examine the model though, as not all spatial problems are clashes, e.g. software might not detect that a duct is at the wrong height and impedes opening a door if it doesn't touch the door. These are often called "soft" clashes, and can only be detected by manual visual checks, using section, plan, 3D or walkthrough views from modelling software.

Examples of Visualisation and Clash Detection Benefits

4.2.6 Uniclass 2015

The use of a common language for identification of construction elements was mandated by both UK and Scottish governments.

The system for use in the UK is Uniclass 2015, current version, and it's a coding system which can applied to all construction elements.

It can be embedded into model elements through parameters within the modelling software.

Uniclass 2015 codes consist of up to five pairs of characters, separated by underscores

Each field added lends more precision to the classification

examples

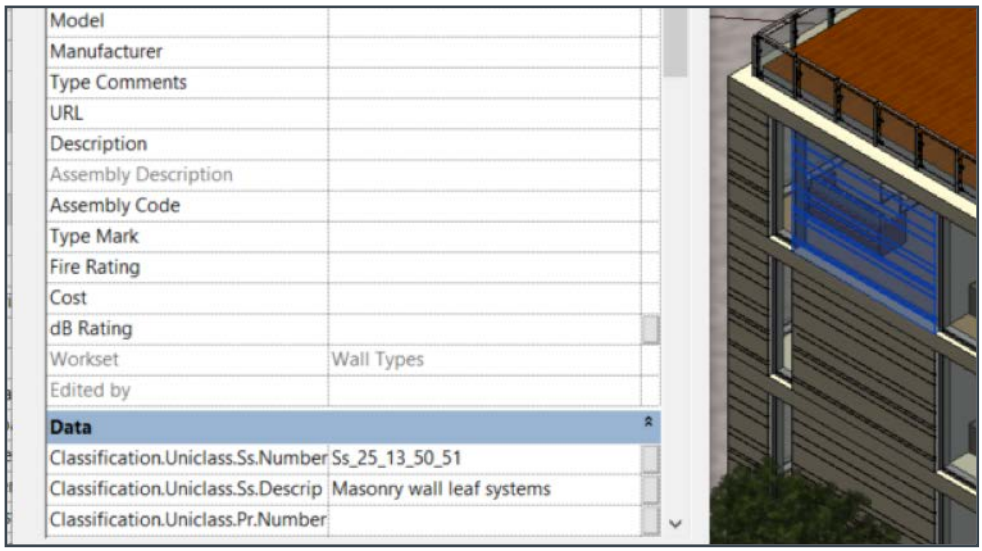
- SS_30 Roof, floor and paving systems
- SS_30_10 Pitched, arched and domed roof structure systems
- SS_30_10_30 Framed roof structure systems
- SS_30_10_30_25 Heavy steel roof framing systems

Full explanation and classification tables can be found within the NBS weblink below:

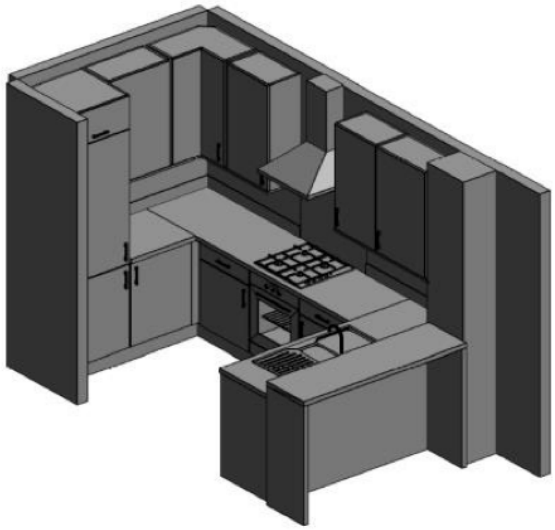
https://www.thenbs.com/our-tools/uniclass-2015

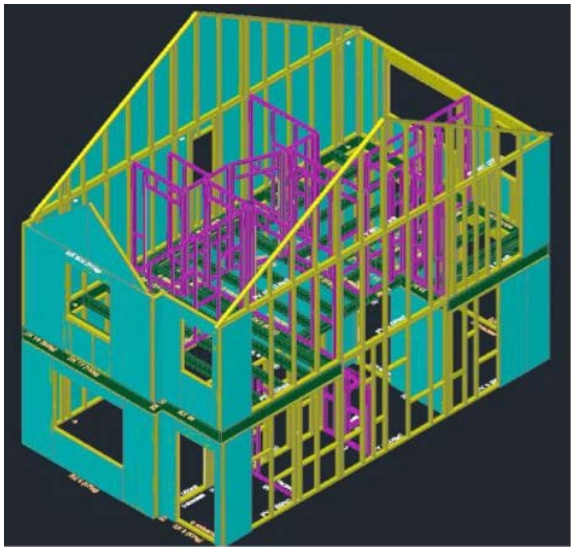
Model elements can be assigned their Uniclass code through manual input, or using an add in software, e.g. Classification Manager from the Autodesk BIM Interoperability Tools. It is also possible to use Dynamo, a visual programming tool to perform this task. Uniclass classification is defined within a model element parameter and while it can be manually populated, there are automated methods and tools to help avoid this, such as:

BIM Interoperability Classification Manager
Dynamo programming



Uniclass classification is a live system, which is developed to introduce additional codes on an ongoing basis and is operated by the NBS. It is also used in NBS Chorus specifications. Although not mandated as part of the BIM process, NBS chorus software allows development of specification documents in a cloud-based application which links directly into the functionality of the BIM model.





Examples of 3D supply chain models, to be federated into master house type model.

4.2.7 COBie

Construction Operation Building Information Exchange (COBie) is a data standard designed to pass on life cycle and maintenance information for a building via an export from the model in a standard, digital format, to replace paper construction handover and O&M manuals. It should contain the minimum data required for management, operation and maintenance of a building following construction handover. It is not software specific, but there are plug ins for modelling software which enable delivery from within a PIM and is exported out of the model in the form of a spreadsheet.

COBie can be manually developed within a spreadsheet, but this a laborious, time consuming task and requires accurately cross reference to model items.

It also works off a series of parameters built into model geometry which can then be exported directly into a standard format spreadsheet. The parameters need to be added to the model, and this can be done using plug in tools to software, or scripted coding methods such as Dynamo or macros.

For further information the following standards are applicable to COBie:

BS 1192-4:2014 Fulfilling employer's information exchange requirements using COBie – Code of practice

PAS 1192-3 Specification for information management for the operational phase of assets using building information modelling

An example spreadsheet view is shown below

Name	TypeName	Space	Description	ExtSystem	ExtObject	ExtIdentifier	SerialNumber	InstallationDate	WarrantyStartDate	TagNumber	BarCode	AssetIdentifier	Area	Length
XXX_Door_Int-Sgl-Blnk-ID-0339	ID1021SHLL	DEN021_Lobby,DEN004_WC: Acc	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0339	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-0104-A	ID1021UHLL	FMD043-5_Corridor,FMD005_Estat	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0104-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Blnk-Eq-ID-0312	ID1921SHWL	RAD021-1_Corridor,RAD008-1_Gen	ID1921SHWL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0312	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0327	ID1021SHLL	RAD007_X Ray: Change,RAD021-1	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0327	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0328	ID1021SHRL	RAD006_X Ray: Change,RAD021-1	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0328	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0325-A	ID1021SHRL_L	RAD013_CT Scanner,RAD012_CT	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0325-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Blnk-Uneq-ID-0102-A	ID1521SHRL	FMD043-5_Corridor,FMD009_Medi	ID1521SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0102-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-0102-B	ID1021UHLL	FMD043-5_Corridor,FMD009_Medi	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0102-B	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0103	ID1021SHRL	FMD010_Medical Physics: Parts/S	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0103	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1212	ID1021UHLL_E	THR024_Exit Bay,THR023-1_Theat	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1212	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1208-A	ID1021UHLL_EUCE	THR023-1_Theatre Prep,THR020-1	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1208-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1214	ID1021UHRL_LE	THR049-1_Corridor,THR022-2_Scru	ID1021UHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1214	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1209	ID1021UHLL_E	THR049-1_Corridor,THR022-1_Scru	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1209	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Vsn-Pnl-Eq-ID-1207	ID1921UHWL_E	THR049-1_Corridor,THR021-1_Ana	ID1921UHWL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1207	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Vsn-Pnl-Eq-ID-1208-B	ID1921UHWL_E	THR021-1_Anaesthetic,THR020-1	ID1921UHWL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1208-B	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Vsn-Pnl-Eq-ID-1216	ID1921UHWL_E	THR049-1_Corridor,THR021-2_Ana	ID1921UHWL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1216	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1204	ID1021UHRL_FR_E	THR049-1_Corridor,THR026-1_Dirty	ID1021UHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1204	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1205-A	ID1021UHRL_FR_E	THR027_Minor Procedure/ Endosc	ID1021UHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1205-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1219-A	ID1021UHLL_FR30_E	THR049-1_Corridor,THR026-2_Dirty	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1219-A	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-1219-B	ID1021UHRL_FR_E	THR020-2_Operating Theatre,THR0	ID1021UHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1219-B	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-1336	ID1021SHRL	THR012_Stage 2 Recovery,THR01	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1336	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-1319	ID1021SHLL	THR008-1_Consult/ Exam,THR049	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1319	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-1318	ID1021SHLL	THR008-2_Consult/ Exam,THR049	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1318	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Vsn-Pnl-Eq-ID-1211-B	ID1921UHWL_E	THR020-2_Operating Theatre,THR0	ID1921UHWL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-1211-B	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Blnk-Uneq-ID-0243-B	ID1521SHLL_FR60	FMD043-4_Corridor,MOR004_Refri	ID1521SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0243-B	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0110	ID1021SHRL	FMD008_Medical Physics: Equipm	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0110	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0122	ID1021SHRL	FMD017_Materials Management: C	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0122	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-0125	ID1021UHLL	FMD015_Materials Management: R	ID1021UHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0125	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0114	ID1021SHLL	FMD018_Materials Management: C	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0114	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0241	ID0921SHRL	MOR002_WC: Visitor,MOR001_Re	ID0921SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0241	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0244	ID1021SHRL	MOR007_Sluice/ Waste Disposal,T	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0244	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0220	ID1021SHRL	CDU026-1_Staff Change: Male,CDU	ID1021SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0220	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0223	ID0921SHRL	CDU026-2_Staff Change: Female,C	ID0921SHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0223	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0213	ID1021SHLL	CDU025_Test Equip/Data,CDU031	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0213	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Blnk-Uneq-ID-0214	ID1521SHLL	CDU031-1_Corridor,CDU020_Raw	ID1521SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0214	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Vsn-Pnl-ID-0216	ID1021UHRL	CDU031-1_Corridor,CDU029_1:1 M	ID1021UHRL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0216	n/a	n/a	n/a	n/a
XXX_Door_Int-Sgl-Blnk-ID-0215	ID1021SHLL	CDU024_General DSR,CDU031-1	ID1021SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0215	n/a	n/a	n/a	n/a
XXX_Door_Int-Dbl-Blnk-Uneq-ID-0228	ID1521SHLL	CDU031-3_Corridor,CDU022_CDU	ID1521SHLL	Autodesk	Doors	90a5500a	n/a	n/a	n/a	ID-0228	n/a	n/a	n/a	n/a

Instruction | Contact | Facility | Floor | Space | Zone | Type | Component | System | Assembly | Connection | Spare | Resource | Job | Impact | Document

4.3 Naming Conventions

A standardised naming convention allows all those in construction to understand the content of files, documents and drawings, and the UK naming convention is outlined in the UK annex of BS EN ISO 19650.

File naming

BS EN ISO 19650-2 requires the UK follows the naming convention of National Annex (NA) NA2. As such file names should be defined using the following fields, separated by a hyphen delimiter.

Note: File naming structure – applies to all files, models, sheets, documents, schedules

Project	Originator	Volume/ System	Level/ Location	Type	Role	Number
2 - 6 characters	3 - 6 characters	2 characters	2 characters	2 characters	1 - 2 characters	4 - 6 digits

The UK National Annex (NA) NA2 further provides codes to be used for each field type and should be referred to when producing file names.

Library Object naming

There is no requirement under ISO 19650 for naming of model elements. BSI points to BS 8541-1:2012, but PAS1192 points to BS1192, which sets a naming convention for containers within the BIM model.

For the purpose of this document we will assume the naming convention of BS8541-1:2012 to be relevant.

Source	_	Type	_	Subtype/Product

Fields are divided by an underscore, and CamelCase (No spaces, and capitalised words) is used

For a full explanation refer to UK National Annex to BS EN ISO 19650-2:2018

4.4 Revision Numbering and Status Codes

In addition to setting out a standard file numbering convention, BS EN ISO 19650 contains a standard format for file status and revision sequencing, shown here.

The UK National Annex to BS EN ISO 19650-2:2018, section NA. 4 further provides the codes to be used for revisions and status attached to files, which will be added to the CDE upload sites as metadata, these are shown in the table here.

Standard Codes for suitability – models and documents		
Code	**Description**	**Revision**
Work In Progress		
S0	Initial status or WIP	P01.01 etc to P0*n*.0*n*
Shared (non-contractual)		
S1	Suitable for coordination	P01 to P0*n*
S2	Suitable for information	
S3	Suitable for review and comment	
S4	Suitable for stage approval	
S6	Suitable for PIM authorization	
S7	Suitable for AIM authorization	
Published Documentation (contractual)		
A1,A2,A3,A*n* etc	Authorised and accepted	C01 to C0*n*
B1,B2,B3,B*n* etc	Partially signed off: With comments	P01 etc to P0*n*
Published for AIM Acceptance		
CR	As constructed record documentation,	C01 to C0*n*

4.5 Working to a BEP

The BIM Execution Plan (BEP) is the plan document prepared to explain how the information modelling aspects of a project will be carried out and how the project team will work collaboratively. The following information is not exhaustive but should be contained within a template BEP which can then be adapted to all company projects:

4.5.1 Project Team Representatives and Role

This section lists the representatives of the project teams who, with the authority of their parent companies, accept the document as the agreed BIM Execution Plan, see example table below

4.5.2 Exchange information requirements

This section should consider the EIR requirements, and list the section of the BEP which details how these requirements will be met, a common method of fulfilling this requirement is to include a mapping table, such as the example shown

EIR Information Requirement		Location of information in BEP
Content of the Employer's Information Requirements (EIR)		
1.0 Operational Information Requirements		
1.1.1	Software Platforms	
1.1.2	Data Exchange Format	
1.1.3	Coordinates	
1.1.4	Level of detail	
1.1.5	Training	
1.1.6	BIM specific competence assessment	
1.2 Asset Information Requirements		
1.2.1	Data drop and product deliverables	
1.2.2	Clients' strategic purposes	
1.2.3	Delivery strategy for asset information	
1.3 Project Information Requirements		
1.3.1.	Standards	
1.3.2	Planning the work and data segregation	
1.3.3	Security	
1.3.4	Coordination and clash detection	
1.3.5	Collaboration success	
1.3.6	Health & Safety/Construction Design Management	
1.3.7	Systems performance	
1.3.8	Compliance plan	

4.5.3 Information delivery team

Within this section the BEP will list the names and positions of the project delivery team, across all consultants, and provide a delivery team organogram see reference organogram below.

Project delivery teams consist of a network of Client/Owner, consultants, contractors, sub-contractors etc. A hierarchy organogram will capture key individuals and give a quick reference point for all team members to access, and a table of contacts will give further contact links to the framework, allowing for efficient communication to key people within the wider team.

The team capability documents will also be contained within this section.

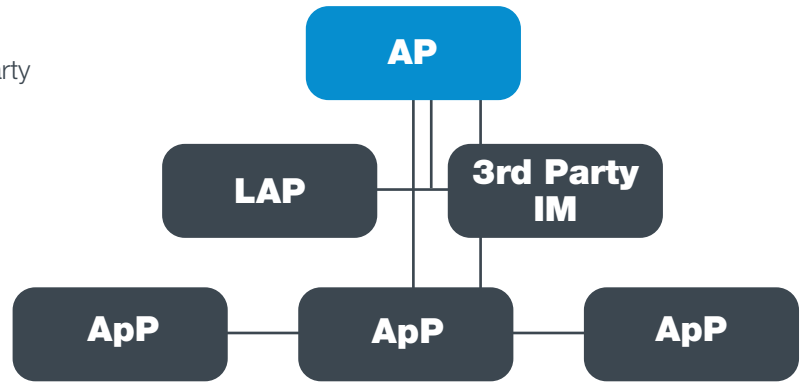
Role	Company Name	Representative & Authorised Agent
Client	<Client Name>	<TBC>
Information Manager	<IM Name>	<TBC>
Main Contractor	<Contractor Name>	<TBC>
Lead Designer	<TBC>	<TBC>
Architect	<TBC>	<TBC>
Structural	<TBC>	<TBC>
Civil	<TBC>	<TBC>
MEP	<TBC>	<TBC>
Cost Consultant	<TBC>	<TBC>
Landscape Architect	<TBC>	<TBC>
Fire Engineer	<TBC>	<TBC>

AP - Appointing Party

LAP - Lead Appointed Party

IM - Information Manager

ApP - Appointed Party



4.5.4 BIM Responsibility Matrix

BIM task matrix identifying Responsibility, Accountability, Consulted Parties, and Informed Parties. The template for this matrix is set within BS EN ISO 19650-2:2018, Refer to Annex A

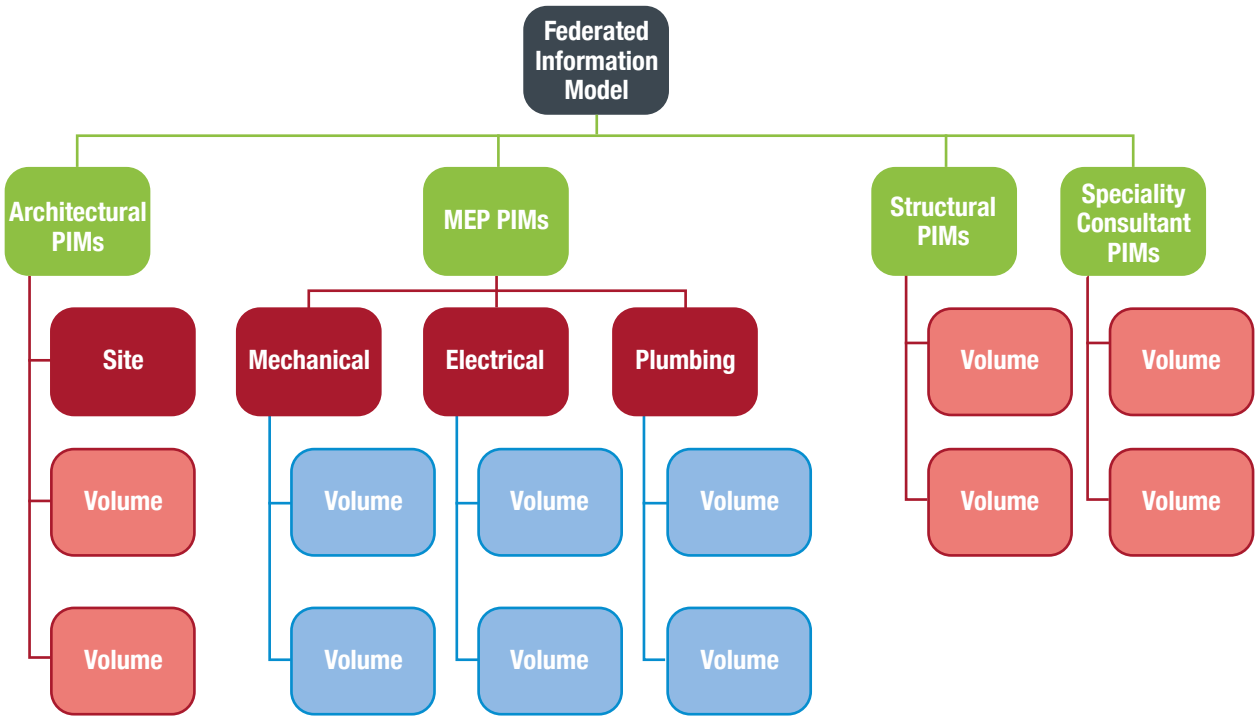
4.5.5 Information generation

Will list and detail information to ensure the project team can generate information which will be suitable for collaborative use, including the following items:

- Existing Asset information
- Survey Strategy
- Coordinate information for project base point
- File naming convention
- Revision & Status convention

4.5.6 Federation strategy

The federation strategy sets the plan for the breakdown of large projects into a series of model files which when linked together will form the federated project model. This information will be provided in both diagrammatic and model production table format, example diagram below.



The federation strategy also considers the following:

- Spatial Coordination – how elements spatially relate to the design intent and to one another, clash voidance and detection
- Communication and meetings – who, when, where, why and how often
- Level of Information Need – graphical and information extents and limits
- Model element responsibilities – who is responsible for the creation of each element

These elements are a vital part of how the team develops the model collaboratively and need to be detailed in advance of any model production.

4.5.7 Exchange of information

This section records how and when those involved in a project will deliver information to one another and/or to a client.

Exchange of Information also considers approvals, records and format of information and contains information on:

- Quality Assurance, Review & approval processes
- Recording model information and revision history
- Information exchange formats, e.g rvt, .pdf, .dwg
- Information exchange frequency

4.5.8 Task Information Delivery Plan (TIDP)

The task information delivery plan is created by each task team and is a projected list of their planned deliverables generated from the model, including drawings, schedules, visualisations and model issues, and the stages at which they'll be issued. If projects are consistent in the output required a company template can be drawn up ready for use.

Each TIDP is then collated by the Lead Appointed Party into a Master Information Delivery Plan (MIDP), an extract from an example TIDP is shown below

Healthcare Project Specific		ISO 19650 Stag	Stage 1	Stage 2	Stage 3	Stage 4 & 5	Stage 5 & 6	Stage 6 & 7	Stage 8	Stage 8
		RIBA POW Stage	0 - Strategic Definition	1 - Preparation & Brief	2 - Concept Design	3 - Developed Design	4 - Technical Design	5 - Construction	6 - Handover and Close Out	7 - In Use
		Decision Points		1	2	2a 2b	3		6	7
Title	Number	Team Information Exchange		1	2	3	4	5	6	7
Design Responsibility Matrix	XXX-KEP-XX-XX-RM-A-403001									
Pre Contract BEP	XXX-KEP-XX-XX-PL-A-406001			X						
Risk Report	XXX-KEP-XX-XX-HS-A-406002			X						
Access and Maintenance Schedule	XXX-KEP-XX-XX-SH-A-805001			X		X				
Access & Maintenance - Site Plan	XXX-KEP-XX-XX-DR-A-805002			X		X				
Access & Maintenance - 1:500 Plan	XXX-KEP-XX-XX-DR-A-805012			X		X				
Access & Maintenance - Roof Plan	XXX-KEP-XX-XX-DR-A-805013			X		X				
Access & Maintenance - 1:200 GA Plan	XXX-KEP-XX-XX-DR-A-805014			X		X				
Site Plan	XXX-KEP-XX-XX-DR-A-601001				X	X				
Level 00 1-500 Departmental Layout	XXX-KEP-XX-00-DR-A-108001				X	X				
Level 01 1-500 Departmental Layout	XXX-KEP-XX-01-DR-A-108002				X	X				
Level 02 1-500 Departmental Layout	XXX-KEP-XX-02-DR-A-108003				X	X				
Level 00 1-200 GA Plan	XXX-KEP-XX-00-DR-A-706001				X	X				
Level 01 1-200 GA Plan	XXX-KEP-XX-01-DR-A-706002				X	X				
Level 02 1-200 GA Plan	XXX-KEP-XX-02-DR-A-706003				X	X				
Level 03 1-200 GA Plan	XXX-KEP-XX-03-DR-A-706004				X	X				
Roof Plan 1-200	XXX-KEP-XX-XX-DR-A-706005				X	X				
ADB sheets	XXX-KEP-XX-XX-DR-A-401001				X	X				
Site Sections as proposed	XXX-KEP-XX-XX-DR-A-601003				X	X				
Outline Architectural Specification	XXX-KEP-XX-XX-SP-A-408001				X					
GA Building Sections	XXX-KEP-XX-XX-DR-A-708001				X					
Level 00 Fire Strategy 1-500	XXX-KEP-XX-00-DR-A-805003				X	X				
Level 01 Fire Strategy 1-500	XXX-KEP-XX-01-DR-A-805004				X	X				
Level 02 Fire Strategy 1-500	XXX-KEP-XX-02-DR-A-805005				X	X				
Level 03 Fire Strategy 1-500	XXX-KEP-XX-03-DR-A-805006				X	X				

4.6 Good Practice

Consideration for good practice working should be agreed and documented through an in-house standards and procedures manual.

This should be communicated to all staff and explained to any new members of staff during their induction time, to ensure consistent application.

Software providers have several resources aimed at helping users to develop good practice, e.g. Autodesk have a knowledge network and free online Autodesk University classes to provide guidance.

Below is an example of a list of headings from a model audit, each heading would have subset checks looking for good practice within the Revit model:

- Model Performance
- Project Settings
- External Files
- Datum and Location Elements
- Views
- Model Elements
- MEP System Families
- Structural System Families
- Duplicate Modelled Elements
- Mirrored Elements
- Work sets and Elements
- Assemblies
- Generic Models
- Total Model Elements
- Annotative Elements

4.7 BIM Policy

Implementation of BIM processes can be perceived as a threat or fear to staff, particularly to those who have been working with other methods for a long time, so BIM implementation requires the backing and input from senior management, if they don't endorse it staff will find excuses to avoid new methods. One way of ensuring this is to have them draw up a BIM policy for the company, reinforcing to staff that BIM is taken seriously as a method of working and helping lead the staff transition to what will be a change in their working processes.

Example of Policy content:

- Company-Wide Policy and Practice
- BIM Management Structure
- Computer Aided Design (CAD) (Acceptable Use)
- Executive Policy
- Training Plans

4.8 Management policies & procedures

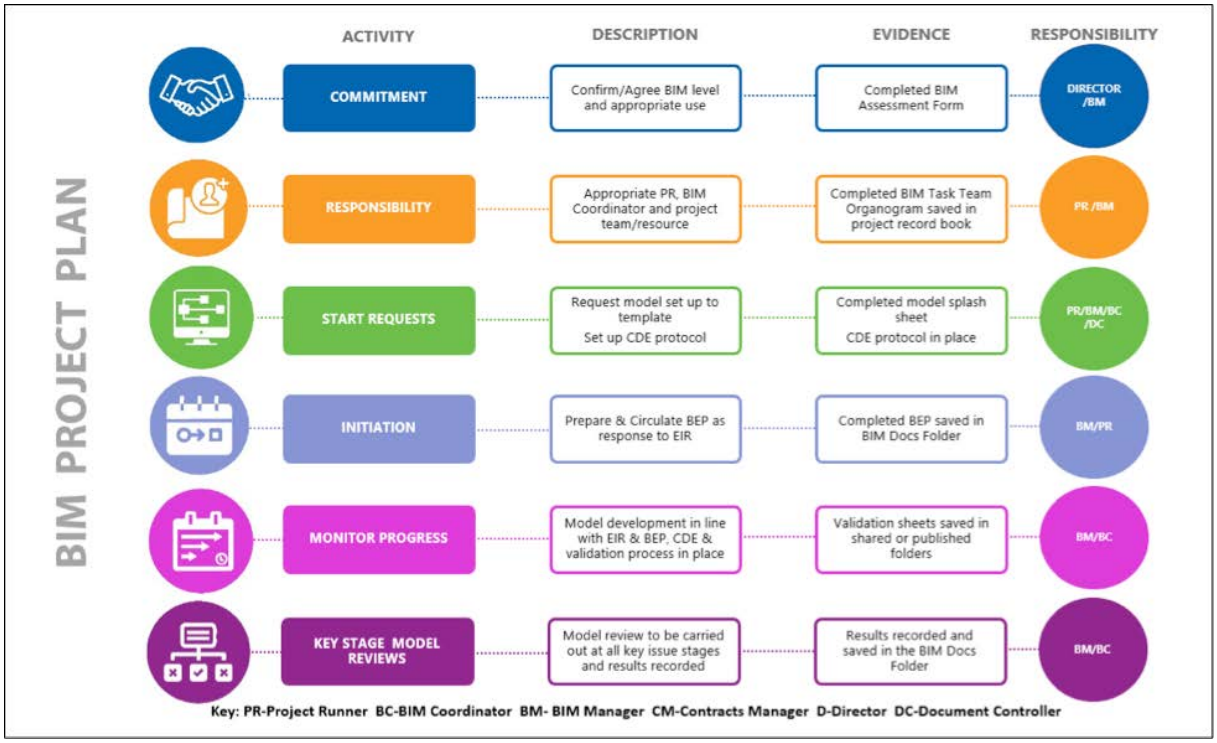
Take the time to consider how the company wants people and processes to work, create procedures around this and communicate them to all staff, giving them guidance to follow until they are comfortable with the new way of working.

An example list of policies to provide could be:

- BIM project plan
- Model set up procedure
- BIM model standards
- Model review procedure

Putting documents like these in place will allow staff to have structure to the new methods of working they have to adopt and will also allow QA tracking of working methods and product/output.

An example BIM Project Plan could look like the example below:



5. INFORMATION POPULATION

5.1 Family management

Set standards for creation, naming and storage of model families and elements based on the current industry standards.

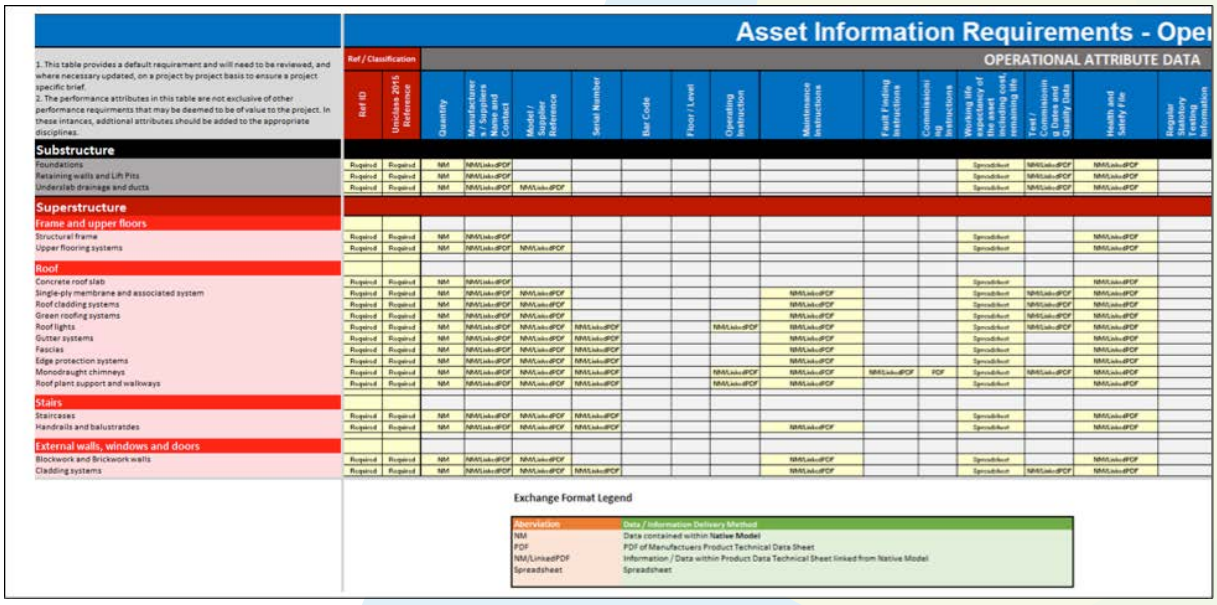
This will ensure ease of access to information when needed, avoid duplication and allow ease of QA and audit procedures. In practical terms it also means that if everyone is naming items in the same way and storing them in a structured system where everyone will be able to find them easily.

Ensure that the standards you have created are communicated to staff, with key individuals in place to monitor and maintain them.

5.2 Defining Requirements

When populating data into a model it's important to find out at the early stages exactly what will be needed for the operational phase of the building, without this the resultant data could be of little use and being expected to provide data on everything could result in excessive data where the important information is lost.

These lists are the Asset Information Requirements (AIR). If there is a standard approach to data requirements it would be beneficial to collate these in a company template and customise to suit individual sites. An example extract from an AIR is shown below:



Asset Information Requirements - Oper

1. This table provides a default requirement and will need to be reviewed, and where necessary updated, on a project by project basis to ensure a project specific brief.
2. The performance attributes in this table are not exclusive of other performance requirments that may be deemed to be of value to the project. In these intances, additional attributes should be added to the appropriate disciplines.

Ref / Classification | OPERATIONAL ATTRIBUTE DATA

Ref ID	Uniclass 2015 Reference	Quantity	Manufacturer's / Suppliers Name and Contact	Model / Supplier Reference	Serial Number	Bar Code	Floor / Level	Operating Instruction	Maintenance Instructions	Fault Finding Instructions	Commissioning Instructions	Working life expectancy of item including cost remaining life	Test / Commissioning Dates and Quality Data	Health and Safety File	Regular Statutory Testing Information
Substructure															
Foundations	Required	Required	NM	NM/LinkedPDF								Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Retaining walls and Lift Pits	Required	Required	NM	NM/LinkedPDF								Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Underslab drainage and ducts	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF							Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Superstructure															
Frame and upper floors															
Structural frame	Required	Required	NM	NM/LinkedPDF										NM/LinkedPDF	
Upper flooring systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF							Spreadsheet		NM/LinkedPDF	
Roof															
Concrete roof slab	Required	Required	NM	NM/LinkedPDF								Spreadsheet		NM/LinkedPDF	
Single-ply membrane and associated system	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF				NM/LinkedPDF			Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Roof cladding systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF				NM/LinkedPDF			Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Green roofing systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF				NM/LinkedPDF			Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Roof lights	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF		NM/LinkedPDF	NM/LinkedPDF			Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Gutter systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF			NM/LinkedPDF			Spreadsheet		NM/LinkedPDF	
Fascias	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF			NM/LinkedPDF			Spreadsheet		NM/LinkedPDF	
Edge protection systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF			NM/LinkedPDF			Spreadsheet		NM/LinkedPDF	
Monodraught chimneys	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF		NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF	PDF	Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	
Roof plant support and walkways	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF		NM/LinkedPDF	NM/LinkedPDF			Spreadsheet		NM/LinkedPDF	
Stairs															
Staircases	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF						Spreadsheet		NM/LinkedPDF	
Handrails and balustrades	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF			NM/LinkedPDF			Spreadsheet		NM/LinkedPDF	
External walls, windows and doors															
Blockwork and Brickwork walls	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF				NM/LinkedPDF					NM/LinkedPDF	
Cladding systems	Required	Required	NM	NM/LinkedPDF	NM/LinkedPDF	NM/LinkedPDF			NM/LinkedPDF			Spreadsheet	NM/LinkedPDF	NM/LinkedPDF	

Exchange Format Legend

Abbreviation	Data / Information Delivery Method
NM	Data contained within Native Model
PDF	PDF of Manufactuers Product Technical Data Sheet
NM/LinkedPDF	Information / Data within Product Data Technical Sheet linked from Native Model
Spreadsheet	Spreadsheet

6. MODEL SET UP

It is essential that the methods employed in building a 3D model, along with the subsequent development of 2D drawings, scheduling and specifications is carefully planned from the outset. This combined with ongoing attention to the management and monitoring of the design data should lead to an efficient process that avoids abortive work.

6.1 New Projects

BIM is a suitable environment to ensure a consistent approach across information authors and modellers if appropriate guidance and protocols are put into place by a management team. To ensure all projects begin on a consistent path it is advisable to use a company template file during set up and control the setup of new projects by either:

1. Ensuring all projects are set up by an authorised BIM Coordinator, using an approved procedure.
2. Ensuring all people setting up a model are fully trained to do so from an approved procedure.

Within the software add and modify information such as Client info, Project No., Site Address etc., as appropriate for the project and suitable to the software.

Ensure your project is located to geolocation coordinates in line with the rest of the delivery team, to ensure federation of models for spatial coordination is possible.

6.2 Template File

Using a standard template on which to base every file created will help ensure a consistent standard of modelling and output from modelling software. This template will contain company specific graphic standards, as well as standard families, annotation items and be set up to employ naming conventions compliant with the current industry standards. The intention is that the template file will lead to project efficiency, reduce time spent on initial set-up while allowing more time for focusing on design and production of project deliverables.

Ensure the following:

- Your template is accessible to authorised staff only and not to all software users, or you risk your standards being overwritten or changed
- All models are created using the standard project template file to ensure uniformity
- Key individuals are tasked with these roles to ensure consistent application

It should be noted that not every line style, symbol, pattern, family etc. is incorporated into the template as these may not necessarily be required on every project and would result in an unnecessarily large file. However, the guidance set out within this document in tandem with the data contained in the template file should allow the user to create new types that follow a similar convention.

6.3 Hardware & Network capabilities and expectations

Refer to the most recent guidance provided by the software authors to ensure your hardware and network is capable of operating the suite of software you intend to implement, and that you have looked to enough capacity built in to future proof efficient operation for future software releases and additions.

Get IT expert advice on setting up systems and storage facilities, network maintenance and disaster recovery systems.

6.4 Archiving policy

3D information models are large files and can quickly fill up server space. More organisations are looking to cloud based storage solutions, but if you use traditional server storage a policy for when and where archiving takes place and who is responsible will help manage server capacity.

Additionally, as the model file develops, there will be a need to record significant stages of the project and to archive these "snapshots" of the Model file in an organised and consistent way. The frequency of these snapshots should record the development of the Model, but not too much that the volume of files generated is excessive and serves no useful purpose.

6.5 Security policy

Information security is an ongoing concern in digital transactions, and *BS EN ISO 19650-1:2018* references this in Annex A.

In addition, an organisational security policy will be requested during assessment for any potential collaboration project.

Many organisations are opting for having their company security policy certified through industry schemes, as a means of showing competence.

6.6 Software Versions

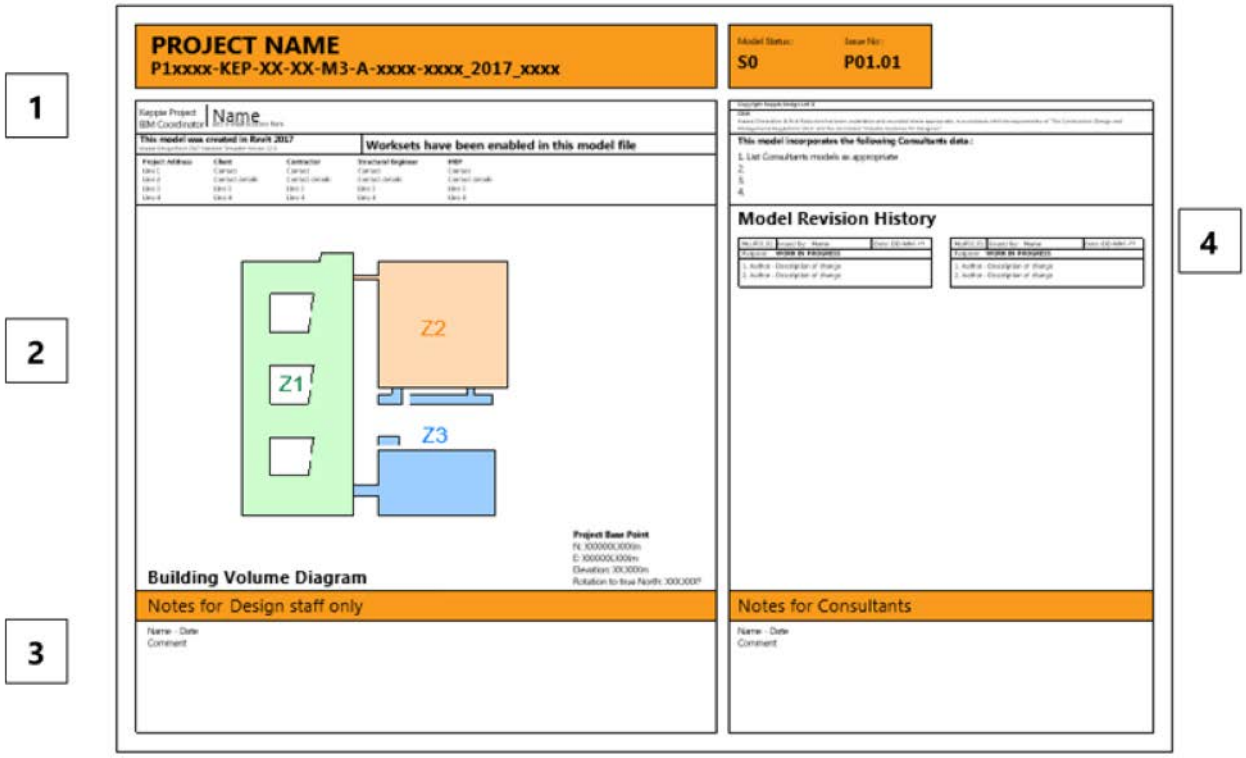
Software is at times version centric, e.g. Revit. When there is no backward save capability, it is critical that the delivery team identifies, agrees and complies with a version of software the project models will be produced in. This should be detailed within the project BEP, and an agreement noted that no party will update to a newer version without full agreement through the BEP document on version and date for upgrade.

6.7 Starting View

When opening a project, it's good practice to set up a standard starting view, also commonly referred to as a splash screen, to ensure that your project always opens onto the same view. This ensures anyone accessing the file can immediately get an overview of the project status and any relevant comments.

This view can contain project information, a volume diagram, and any other comments you want to convey whenever the project is opened.

The example below contains basic 2D information but conveys core information to anyone opening the project.



NOTE: the recording of changes in this starting view (splash sheet) is in addition to revisions recorded on individual drawing sheets.

7. MODEL MANAGEMENT

Both PAS1192 and subsequently ISO 19650 place a duty of quality assurance on model production. It is essential that there are processes in place to monitor and advance quality and good practice within the PIM.

Where a BIM Execution Plan (BEP) is in place be familiar with the agreed model requirements as it will determine the overall strategy and requirements for output and collaboration. Below are several key principles that should be taken into consideration.

Continual assessment of the model against the BEP will ensure that the model is being generated and maintained in the most efficient way possible.

Again, it is vital that key individuals are tasked with model management, and in most cases, this will be carried out by BIM coordinators and BIM Managers.

7.1 Model Internal Review

To ensure good practice is followed there should be periodic checks on the integrity of the model data and to check that the model is organised in an efficient manner and in compliance with the provisions of the company protocols and BEP (if one is applicable). The frequency of these checks will be dependent on the scale and complexity of the project model and should be agreed in principle between the project runner and the project BIM Coordinator.

It is beneficial to prepare checklist to assist this process, to maintain consistency across models.

Note: This is not the same as the Model Validation process which is to check the suitability of a Model file for external issue.

7.2 Technical Reviews

It is advisable to carry out technical reviews within the model environment to ensure that all modelled elements are compliant with current regulations and statutory requirements. Carrying these out from 2D exported views can miss vital disconnect between model and detail elements, e.g. If a detail is drawn in a drafting view it has no connection at all to the modelled components.

7.3 Model Validation

At each point at which the Model file is to be issued externally, a Model Validation is recommended as good practice, to ensure the integrity and consistency of the information being issued.

A "Model Validation Checklist" could be as the example below which is based on the BS EN ISO 19650-2:2013 task team check review and approval procedure, but has been augmented with additional guidance and clarification of the Validation sequence and comprises 2 stages:

1. Model preparation
2. Validation for issue

The completed checklist should be signed and saved as part of the project documentation.

Model Preparation	
Check model file name conforms to project Standards	☐
Review and fix all warning messages where possible	☐
Check that all families conform to project naming conventions	☐
Check Line Styles conform to project naming conventions	☐
Check that all content is in the correct Work set and conforms to project Standards	☐
Check model is correctly assembled through visual inspection for stage completeness	☐
Check model for dimensional accuracy	☐
Check correct use of Phasing / Design Options if necessary	☐
Change model stage	☐
Set revision on Model file & on Starting View, adding any guidance notes for recipients if necessary	☐
Print the Starting View as PDF and save a copy for project records and to accompany the issue	☐

Validation of Models to be Shared	
The following assumes that you are working from your local copy of the Model File. **Opening the Central File is strongly discouraged.**	
1. Create a suitably dated and titled destination folder for storage of model files to be shared	
2. Ensure everyone working on the project model performs a "Save to Central" and "relinquish all".	
3. "Save As" project file, navigate to the previously created issue folder (step 1) and name the file as required. Note: most CDE upload sites require the model name to remain identical to keep a revision history accurate. In "Options" make sure that the "Make this a Central Model after save" and the "Compact File" boxes are both ticked. If you rename the file, then the "Compact File" box is ticked by default. *Note: This may require a 2 step "save as" operation.*	
4. In the Collaborate tab. under sync settings, check the destination folder to ensure that the new file has been created and that you are editing that file rather than the original working file.	
You have now created a new Central Model File. At this point you can delete any unnecessary content as follows -	
5. Remove any linked files that are not to be shared with the model – CADs, IFCs, RVTs, Images etc	
6. Remove all non-required Views / Legends / Schedules / Sheets / Images	
7. Remove unwanted Design Options	
8. Purge model (repeat process three times as materials are only removed after the parent object has been removed)	
9. Now "Save to Central" – this is the only option you are given. If you wish to double check the file, close it and reopen again to check that the file opens cleanly.	

7.4 Model File Archiving

As the model file develops, there will be a need to record significant stages of the project and to archive these “snapshots” of the Model file in an organised and consistent way. The frequency of these snapshots should be enough to record the development of the Model, but not too much that the volume of files generated is excessive and serves no useful purpose and should be agreed between the project runner and BIM Coordinator at the commencement of the project.

It is certainly recommended that archive copies of models are taken before any major design changes are applied.

This requires an integrated protocol with your IT team, as model sizes can be large, and require dedicated server, off server or cloud storage space, dependant on an organisations’ IT strategy.

7.5 View Management

Within any project the number of views may cause difficulty easily finding information. A views hierarchy within the project browser of the model allows ease of navigation, and a strategy should be put in place to ensure consistency is used across models.

e.g. View names could follow BS1192 container naming convention, i.e. Role-Classification-Presentation (Uniclass 2015) Description

e.g. A-7060-M_1-500 Fire Strategy Level 00

Excessive numbers of views – particularly 3D’s – can have a great impact on the file size, so unused views should be removed from the model. The BIM Project Coordinator should put in place an agreed project procedure to stipulate when redundant and/or unused views will be purged from the model file.

7.6 Sheet Management

7.6.1 View Purpose

For ease of finding information according to its content sheets can be organised in a similar manner to views using an appropriate codes or Project system as agreed in the BEP to allow ease of navigating and finding information.

7.6.2 Sheet Names

Sheets (drawings) should be named following the convention for naming files set out in section 5.6

7.7 Linked Files

7.7.1 Linked Model Files

Linking (or federating) model files for the purposes of creating a coordinated set of drawings and scrutinizing the data for clash detection studies is a fundamental part of the collaboration process.

Linking of models should generally be carried out by the project BIM coordinator, importing & linking models through shared coordinates.

The number of models will vary from project to project and will be largely dependent on the agreed BEP and volume strategy employed by the project team. Generally, the linking of model files will relate to the following:

1. Where a project is delivered by different disciplines in collaboration BS EN ISO 19650-2-2013 a federation strategy is defined as part of the BEP, defining the separate models and their relationships.
2. Practical size limits imposed by the hardware. This is largely dependent on the specification of the hardware, but as a rule individual files should be reviewed if they exceed 200Mb in size, when consideration should be given on how to manage geometry within the models or whether to split it into separate models. A noticeable slow down also occurs if there are excessive sheet numbers. Any change to a model which is predefined with the project BEP volume strategy must be reviewed and agreed by the project team and recorded in an amendment of the BEP.

7.7.2 2D CAD Information

Bringing large numbers of CAD files into a model can impact model file size. Whilst they are often used to form a background for creating or altering geometry it is recommended that they are regularly reviewed, and any redundant or unused CAD element are deleting out of the model file.

Before being brought into a model it is recommended that a CAD file is reviewed to ensure it is suitable for use in the model.

The content of CAD files impacts significantly on the performance of the Model file. Any CAD files which are no longer needed on a project should be removed from the Model.

8. GRAPHIC STANDARDS

Create a graphic standard that manages and controls graphically the deliverable or production output from CAD and modelling software to reflect company standards, ensure visual consistency and improve staff efficiency.

Any proposed deviation or personal customisation of line styles and graphics etc away from the graphic standard should not be permitted unless a requirement of the Contract deliverables.

In all instances such deviation should be agreed with the company BIM Manager prior to development.

View templates can be used to help create a graphic standard by applying a view style. View templates use controlled settings for the visibility/ graphics overrides of categories, view scales, detail levels, graphic display options and filters. A series of view templates can be pre-loaded into a standard template file.

These settings are not fixed and can be manipulated to suit project needs.

The use of view templates is encouraged, and additional types should be added as the project needs develop.

Some of the items you may want to manipulate graphically to make company drawings visually specific to your organisation and not out of the box, are:

- Text
- Dimensions
- Grids
- Level markers
- View Titles
- Elevation markers
- Section Markers
- Call out (detail) markers
- Room, Wall, Window & Door tags
- Line Styles
- Line Patterns
- Line Names
- Hatching & Regions
- Materials
- North Point symbol
- Scale Bar

9. MODELLING

When modelling consider the experience levels of project staff and fellow project team members to avoid complicating the model to an extent where others don't understand how to manipulate it.

BS EN ISO 19650-2:2013 states in section 5.1.4 that the appointing party, within the Project Information Requirements shall consider

"the method of assignment for level of information need"

Further, in 5.6.2, it points out that task teams should

"not generate information that:

- exceeds the required level of information need,"

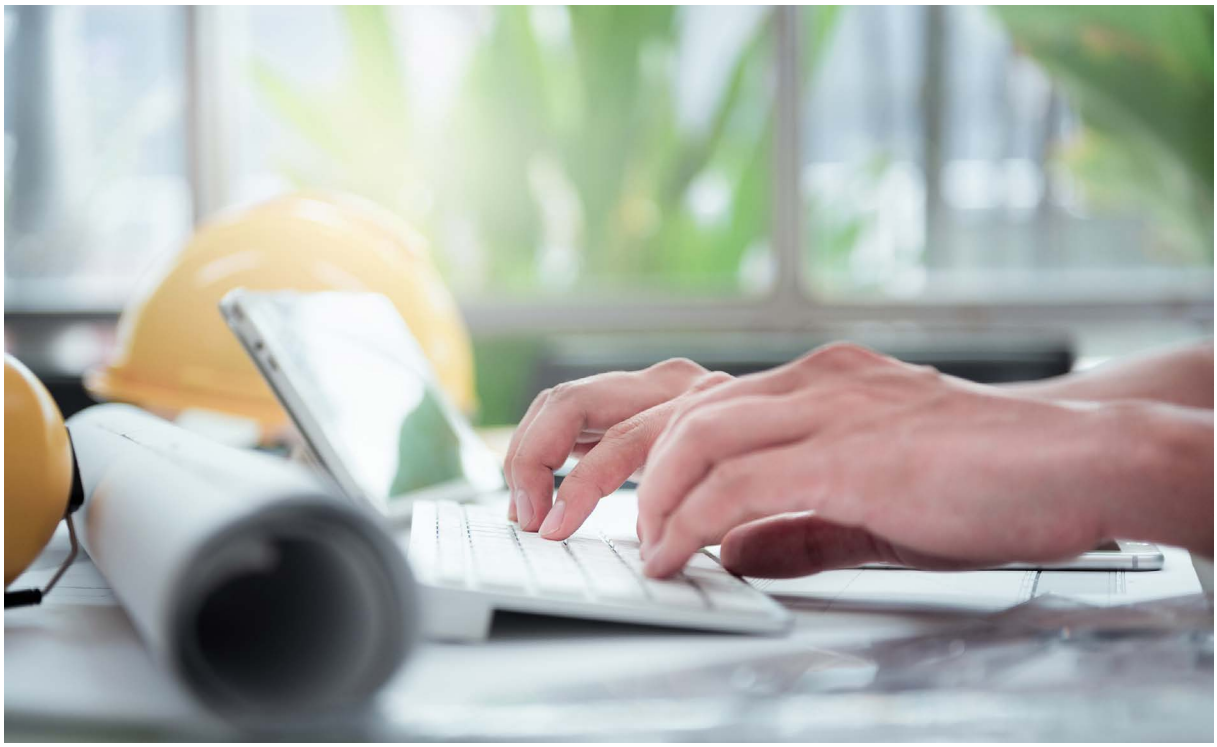
Therefore, refer to the Project Information Requirements documents for level of information need where they are in place. Where they are not in place reference could be made to the LOD's as defined in the NBS BIM Toolkit. For further details refer to https://toolkit.thenbs.com/

Note: The nature of BIM will mean that ownership of some aspects of the BIM model will often transfer from one party to another. An Architect may produce Curtain Walling details to a design intent LOD 3 or LOI 3 with a Designing Sub-Contractor providing greater levels of detail / information.

Where specific methods of modelling information have been used, a clear and concise description of the process involved should be conveyed in writing - possibly on the starting screen – to ensure all team members have an awareness of the issue.

Where a BIM Execution Plan (BEP) is in place be familiar with the agreed model requirements.

Continual assessment of the model against the BEP will ensure that the model is being generated and maintained in the most efficient way possible.



9.1 Use of manufacturers' families

Prior to use confirm that there is a licence to use the family and that no copyright has been breached.

Care must be taken when using manufacturers' families, they can be very data "heavy" as they are a way for the manufacturer to showcase product and contain many manufacturer specific parameters and web links. It is advisable to avoid using content from unregulated download sites. While these families are freely shared there is no regulatory checks on the quality of the content.

9.2 2D Detailing

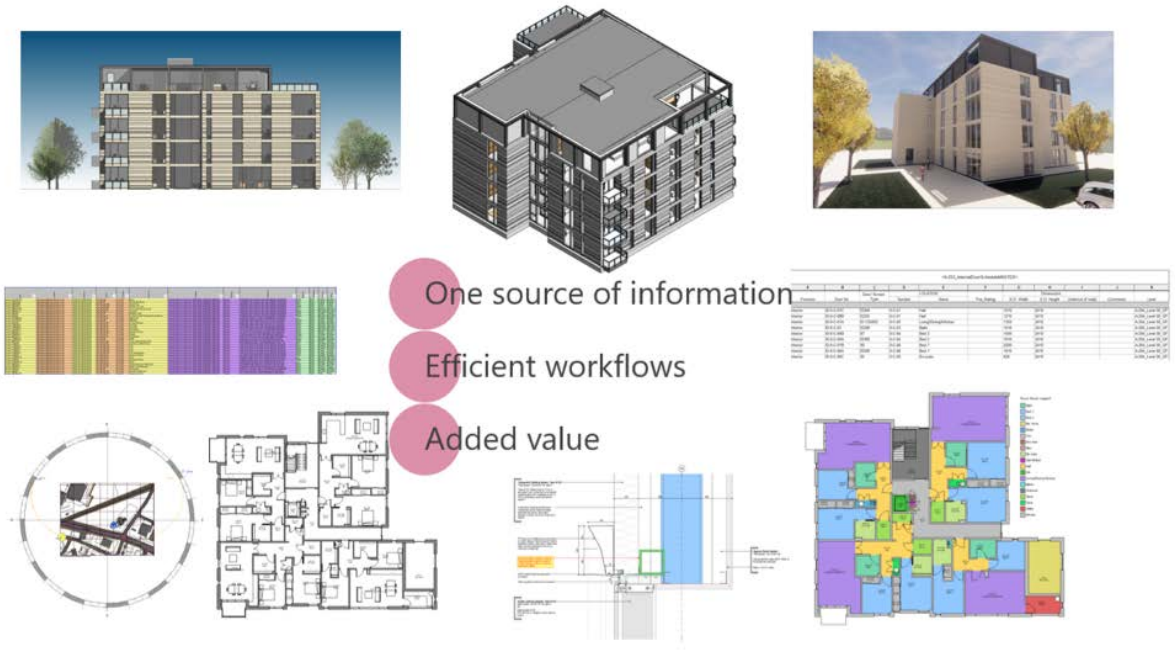
The use of standardised components will accelerate and improve accuracy/ consistency of detail creation. 2D Detail Families can have graphical and non-graphical. Information attached, can be parametric so adaptable for different size components, and can link with NBS specification through the NBS Create Revit plugin.

Be aware of the level of information required within the EIR and as agreed in the project BEP. While it is recommended that detailing is done within live model views to ensure coordination with model elements these detail views should be supplemented with 2D information appropriate to avoid over complicated modelling and maintain lean practices.

9.3 Specification within model

There is specification software available which allow the specification clauses to be linked to the model elements, NBS being the market leader, and their new product release, Chorus, allows direct specification creation within the model. Since it is cloud based it also allows coordinated specification development between consultants.

10. INFORMATION EXTRACTION



10.1 Information for statutory use

Planning and building warrant applications still rely on 2D output information. 3D modelling software allows export to various 2D CAD formats and print to PDF capabilities. If large numbers of drawing sheets require to be exported to .dwg or printed to .pdf format there are add in software solutions available to ease the generation of these. Whether created through the native software or by using an add-in software, all output should be checked for legibility, technical accuracy and graphical quality before uploading or sending to the local authority or verifier.

For housing design these would commonly consist of sets of the following at various scales:

- Plans
- Elevations
- Sections
- Details
- 3D Images and CGI visuals
- Specifications

10.2 Information for marketing

Filters, templates and schedules are easily created within modelling software, and can be used to create graphically appropriate material for marketing purposes. The time taken to set these up initially is worthwhile as they can be applied to views to create instant consistency in appearance, dimensioning styles and area scheduling.

10.3 Information for construction use

Using typical detail drawings across their house type ranges is commonplace. These are easily incorporated into 3D software as 2D components and transferred between projects, provided they are updated and checked against industry standards on a regular basis.

Where developments are larger scale and require coordination with external structural and MEP consultants it is recommended to make use of live model detail views to create project details, since many contracts will state that in the event of a discrepancy between 2D and model geometry, the model will prevail. In these cases, it is critical that details are project specific and relate exactly to the geometry of the model to ensure less risk of inconsistency and element clashes once the project gets to site construction stages.

10.4 Export Formats

Geometry and data can be exported in many formats, making it adaptable to suit a variety of other uses however it must be noted that any export from native format carries the risk of data loss and/or loss of accuracy in the output.

Common export formats include:

- DWG – AutoCAD export format
- DXF - AutoCAD export format
- DGN – MicroStation CAD platform export format
- IFC - Industry Foundation Classes
- JPEG – Image format
- PNG – Image format
- HTML – Webpage format
- gbXML To perform energy analysis using other software
- FBX - 3D max
- CSV – fabrication data
- SAT - ACIS 3D view Solid geometry exports
- TXT – unformatted text which can be used by most other programs, commonly used by word processing and spreadsheet software
- ODBC – database export format

10.5 Information Use

Exported data can be used in many ways, to aid sub-contractors, e.g. to communicate with those who wouldn't understand information shown in plans and details, and to engage with potential customers.

The data can also be used through other software to convert into data to inform digitalised methods of manufacturing. It can also be used to produce digital operation & maintenance manuals and schedules, for use by facilities maintenance teams for the entirety of the building lifecycle. BIM methods are still developing, and by adapting to them now the housing sector can reap many benefits through adding to the knowledge pool and transformation to a digital construction industry.

11. BIM CAPABILITY & SKILLS

Working within a BIM environment brings with it many people related challenges. These are very important to consider within any strategic transition to BIM. Success factors include

1. Individual Roles – BIM competency & skills
2. Organizational Competency
3. BIM Knowledge Levels & Needs Assessment
4. Critical Roles
5. BIM Strategy
6. BIM Training

11.1 Individual Roles & Competency

It is important to understand the primary and secondary roles within any BIM transition strategy. Undertaking role assessments will assist map the required BIM competency outcomes. This will inform your approach to developing key competencies by role. All roles differ, driving different training and awareness criteria, specific to that role. The table below provides some guidance on differing roles.

Primary competency set	Summary	Key competencies
Managerial	Managerial competencies are the decision-making abilities which drive the selection/adoption of long-term strategies and initiatives. Managerial competencies include leadership, strategic planning, and organizational management.	• Leadership • Strategic planning • Organisational management
Functional	Functional competencies are the non-technical, overall abilities required to initiate, manage and deliver projects. Functional competencies include collaboration, facilitation and project management.	• Collaboration • Project management • Team and workflow management
Technical	Technical competencies are the individual abilities required to generate project deliverables across disciplines and specialties. Technical competencies include modelling, drafting and model management.	• Software and hardware • Modelling and model management • Document (information management)
Supportive	Supportive competencies are the abilities needed to maintain information technology and communication systems. Supportive competencies include data and network support, equipment support and software troubleshooting.	• IT, data, network support • Common Data Environment • Software support
Administration	Administration competencies are the day-to-day organisational activities required to meet and maintain strategic objectives. Administration competencies include tendering and procurement, contract management, and human resource management.	• Policies, Procedures • Procurement • Contract Management • Quality Management
Operation	Operation competencies are the daily, hands-on individual efforts required to deliver a project or part/aspect of a project. Operational competencies include designing, simulating and quantifying.	• Modelling and model analysis • Construction, Fabrication • Operation, maintenance
Implementation	Implementation competencies are the activities required to introduce BIM concepts, tools and workflows into an organization. Implementation competencies include component development, standardization and technical training.	• Component development • Library management • Technical training
Research and development	Research and Development competencies are the abilities required to evaluate existing processes, investigate new solutions and facilitate their adoption - within the organization or by the larger industry. R&D competencies include change management, knowledge engineering and industry engagement.	• R&D • Strategy development and planning • Knowledge management • Change management

11.2 Organisational Competency

The business needs to evaluate and be are of its organisation capability to support BIM. This is often overlooked but is a key success factor if driving uptake and embedding BIM into any house building business. Organisational capability can be split into 3 core competencies:

1. Leadership
2. Collaboration
3. Communication

These core organisational competencies are set out below:

Core competency	Summary and secondary competencies	Key outcomes
Leadership	Organisational ability to establish strategy for the use and adoption of BIM. Ability to ensure strategic planning and organisational management, including change management to support BIM. Setting clear goals and targets. Identifying key individual skills needs and support to meet skills requirements.	• Leadership • Organisational BIM Strategy • Organisational planning and management • Organisational goals and targets
Collaboration	Organisational ability to provide a framework for collaboration to support BIM through the identification of clear common objectives, goals and targets. Development and implementation of collaborative processes and tools for BIM and information management. Development and implementation of project management processes and tools for BIM.	• Collaboration • Collaborative processes and tools for information management • Project management • Team and workflow management
Communication	Organisational ability to clearly communicate strategy. Organisational ability to involve, engage and empower individuals in using BIM. Structured approaches to understand and manage internal and external relationships. Engage and manage supply chain in the implementation and use of BIM	• Communication strategy for BIM • Processes to engage and manage staff • Processes to engage and mange supply chain

11.3 BIM Knowledge Levels & Skills Assessment

Through understanding the desired knowledge levels, individual roles and training plans can be tailored to suit a wide variety of roles and skillsets. There are typically 5 X BIM knowledge levels, set out below:

Knowledge level	Definition of knowledge level
None	Denotes a lack of competence in a specific area or topic. This would include those who are completely new to BIM as a concept
Basic	Denotes an understanding of fundamentals and some initial practical application. This includes understanding the drivers and benefits of using BIM and an overview of the processes and systems developed to control information management.
Intermediate	Denotes a solid conceptual understanding and some practical application. For example, this would include an understanding of the processes in place to control information management and the systems for the manipulation and analysis of digital information.
Advanced	Denotes significant conceptual knowledge and practical experience in performing a competency to a consistently high standard. This includes, as a minimum, a detailed knowledge of the processes and systems for information management alongside experience of implementing and controlling them. For some roles, it would also include refined skills in model creation, manipulation and analysis.
Expert	denotes extensive knowledge, refined skill and prolonged experience in performing a defined competency at the highest standard. An expert would be able to provide training and mentoring internally as well as provide leadership on the implementation and application of technology and/or processes for BIM.

Training will be required in any BIM adoptions strategy. It is important that a detailed training needs assessment is undertaken. This will ensure the correct level of training is applied to specific roles, function or support groups, that is appropriate for the BIM engagement they are likely to undertake within the organisation. For example, senior management may only require a general knowledge, whereas detailed technical roles, will require in depth software and business process training.

An example of the training needs assessments for varying house building roles at an operational and group support level are shown below:

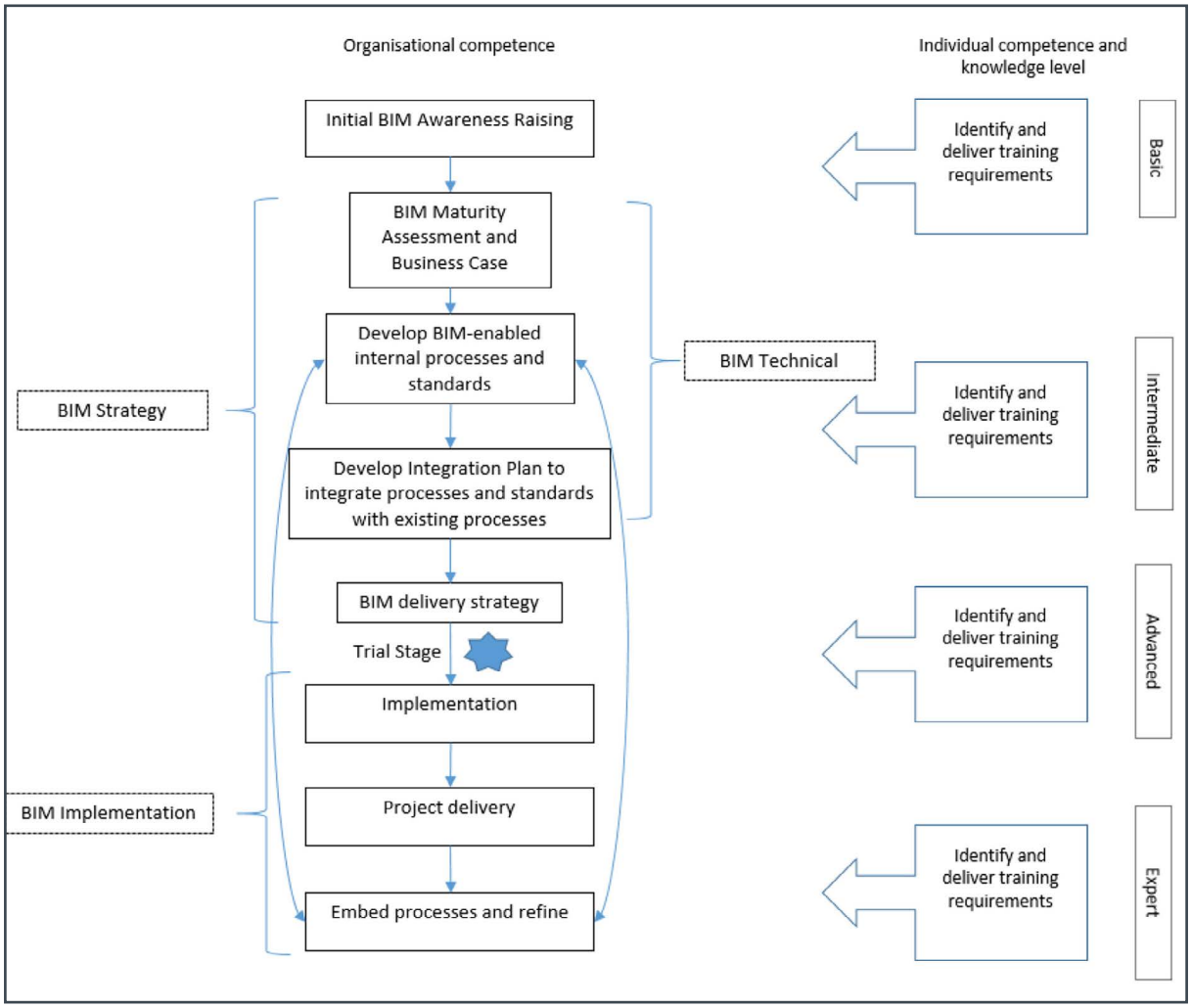
Competency set and role	Knowledge,	Competency, Skill
Managerial: Director / Senior Management	Basic Intermediate	**Primary competencies:** • Leadership • Strategic planning • Organisational management
Functional • Commercial • Finance • Land • Sales and Marketing	Basic Intermediate	**Primary competencies:** • Collaboration • Project management • Team and workflow management **Secondary competencies:** • Software and model use • Document (information management)
Technical • Construction • Engineering • Technical	Basic Intermediate Advanced Expert	**Primary competencies:** • Software and hardware • Modelling and model management • Document (information management) **Secondary competencies**: • Collaboration • Project management • Team and workflow management
Support / Administration • Buying • Customer Services and Maintenance • Office and Facilities • IT	Basic Intermediate	**Primary competencies:** • IT, data, network support • Common Data Environment • Software support **Secondary competencies:** • Policies, Procedures • Procurement • Contract Management • Quality Management

Training Needs Assessment Operational Roles

Competency set and role	Knowledge level	Competencies required
Managerial: Director / Senior Management	Basic Intermediate	**Primary competencies:** • Leadership • Strategic planning • Organisational management
Functional • Finance • Holdings • Sales and Marketing	Basic Intermediate	**Primary competencies:** • Collaboration • Project management • Team and workflow management **Secondary competencies:** • Finance, Budgeting • Software and model use
Technical • Product Development	Basic Intermediate Advanced Expert	**Primary competencies:** • Software and hardware • Modelling and model management • Document (information management)
Support / Administration • HSEQ • HR • IT • Office and Facilities • Payroll	Basic Intermediate	**Primary competencies:** • IT, data, network support • Common Data Environment **Secondary competencies:** • Software support • Policies, Procedures • Procurement • Contract Management • Quality Management

Training Needs Assessment Group Roles

Organisational competency & skills development are intrinsically linked to your BIM strategy. As the BIM strategy and implementation plan is delivered, knowledge levels will mature and working practises become embedded. This is shown in the flow chart below:



11.4 Critical Roles

Within any BIM strategy, there are 3 x critical roles that are pivotal in the business BIM implementation strategy, plan and delivery approach. Senior business leaders are critical to demonstrating their unwavering commitment to BIM. BIM Champions are fundamental to fuelling day to day progression and mentoring staff. The Information Manager is likely to be a new role, central to BIM responsible for developing content, aligning work flows and governing outcomes. These roles are explained in more detail below:

Key roles to support the development of core organisational competencies:

a) **Senior level leadership:** Demonstrates senior management's commitment to implementing BIM, articulating the vision and objectives, sell the concept across the organisation and provide a focus for the implementation of a BIM Strategy.

b) **BIM Champions:** Responsible for the day-to-day implementation of a BIM Strategy, the delivery of coaching and support to other staff, monitoring progress and reporting against performance measures.

c) **Information Manager:** Responsible for developing and implementing the processes wich define how information will be created, managed, exchanged and used. This includes approaches to collaborative working within the company and with supply chain partners and setting up and managing a Common Data Environment.

11.5 BIM Strategy

There must be a clear cohesive BIM vision and set of objectives agreed and signed off, by senior management, in any BIM strategy implementation. Without this many BIM strategies fail. The strategy must be clear and well considered, planned and robust.

BIM is a strategic investment and will demand the business sticks to the vision and drive's unwavering adoption, even when things get tough and challenges arise, that are likely to question the vision and strategy. It is important this is developed and embedded into the implementation strategy and delivery plan. The key aspects are explained below:

BIM Strategy to guide and support the adoption of BIM:

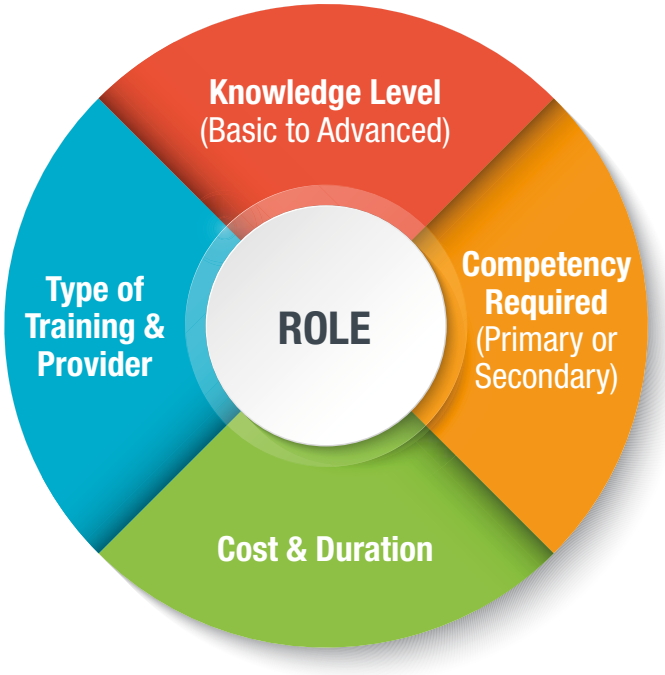
- **Vision and Objectives:** To set out what the organisation wants to achieve with regards to BIM and the resulting benefits; to demonstrate to staff the organisation's commitment to BIM and what it aims to achieve; to set out the business case for BIM and "sell the concept" across the organisation
- **BIM Strategy and Implemetation Plan:** To identify the steps in achieving the vision and objectives providing clarity around roles and responsibilities, development of information management processes, implementation of systems and technology solutions, the steps in the implementation of the processes, supports the delivery of the training requirements and approaches to cultural change

BIM VISION	Working together in a seamless team to common objectives that deliver benefit for all through mutually-beneficial (i.e. including commercial) alignment					
CORE PRINCIPALS	Common vision and leadership		Collaborative cultures & behaviours		Collaborative processes and tools	
SUCCESS FACTORS	Early involvement	Selection by value	Aligned commercial arrangments	Long term relationships	Common processes and tools	Performance measurement

11.6 BIM Training

Fundamental to BIM adoption will be the effective delivery of training. This will embrace not just software and practical training but, equally as important awareness training and general understanding. It is important all roles are assessed, and training put in place. Suggested roles are:

1. **Senior Managers & Leaders**
2. **BIM Champions**
3. **Technical Roles**
   a. Design & Technical
   b. Estimating
   c. Commercial & Procurement
   d. Construction
4. **Functional Roles**
   a. Finance
   b. Sales and Marketing
   c. Research & Development
5. **Support Roles**
   a. HSEQ, HR & IT



Map of Training Considerations by Role

Competency set and Role	BIM knowledge levels required	BIM competencies required	Training: Type and content of training initiatives and the knowledge levels met	Source	Costs: per day / per person (all costs exc. VAT)	Comments / Other information
Managerial: • Senior Management	Basic Intermediate	*Primary competencies:* • Leadership • Strategic planning • Organisational management *Secondary competencies* • Strategy development and planning • Change management	BIM Fundamentals: Introductory course providing the basic knowledge of BIM ***Knowledge levels: Basic***	BRE	£785 per person	Two-day course, delivered in at BRE in Watford
				BSI	£1,015 per person	Two-day course, delivered at BSI in London
				NFB (CITB)	£1,100 / one day, up to 12 delegates	One-day course, delivered at client's premises, or other venue as agreed
				RICS	£295 (members) £395 (non-members) per person	One-day course at RICS, London
			BIM Strategy: To enable development of a company BIM Strategy / Implementation Plan ***Knowledge level: Intermediate***	NFB (CITB)	£3,000, 3 days, up to 12 delegates	3-day course, delivered at client's premises
• BIM Champions	Basic Intermediate Advanced Expert	*Primary competencies:* • Leadership • Strategic planning • Organisational management *Secondary competencies* • Strategy development and planning • Change management		CIRIA	No cost details available	One-day course *"to develop a strategy for full implementation with minimum investment in software and training"*
			BIM Champion/BIM Practitioner course to train the BIM Champions/change agents responsible for the day-to-day implementation of the BIM Strategy ***Knowledge level: Intermediate, Advanced***	NFB (CITB)	£3,000, 3 days, up to 12 delegates	BIM Practitioner 3-day course, delivered at client's premises
			BIM Strategy consultancy: Training and consultancy to support BIM Champions in with BIM Strategy / Implementation Plan ***Knowledge level: Intermediate, Advanced, Expert***	Various	£750 per day upwards	Bespoke consultancy option to work with senior leaders to develop the BIM Strategy / Implementation Plan. A bespoke alternative to structured BIM Strategy training.
			Information management consultancy and training: Bespoke consultancy to develop and implement training for new information management processes in line with the company's BIM Strategy ***Knowledge level: Advanced, Expert***	Various	£750 per day upwards	Bespoke training on the new information management procedures. A company-specific approach and an alternative to structured information management training which aligns with the company's BIM Strategy. Training needs unlikely to be met by training available in the open market.
			Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working ***Knowledge level: Intermediate, Advanced, Expert***	Various	£750 per day upwards	Bespoke training for staff to use the Common Data Environment implemented as part of the BIM Strategy. A company-specific alternative to structured CDE training which aligns with the BIM Strategy.
				Internal	N/A	Internal training driven by the requirements of the company's BIM Strategy and the nature of the processes and documentation developed to support it.

Example Training Plan – Managerial Role

Competency set and role	BIM knowledge levels required	BIM competencies required	Training: Type and content of training initiatives	Source	Costs: per day / per person (all costs exc. VAT)	Comments / Other Information
Technical: • Product Development • Design • Engineering • Estimating • Timber Systems • Planning • Surveying • Construction	Basic Intermediate Advanced Expert	**Primary competencies:** • Software and hardware • Modelling and model management • Document (information management) **Secondary competencies:** • Policies, Procedures • Procurement • Contract Management • Quality Management	BIM Fundamentals: Introductory course providing the basic knowledge of BIM Knowledge levels: Basic	BRE	£785 per person	Two-day course, delivered in at BRE in Watford
				BSI	£1,015 per person	Two-day course, delivered at BSI in London
				NFB (CITB)	£1,100 / one day, up to 12 delegates	One-day course, delivered at client's premises
				RICS	£295 (members) £395 (non-members) per person	One-day course at RICS, London
			Software training to meet the skills needs to create and manage model information during design and construction using specific software packages Knowledge level: Basic, Intermediate, Advanced, Expert			
			Introduction to model authoring software (Revit Architecture, MEP, Structures etc…) Knowledge level: Basic, Intermediate	CADline	£650-£750 per person	Three-day course, delivered at locations across UK
				BIM Technologies	TBC	TBC
				Cadassist	£350 per person	One-day course
				Nottingham Trent University	£810 per person	Three-day course, delivered in Nottingham
				Graitec	c.£650 per person per day	Various one, two and three day courses, various locations across UK
			Revit Intermediate and Advanced courses Knowledge level: Intermediate, Advanced, Expert	Academy Class	£1,300 per person	8-day course, locations across UK
				Academy Class	£600-£800 per person	2 or 3 day courses, locations across the UK
				Graitec	c.£650 per person per day	Various courses covering model creation, creating and managing families and managing COBie information fields
				BIM Technologies	TBC	TBC
			Navisworks basic introductory training, e.g: • Design co-ordination and model analysis • Clash detection • 4D and 5D simulations and analysis Knowledge level: Basic, Intermediate	Academy Class	£900 per person	Two-day course, locations across UK
				BIM Technologies	TBC	TBC
				Graitec	c.£650 per person per day	
			Navisworks advanced training: • 3D model review • Advanced clash detection • Timelining, scheduling: 4D and 5D • Animations and visualisations Knowledge level: Intermediate, Advanced, Expert	Academy Class, Graitec, CADline	c.£600-£900 per person per course	Various two and three day courses. Content often tailored and precise costs on application
				BIM Technologies	TBC	TBC
			Other software specific training, which will be dictated by the development of the company's BIM Strategy. This might include: • Estimating software, for example, which could potentially be included within the license fee and agreement for the specific software packages. • Common Data Environment • Bespoke training for the integration of different software packages, e.g. integrating software used by engineers/supply chain with modelling and analysis packages Knowledge level: Intermediate, Advanced, Expert	Various	£750 per day upwards	Bespoke consultancy to work with staff to develop and implement training on specified software identified in the company's BIM Strategy. for new information management procedures. A company-specific alternative to structured information management training.

Example Training Plan – Technical Roles

Competency set and Roles	Training required to meet the knowledge levels			
	Knowledge Level: Basic	Knowledge Level: Intermediate	Knowledge Level: Advanced	Knowledge Level: Expert
Managerial: • Senior Management	BIM Fundamentals	BIM Strategy: To enable development of a company BIM Strategy / Implementation Plan		
Managerial: • BIM Champions	BIM Fundamentals	BIM Strategy: To enable development of a company BIM Strategy / Implementation Plan BIM Strategy consultancy: Bespoke training and consultancy to support BIM Champions	BIM Champion/BIM Practitioner course to train the BIM Champions/change agents BIM Strategy consultancy: Bespoke training and consultancy to support BIM Champions Information management consultancy and training to develop information management processes	BIM Champion/BIM Practitioner course to train the BIM Champions/change agents BIM Strategy consultancy: Bespoke training and consultancy to support BIM Champions Information management consultancy and training to develop information management processes
		Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working	Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working	Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working
Technical: • Product Development • Design • Engineering • Estimating • Timber Systems • Planning • Surveying • Construction	BIM Fundamentals Introduction to model authoring software (Revit, Navisworks, etc...)	Introduction to model authoring software (Revit, Navisworks) Navisworks advanced training Revit Intermediate and Advanced courses Other software training driven by the BIM Strategy: • Estimating software • Common Data Environment • Bespoke training for the integration of software	Revit Intermediate and Advanced courses Navisworks advanced training Other software training driven by the BIM Strategy: • Estimating software • Common Data Environment • Bespoke training for the integration of software	Revit Intermediate and Advanced courses Navisworks advanced training Other software training driven by the BIM Strategy: • Estimating software • Common Data Environment • Bespoke training for the integration of software
		Company-specific training on new information management processes and documentation	Company-specific training on new information management processes and documentation	Company-specific training on new information management processes and documentation
		Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working	Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working	Specific training, driven by the company's BIM Strategy, e.g.: • Common Data Environment • BIM Protocol • Employers Information Requirements • Information management processes • BIM Execution Plan • Procurement • BIM outcomes (deliverables) • Processes for collaborative working
		Specific support to develop and implement new information management processes specific to Technical competency set	Specific support to develop and implement new information management processes specific to Technical competency set	Specific support to develop and implement new information management processes specific to Technical competency set

Example Summary of Training Courses Available to meet BIM Knowledge Levels & Roles

12. BIM CULTURE & CHANGE MANAGEMENT

A critical component of any BIM strategy is the organisational culture and change management support. There are three fundamental cultural values and supporting components to be focused on. These are:

Leadership

1. Senior Executives
2. BIM Vision & Objectives
3. BIM Champions
4. BIM Strategy & Plan

Communication

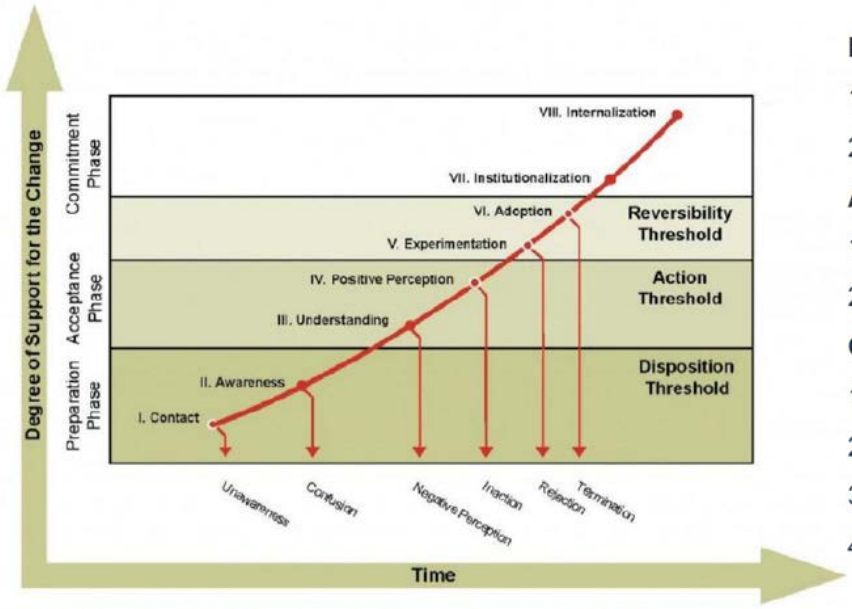
1. Communication Plan
2. Training Plan

Collaboration

1. Information Management Process
2. Common Data Environment
3. Pilot Project (s)

12.1 Building Commitment to Change

Changing working practises and processes, whilst building a culture of collaboration, openness and trust, can be very difficult. Building commitment will take many years and go through three development phases as shown below:



Preparation

1. Contact
2. Awareness

Acceptance

1. Understanding
2. Positive perception

Commitment

1. Experimentation
2. Adoption
3. Institutionalization
4. Internalization

Figure 9. The Eight Stages of Building Commitment model as developed by Conner Partners

12.2 Change Support Mechanisms

Within the BIM strategy support for change must be provided. It is important the maturity stages are recognised, and the supporting mechanisms implemented to ensure delivery is sustained and that relapses do not arise. This is often overlooked and worthy of consideration in any BIM implementation delivery plan and approach. The supporting mechanisms and trigger points are shown below:

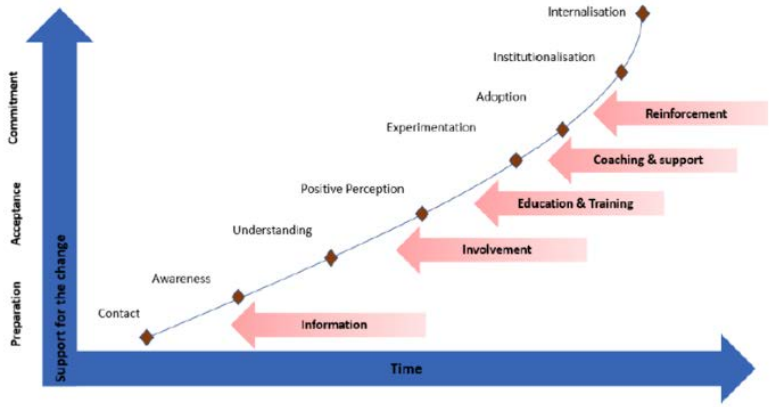


Figure 10. Mechanisms that can support the progression through the Eight Stages of Building Commitment Model

12.3 Cultural Change Plan

As part of the BIM strategy and implementation, a cultural change plan should be developed. This will review the current and future cultural outcomes. Change can be mapped against the three key stages of cultural maturity & development, shown below:

Preparation

1. Contact
2. Awareness

Acceptance

1. Understanding
2. Positive perception

Commitment

1. Experimentation
2. Adoption
3. Institutionalization
4. Internalization

Stage	How	Responsibility	With what	Outcome	Measure	Risks/Blockers	Mitigation
Contact	Develop and communicate company Vision and Objectives for BIM	Senior Leadership	Business Plan Communications Plan BIM Implementation Plan	All staff aware of BIM and the company's Vision and Objectives for BIM	% staff engaged	Lack of awareness prevents progress Failure to engage key staff / departments	Use a range of communication methods Ensure messages are simple and benefits clear
	Appoint BIM Champions to lead day-to-day implementation of BIM	Senior Leadership	Business Plan Communications Plan BIM Implementation Plan	BIM Champions appointed and equipped to drive BIM implementation	No BIM Champions appointed	Lack of day to day responsibility and in-depth knowledge to support adoption and engagement of staff	Ensure BIM Champions are appropriately resources
Awareness	Internal communications with key messages for BIM adoption Develop clear BIM Implementation Plan	Senior Leadership Internal BIM Champions	Internal communication channels BIM Implementation Plan	All staff with knowledge of the company's approach to the adoption of BIM	% staff receiving internal communications	Confusion among staff of what BIM is and what the organisation is aiming to achieve and why	Ensure benefits to the organisation are clear and approach
	Structured BIM Awareness training for all staff	BIM Champions in association with external training providers	Structured BIM Awareness Training programme	All staff with a basic knowledge of BIM and the benefits to the organisation	% staff attending basic BIM awareness sessions	Lack of awareness and basic knowledge around BIM	Ensure training is focused and company-specific
	Engage key supply chain partners to promote company Vision and Objectives for BIM	BIM Champions Supply chain managers / Procurement	Business Plan Communications Plan BIM Implementation Plan	Key supply chain partners aware of company's Vision and Objectives for BIM	% key supply chain partners engaged and aware	Lack of awareness and basic knowledge of BIM	Ensure messages are simple and benefits clear Target communications appropriately to different supply chain partners
Understanding	Deliver in-depth and focused training around specific topics/areas of BIM	External training providers Internal BIM Champions Technical staff	Structured BIM Training around specific topics/ technical areas, including software training	Identified project delivery staff trained in specific topics / technical areas / software	No BIM Champions appointed No technical staff with specific software training	Negative perception among key staff responsible for BIM adoption Lack of knowledge and skills in specific technical areas or in the use of software	Ensure training is focused and company specific, linking to Vision and Objectives
	Development of clear processes for information management	Internal BIM Champions Technical staff External providers	Structured BIM Training around new processes for information management	Formal processes for information management adopted to support BIM	Information management processes developed and adopted	Lack of a structured and consistent approach to information management	Align processes with BIM standards, BIM Protocol, PAS 1192-2 etc…
	Adoption of Common Data Environment	Senior Leadership, Internal BIM Champions, Technical staff, IT	BIM Implementation Plan Common Data Environment structure agreed, access / permissions implemented	Common Data Environment system identified and adopted	Common Data Environment identified and adopted	Lack of a structured and consistent approach to information management	Engage external support where necessary
Positive Perception	Engage key staff in development of information management processes	Internal BIM Champions Technical staff	BIM Implementation Plan Communications Plan	Key staff aware of and understand the information management processes	% staff trained to use new information management processes	Inaction, leading to a lack of a structured and consistent approach to information management	Support from Senior Leadership
	Engage key staff in development and use of building information models	Internal BIM Champions Technical staff External training providers	Structured training in use of models	Key staff aware of and understand the structure and use of building information models	% staff trained to work with building information models	Inability to use building information models and realise the benefits of BIM	Ensure use of building information models linked with Vision and Objectives
	Identify pilot projects and plan roll out of information management processes Identify objectives (outcomes) for delivering pilot projects	Internal BIM Champions Technical staff	BIM Implementation Plan Structured programme, training and support for the pilot projects	Pilot projects identified and BIM objectives (outcomes) identified	No pilot projects identified BIM objectives (outcomes) identified	Inaction leading to lack of momentum Implementation stalls due to lack of practical experience	Ensure pilots link with Vision/Objectives Support from Senior Leadership
	Train staff to use of Common Data Environment on pilot projects	Internal BIM Champions Technical staff IT	Develop structured and focused training programme linking CDE with information management processes	Key staff capable of using CDE for project delivery Pilot projects delivered using information management processes and CDE	No of key staff trained to use CDE Information management processes integrated with CDE Pilot projects identified	Lack of a structured and consistent approach to information management Inaction leading to lack of momentum Not using CDE undermines collaborative working	Engage external support where necessary Support from Senior Leadership

Example: Detailed Change Management Plan, set against Cultural Maturity Levels

Strategic Component	Activity and Outcomes			
	Phase 1	Phase 2	Phase 3	Phase 4
Senior leadership	BIM Fundamentals training for senior leadership teams **Outcome: Senior leaders with basic BIM knowledge**	Senior leadership lead communication of vision and objectives BIM Champions support senior leadership to communicate vision and objectives **Outcome: Senior leaders demonstrate visible leadership for staff and BIM Champions responsible for day-to-day responsibility** ***Overlaps with Contact and Awareness stages***	Continued support from senior leaders and BIM Champions to communicate the vision and objectives BIM Champions lead the BIM Strategy, Implementation Plan and Communications Plan **Outcome: Senior leaders demonstrate visible leadership for staff and BIM Champions responsible for day-to-day responsibility** ***Overlaps with Contact and Awareness stages and continues through subsequent stages***	Continued support from senior leaders and BIM Champions with vision and objectives and BIM Strategy, Implementation Plan and Communications Plan BIM Champions lead and support the ongoing training, coaching, support of staff and delivery of pilot projects **Outcome: Senior leaders demonstrate visible leadership for staff and BIM Champions responsible for day-to-day responsibility** ***Overlaps with Contact and Awareness stages and continues through subsequent stages***
Vision and Objectives for BIM	Senior Leadership team establish vision and objectives for BIM **Outcome: Vision and Objectives for BIM in place**			
BIM Champions	Define the scope of the BIM Champions role Identify and appoint BIM Champions Deliver BIM Practitioner/BIM Champion training **Outcome: BIM Champions appointed and trained**			
BIM Strategy / Implementation Plan		BIM Champions and Senior Leaders develop BIM Strategy Training and support for BIM Champions for BIM Strategy Detailed Implementation Plan developed **Outcome: BIM Strategy & Implementation Plan in place**	BIM Champions lead roll-out of BIM Strategy & Implementation Plan BIM Champions develop support and coaching for staff BIM Champions and HR / Training align Implementation Plan and Training Plan **Outcome: Implementation ongoing, support and coaching in place for key staff**	
Communications Plan		Develop Communications Plan alongside BIM Strategy Develop key messages and communication channels Begin high-level message communications **Outcome: Communications Plan to support BIM Strategy**	BIM Champions and HR / Training teams lead roll-out of Communications Plan Continued support from senior leaders to communicate vision and objectives. Strategy, implementation **Outcome: Key messages, inc. Vision and Objectives and process of implementation cascaded through company**	
Training Plan	HR / Training evaluates draft Training Plan and begin development of detailed Plan **Outcome: Scope of final Training Plan developed**	Finalise detailed Training Plan Develop timing of training delivery Communicate Training Plan to staff **Outcome: Final Training Plan in place with delivery plan**	Identify and engage priority competency sets for basic-level BIM training Begin roll-out of BIM Fundamentals training Begin roll out of basic software training **Outcome: Priority competency sets trained in BIM Fundamentals and basic software**	Continue BIM Fundamentals training across all competency sets Continue with basic software training Begin training on the use of Common Data Environment **Outcome: BIM Fundamentals, basic software and CDE training ongoing**
Information Management Processes	Define scope of Information Manager role **Outcome: Scope of Information Manager role, inc. competency requirements, responsibilities etc…**	Appoint Information Manager and deliver training Define scope of information management processes Identify supporting documentation and standards **Outcome: Information management processes, standards and documentation all defined though not developed; Information Manager appointed and trained**	Develop information management processes and supporting documentation Link with Communications Plan, Implementation Plan and begin staff awareness raising of new processes **Outcome: Information management processes and supporting documentation developed**	BIM Champions and Information Manager lead roll-out of information management processes Identify and engage relevant competency sets to begin training in information management processes Link to implementation of CDE **Outcome: Information management processes in place and training / support ongoing**
Common Data Environment	Identify / evaluate systems for Common Data Environment Outcome of evaluation published with recommendations for appropriate CDE system(s) **Outcome: Evaluation of CDE systems complete and recommendations made**	Decision on Common Data Environment system Common Data Environment system purchased/ licensed **Outcome: System for CDE identified and purchased**	Information Manager and IT implement system for CDE Information Manager develops structure for the CDE Assign access and security levels Integrate information management processes and CDE **Outcome: CDE adopted and implemented; CDE structure in place with process for information management**	Information Manager & IT lead roll-out of CDE Information Manager & IT lead training for staff on structure and use of CDE Information Manager set up CDE for pilot projects **Outcome: CDE in place and in use for pilot projects; training on CDE commenced**
Pilot project(s)		Evaluate potential pilot projects as part of BIM Strategy and Implementation Plan **Outcome: Evaluation of potential pilot projects complete to enable identification of appropriate pilots**	Identify pilot projects BIM Champions and Information Manager develop approach to delivering pilot projects Develop BIM outcomes and performance measures Identify key staff and depts. for pilot projects **Outcome: Pilot projects identified and approach agreed**	BIM Champions lead implementation of pilot projects BIM Champions engage staff involved in pilot projects Information Manager set up CDE for pilot projects Develop training, coaching and support for staff for pilot projects and to use the CDE **Outcome: Pilot projects underway and staff receiving support and coaching**

Example: Summary of Initial Steps to Implement Cultural Change

13. SUMMARY & CONCLUSIONS

This Guide to Creating a BIM Housing Manual provides a framework for house building companies to utilise in the creation of there own specific BIM Housing Manual, suitable for their businesses. The guide provides a structure and content to assist users navigate there way through BIM adoption and implementation.

The guide covers the core technical aspects as well as the people aspects. It is very important both aspects are covered. BIM is not a software it is a process and demands collaborative working, founded on an open and trustworthy relationships. There are many challenges around upskilling, knowledge, culture and change management, that are significantly more difficult to implement that just buying software and considering BIM as an IT project.

The transition to 3D BIM enabled digital working with the housebuilding industry is already underway. Overtime this way of working will become the new norm, as was the case when drawing board were replaced with 2D CAD drawing systems. Other sectors, such as the automotive have seen real benefits in adopting digital work flows. It is highly likely this will be the case for house building.

By adopting digital working housebuilding will be industrialised and transform how homes are designed, procured, manufactured, assembled and delivered, leading to reduced costs, increased output, fewer defects and high quality homes, the sector can be proud of.

This report is part of the AIMCH project which is developing all areas of modern methods of construction in housebuilding. For more information on the full scope and outputs of the project visit aimch.co.uk and follow us on LinkedIn and Twitter.

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