

# **BIM Overlay** to the RIBA Outline Plan of Work

Edited by Dale Sinclair  
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## President's Foreword

The three inter-related issues of sustainable design, Building Information Modelling (BIM) and procurement will have a great deal of influence on the future shape of both the architects' profession and the broader construction industry. Unsurprisingly, they all feature strongly in the UK Government Construction Strategy, published in May 2011. Building on the work already undertaken by the RIBA in the Green Overlay to the RIBA Outline Plan of Work, published in November 2011, the BIM Overlay to the RIBA Outline Plan of Work provides straightforward guidance on the activities needed at each RIBA work stage to successfully design and manage construction projects in a BIM environment.

Evolving BIM technology is transforming modes of working in the construction industry in terms of the ways in which design data is generated, shared and integrated, and this creates a requirement for new protocols, activities and definitions. The technological and conceptual basis of BIM has been emerging for more than twenty years and is now rapidly approaching maturity. The UK Government has set out an ambitious vision for the adoption of BIM on all public sector projects. The RIBA believes that architects have a central role to play in ensuring that the construction industry responds to the opportunities offered by BIM in both public and private sectors, and this new overlay, based on the familiar and widely used RIBA Plan of Work, is an important piece of new guidance for architects and co-professionals. As well as setting out BIM activities at each work stage, key data drop points are identified within the overall project process. The aim is to assist design and construction teams in using BIM to provide a more efficient, intelligent and cost effective design process and to offer enhanced services to clients, particularly in relation to the whole life value of buildings.

Some commentators have suggested that there are financial and skills barriers to the adoption of BIM by smaller practices and that the benefits to smaller practices may be more limited. However, the RIBA believes that, as happened with the introduction of CAD, a tipping point will soon be reached when BIM will gain widespread acceptance as a transformative technology and working philosophy at all scales of practice. The principles of BIM can be applied to both complex projects with large multi-disciplinary design teams and large numbers of specialist sub-contractors and also to smaller, bespoke projects undertaken in a more traditional manner.

I hope that this publication will help practitioners to cut through some of both the current hype and anxiety about BIM by offering some basic best practice principles, and that it will help to make the business case for investing in the training, hardware and software needed to make full and effective use of the BIM approach. BIM offers a unique opportunity; let's go for it!



**Angela Brady**  
RIBA President  
April 2012

*Photograph by James Jordan*

## Introduction

This document is the result of a review of the Outline Plan of Work 2007 (Amended November 2008) by a working group under the direction of the RIBA Practice and Profession Committee. A number of clients have assisted in the review, and the RIBA members involved in the UK Government Cabinet Office and CIC BIM working groups have also contributed to the document.

The BIM Overlay builds on the Green Overlay to the RIBA Outline Plan of Work, edited by Bill Gething and recently published by RIBA Publishing. Together these two documents are part of the preparatory work being undertaken prior to a fundamental review of the RIBA Plan of Work that will take place in 2012-13.

This document also forms part of the response from the construction industry, and in particular the RIBA, to the Government's commitment to have all its projects utilising BIM from the summer of 2012.<sup>(1)</sup> Needless to say, as a result of this stated intention and the release of other key government documents<sup>(2)</sup> there has been a growing interest in the subject, and whilst enhanced levels of BIM have successfully been used on a number of completed projects, for many designers the subject is relatively new. This increased interest has resulted in various papers, discussions and conferences on the subject, and although opinions on certain subjects are converging, there is a wide ranging set of views on others.

These varying views make it difficult for those seeking a strategic overview to relate to the subject, to understand clearly what BIM actually is and to consider how they might embrace BIM working methods in their own practices. Conflicting terminologies with differing definitions create further confusion for those researching the subject for the first time. This document provides an Overlay that simplifies the BIM processes and clarifies contradictory terms causing confusion in the industry.

What is clear from the government documents is that BIM is seen as being a key contributor in the drive by the Government for its estate to be more energy and cost efficient from both a capex (capital cost) and opex (operating cost) perspective, and that the construction industry must respond to the challenges that have been set. With this in mind, the working group has evaluated the various strands of knowledge in relation to BIM and has produced an Overlay of the succinct wording of the current 2007 Outline Plan of Work (updated 2008) that is essential to BIM. The working party has also considered what the core BIM activities should be at each stage of the plan. The document is not intended to be a fundamental review of the Plan of Work: rather guidance on the use of BIM in the context of the current Plan of Work.



**Dale Sinclair RIBA**  
Editor

(1) Government Construction Strategy – UK Government Cabinet Office, May 2011

(2) Low Carbon Construction – BIS, Autumn 2010  
BIM Working Party Strategy Paper – BIS, March 2011  
Government Construction Strategy – Cabinet Office, May 2011

## What is BIM?

Before considering the practical implications of BIM on current working processes, it is essential to consider its definition. BIM is widely used as the acronym for 'Building Information Modelling' which is commonly defined using the Construction Project Information Committee (CPIC) definition as:

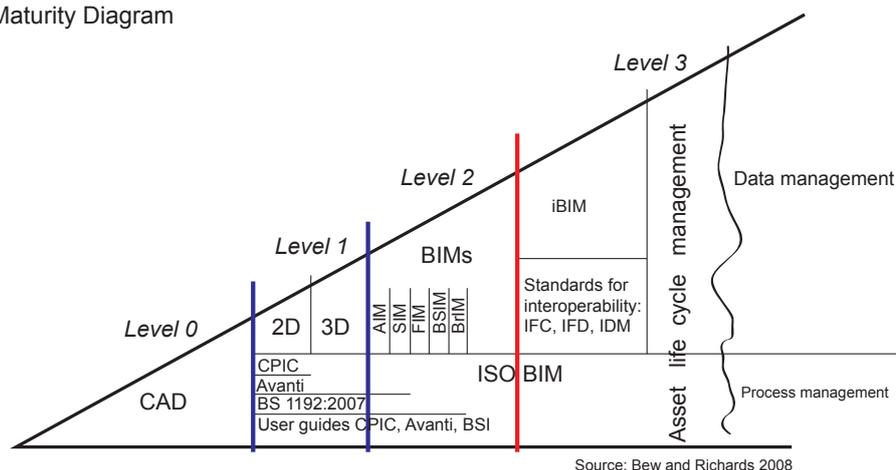
'...digital representation of physical and functional characteristics of a facility creating a shared knowledge resource for information about it forming a reliable basis for decisions during its life cycle, from earliest conception to demolition.'

It is important to note that some observers believe that BIM should be the abbreviation for 'Building Information Management' and others use the term BIM(M) alluding to 'Building Information Modelling and Management'. Below is set out why, in some respects, the latter description is more accurate.

The most effective way to understand BIM is to refer to the widely used BIM Maturity Diagram prepared by Mervyn Richards and Mark Bew in 2008, as illustrated in Figure 1 below.

This diagram is important as the maturity levels (level 0, 1, 2 and 3) are widely referred to in the industry to the extent that the Government's phased implementation is based on these levels: from summer 2012 projects will be required to implement level 2 BIM, with the Government's aspirations being to have fully collaborative BIM with all project and asset information, documentation and data being electronic as a minimum by 2016.

**Figure 1:** BIM Maturity Diagram



Importantly, the diagram acknowledges the impact that both data and process management have on BIM. A brief summary of each BIM level is listed below.

### Level 0

Level 0 BIM, as defined by this diagram, is the use of 2D CAD files for production information: a process that the majority of design practices has used for many years. The important point to be derived from the diagram (from the horizontal line separating data and process management which does not commence until level 1 BIM) is that common standards and processes in relation to the use of CAD failed to gain traction as the use of CAD developed.

### Level 1

Level 1 BIM acknowledges the increased use of both 2D and 3D information on projects. For architects, 3D software has increasingly been used as a conceptual design tool during the early project stages (typically RIBA stages C & D) and for visualisation of the finished project for presentation to the client. This form of BIM where

only one party utilises the benefits of the model is frequently referred to as 'Lonely BIM' – the BIM model is not used collaboratively between team members. The use of 3D tools beyond this stage has commonly been limited to large infrastructure projects. On such projects, the use of 3D models by trade contractors is also becoming more commonplace. The larger M&E contractors have embraced BIM to assist their design processes using supplementary checks undertaken with proprietary software to ensure that co-ordination issues are resolved during the design phase rather than on site. This is a significant step forward towards the aim of minimising waste and inefficiencies in current design and construction processes.

In terms of processes, level 1 embraces the need for management processes to sit alongside design processes. The work of CPIC and Avanti commenced concurrent with early level 1 BIM projects and set out new processes for managing information which are now embedded in *BS 1192:2007, Collaborative production of architectural, engineering and construction information – Code of practice*. Further work is currently being undertaken to develop and improve these standards in order to standardise certain aspects of the design process and create consistency in the way the industry works from project to project.

## Level 2

Level 2 BIM requires the production of 3D information models by all key members of the Integrated Team. However, these models need not co-exist in a single model. By understanding and utilising BS 1192:2007, designers can ensure that each designer's model progresses in a logical manner before it is used by another designer or a designing subcontractor.

It is not anticipated that the legal, contractual or insurance issues currently utilised by the industry will change for level 2 but it is fair to say that level 2 BIM does expose some of the deficiencies of current contractual documentation. For example, the role of the Model Manager needs to be considered and the roles and responsibilities of the various designers and contracting parties need to be clearer, particularly in relation to Performance Specified Work. The outputs required at each stage will also require greater definition, and in turn this will require the Lead Designer to clarify the inputs that they require at each stage of the design in order to co-ordinate the design as it progresses.

Level 2 BIM requires the current fragmentation of the design team from designing subcontractors to be replaced by Integrated Teams working collaboratively under new forms of procurement using 'plug and play' working methods.

## Level 3

The greatest BIM challenges arise when moving from level 2 BIM to level 3 BIM and the perceived 'holy grail' of the single project model. With level 2 resolving the methodology of all the designers working in 3D, the challenge with the single model will not be the collaborative use of the information: it will be harnessing the information in the model so that it is of greater use. For the information to have more value, software Interoperability will be required and the BIM Maturity Diagram acknowledges this (see box under iBIM). With level 3 BIM it will be possible for:

- early 'rough and ready' design analysis on environmental performance minimising iterative design time;
- cost models to be quickly derived from the model using new costing interfaces;
- health and safety aspects associated with the construction and maintenance of the building to be analysed parallel with the design; and
- asset management, KPI, and other feedback information to be aligned with intelligent briefing, enabling information in the model to develop during design and to be used as part of a Soft Landings approach, and to inform and improve future projects.

Design processes will need to be developed to their next level of refinement so that there are clear and established methods setting out how many parties can work in the same model environment at the same time. These processes aligned with better scope of service and responsibility documents will allay the fears of some legal or insurance observers, but it has to be acknowledged that the implications and legal issues associated with copyright, responsibilities and scope of services need to be identified and considered further if level 3 BIM is to be successful.

Some observers seem to believe that the single project model will be a 'free for all' but this will not be the case and the software already exists to give read and/or write authorities to each user, and with more sophisticated design management programming techniques it will be possible to prevent designers working on the same area at the same time: for example, ensuring that the M&E engineer is not adding the grilles to the ceiling plan at the same time that the architect is amending it.

### Challenges Ahead

Whilst the move from 2D CAD to BIM is demonstrated in the BIM Maturity diagram, what the diagram does not convey is the fundamental changes that will be required to the construction industry as BIM is rolled out. The shift from level 0 BIM to level 3 BIM has been compared to the shift from drafting on tracing paper to CAD. However, the reality is that the shift is more significant because the latter shift did not change the outputs that were issued to industry: indeed, the issue of 2D drawings on paper, or alternatively as PDF files, is still commonplace. In stark contrast, the shift from level 0 to level 3 BIM requires:

- collaborative and integrated working methods and teamwork with closer ties between all designers on a project, including designing trade contractors;
- knowledge of databases and how these can be integrated with the building model to produce a data-rich model, incorporating specification, cost, time and FM information;
- new procurement routes and forms of contracts aligned to the new working methods;
- interoperability of software to enable concurrent design activities, for example, allowing environmental modelling to occur concurrent with orientation and façade studies;
- standardisation of the frequently used definitions and a rationalisation of the new terms being developed in relation to BIM; and
- use of BIM data to analyse time (4D), cost (5D) and FM (6D) aspects of a project.

It is logical given the move toward Integrated BIM (iBIM), new procurement models which consider ways of harnessing the skills of all of the parties involved in the design, construction and management of a building will need to be developed alongside the new collaborative and multi-party contractual documents.

Various BIM documents make reference to new roles, such as the Model Manager, or new process documents such as the BIM Execution Plan, and there are many acronyms used in connection with the subject. The supplementary guidance in this document sets out a view on how these roles might work, as well as summarising the various definitions and acronyms in use.

One of the greater industry challenges will relate to training, particularly in relation to teamwork and collaborative approaches to design and construction, and the next generation of collaborative designers and contractors will need to embrace new working methods and leave behind some old assumptions and role stereotypes.

The Government's pilot BIM projects that are currently underway are utilising contractor-led procurement, but one of the challenges of the industry will be to examine current successful private sector Integrated Team models and to set out how different models might be appropriate, depending on the client's aspirations and risk profile in a similar manner to the way that procurement is presently assessed against time, cost and quality.

To move smoothly from one BIM maturity level to another there is a need to adopt industry-wide (rather than professional or practice-exclusive) processes, and consider ways to build and manage successful project teams and contribute to the debate on the best forms of procurement that will truly encourage collaboration and innovation, and drive waste and inefficiency out of the construction industry.

The RIBA hopes that this document provides a useful insight into the subject and that it also acts as a catalyst to encourage thinking on the subject and as a springboard towards the next generation of the RIBA Plan of Work.

# BIM Overlay to the RIBA Outline Plan of Work

RIBA Work Stage		Description of Key Tasks	Core BIM Activities
Preparation	A Appraisal	<p>Identification of client’s needs and objectives, business case, <b>sustainability, life cycle and Facilities Management aspirations</b> and possible constraints on development.</p> <p>Preparation of feasibility studies and assessment of options to enable the client to decide whether to proceed.</p>	<ul style="list-style-type: none"> <li>Advise client on purpose of BIM including benefits and implications. Agree level and extent of BIM including 4D (time), 5D (cost) and 6D (FM) following software assessment. Advise client on Integrated Team scope of service in totality and for each designer including requirements for specialists and appointment of a BIM Model Manager.</li> <li>Define long-term responsibilities, including ownership of model.</li> <li>Define BIM Inputs and Outputs and scope of post-occupancy evaluation (Soft Landings).</li> <li>Identify scope of and commission BIM surveys and investigation reports.</li> <li>Data drop 1.</li> </ul>
	B Design Brief	<p>Development of initial statement of requirements into the Design Brief by or on behalf of the client, confirming key requirements and constraints. Identification of procurement method, <b>project sustainability and BIM</b> procedures, <b>building design lifetime and project</b> organisational structure and range of consultants and others to be engaged for the project, <b>including definition of responsibilities.</b></p>	
Design	C Concept	<p>Implementation of Design Brief and preparation of additional data. <b>Agreement of Project Quality Plan including BIM and Change Control protocols.</b></p> <p>Preparation of Concept Design including outline proposals for structural and <b>environmental strategies and services systems, site landscape and ecology</b>, outline specifications, preliminary cost <b>and energy plans.</b></p> <p>Review of procurement route.</p>	<ul style="list-style-type: none"> <li>BIM pre-start meeting.</li> <li>Initial model sharing with Design Team for strategic analysis and options appraisal.</li> <li>BIM data used for environmental performance and area analysis.</li> <li>Identify key model elements (e.g. prefabricated component) and create concept level parametric objects for all major elements.</li> <li>Enable design team access to BIM data.</li> <li>Agree extent of performance specified work.</li> <li>Data drop 2.</li> </ul>
	D Design Development	<p>Development of concept design <b>using project BIM data</b> to include structural and <b>environmental strategies and services systems, site landscape and ecology</b>, updated outline specifications and cost <b>and energy plans.</b></p> <p>Completion of Project Brief.</p> <p><i>Application for detailed planning permission.</i></p>	<ul style="list-style-type: none"> <li>Data sharing and integration for design co-ordination and detailed analysis including data links between models.</li> <li>Integration/development of generic/bespoke design components.</li> <li>BIM data used for environmental performance and area analysis.</li> <li>Data sharing for design co-ordination, technical analysis and addition of specification data.</li> </ul>
	E Technical Design	<p>Preparation of technical design(s) and specifications, sufficient to co-ordinate components and elements of the project, <b>BIM data</b> and <i>information for statutory standards, sustainability assessment and construction safety.</i></p>	<ul style="list-style-type: none"> <li>Export data for Planning Application.</li> <li>4D and/or 5D assessment.</li> <li>Data drop 3.</li> </ul>
Pre-Construction	F Production Information	<p>F1 Preparation of production information <b>Development of BIM data in sufficient detail to conclude co-ordination of design team inputs, to enable performance specified work to commence and</b> enable a tender or tenders to be obtained.</p> <p><i>Application for statutory approvals.</i></p> <p>F2 Preparation of further information for construction required under the building contract: <b>Development of BIM data to integrate performance specified design work into model.</b> Review of <b>BIM</b> information provided by contractors and specialists, <b>including integration into project BIM data.</b></p>	<ul style="list-style-type: none"> <li>Export data for Building Control Analysis.</li> <li>Data sharing for conclusion of design co-ordination and detailed analysis with subcontractors.</li> <li>Detailed modelling, integration and analysis.</li> <li>Create production level parametric objects for all major elements (where appropriate and information exists this may be based on tier 2 supplier’s information).</li> <li>Embed specification to model.</li> <li>Final review and sign off of model.</li> <li>Enable access to BIM model to contractor(s).</li> <li>Integration of subcontractor performance specified work model information into BIM model data.</li> <li>Review construction sequencing (4D) with contractor.</li> <li>Data drop 4.</li> </ul>
	G Tender Documentation	<p>Preparation and/or collation of tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project.</p>	
	H Tender Action	<p>Identification and evaluation of potential contractors and/or specialists for the project.</p> <p>Obtaining and appraising tenders; submission of recommendations to the client.</p>	

The activities in italics may be moved to suit project requirements.

RIBA Work Stage		Description of Key Tasks	Core BIM Activities
Construction	J	<p><b>Mobilisation</b></p> <p>Letting the building contract, appointing the contractor.</p> <p>Issuing of information to the contractor.</p> <p>Arranging site handover to the contractor.</p>	<ul style="list-style-type: none"> <li>• Agree timing and scope of 'Soft Landings'.</li> <li>• Co-ordinate and release of 'End of Construction' BIM record model data.</li> <li>• Use of 4D/5D BIM data for contract administration purposes.</li> <li>• Data drop 5.</li> </ul>
	K	<p><b>Construction to Practical Completion</b></p> <p>Administration of the building contract to Practical Completion.</p> <p>Provision to the contractor of further information as and when reasonably required. <b>Clarification and resolution of design queries as they arise.</b></p> <p>Review of information provided by contractors and specialists.</p> <p><b>Assist with preparation for commissioning, training, handover, future monitoring and maintenance.</b></p>	
Use	L	<p><b>Post Practical Completion</b></p> <p>L1 Administration of the building contract after Practical Completion and making final inspections.</p> <p>L2 Assisting building user during initial occupation period.</p>	<ul style="list-style-type: none"> <li>• FM BIM model data issued as asset changes are made.</li> <li>• Study of parametric object information contained within BIM model data.</li> <li>• Data drop 6.</li> </ul>
R&D	M	<p><b>Model Maintenance &amp; Development</b></p> <p>L3 Review of project performance in use <b>and comparison with BIM data.</b></p> <p><b>Analysis of BIM data for use on future projects, following feedback and research.</b></p>	

## Current Plan of Work

The current version of the RIBA Outline Plan of Work is available to download at:

<http://www.ribabookshops.com/plan-of-work>

## Green Overlay

To allow the BIM Overlay to sit alongside the Green Overlay to the RIBA Outline Plan of Work, the suggested amendments to the 'description of key tasks' included in the Green Overlay have also been included in the BIM Overlay. The Green Overlay text is highlighted in **green**, and to avoid confusion the BIM Overlay text is shown in **purple**.

In reality, many of the changes in the Green Overlay are pertinent to the BIM Overlay. For example, subjects such as Soft Landings are relevant from both a sustainability and BIM perspective. The Green Overlay of the Outline Plan of Work, that also contains additional valuable guidance on green issues, can be downloaded from:

<http://www.ribabookshops.com/plan-of-work>

*The activities in italics may be moved to suit project requirements.*

## Supplementary Guidance

### Changes to 'Description of Key Tasks': an Overview

Whilst there has not been a significant number of changes to the 'Description of key tasks' (and the majority of changes are self-explanatory or relate to certain BIM activities and definitions set out in this document), a number of changes require an overview or explanation, as follows:

#### Preparation (Stage A: Appraisal and Stage B: Design Brief)

The Description of key tasks has been amended to include client's FM and life cycle requirements within the brief along with a statement on the desired project outcomes. The Stage B tasks reflect the importance of defining the roles and responsibilities of each member of the Integrated Team early in the project.

#### Design (Stage C: Concept, Stage D: Design Development and Stage E: Technical Design)

The important task of establishing a Project Quality Plan which sets out the BIM Execution Plan and change control procedures is now included.

#### Pre-construction (Stage F: Production Information)

Stage F1 has been amended to reflect the need for the co-ordination work in the BIM model to be completed in sufficient detail at tender stage, enabling specialist contractors to commence performance-specified work. New forms of procurement may enable these designers to be appointed earlier as part of the Integrated Team and this will be considered further in the Plan of Work review.

Stage F2 is shown as the period when designing subcontractors undertake their design work and when this work is integrated into the co-ordinated design. The checking of drawings (typically via the categorisation of drawings: A, B or C) has been moved from Stage K as it is associated with the integration process and in an Integrated Team may take place prior to work commencing on site.

#### Construction (Stage K: Construction to Practical Completion)

Stage K has been amended to reflect the fact that the design was substantially complete at stage F2 and that the clarification and resolution of design issues as they arise on site is the only design activity occurring at this stage.

#### Use (Stage L: Post Practical Completion)

Some of the post-occupancy processes have been moved into Stage K as part of the Soft Landings initiative and it is likely that further post-occupancy services will be identified and developed in the future.

A new Stage M has been added, entitled 'Model Maintenance & Development'. This stage reflects the fact that in a BIM environment the starting point of the next project is the end of the last, particularly where the next project is for the same client. It also acknowledges that a greater level of research and development is required by practices in order to be continually improving at industry, professional and practice level.

### Core BIM Activities

The core BIM activities listed adjacent to each stage of the Outline Plan of Work are indicative in their nature. A number of initiatives are underway by government and BSI in order to bring further clarity to the content of 'information or Data Drops' and to clarify roles and responsibilities on a BIM project, and this document should be read in conjunction with these documents when they are published.

To assist further in the understanding of certain terms, the next section of this guidance reviews the terminology commonly used in the BIM process.

Please note that the core BIM activities have been based on a level 2 maturity BIM project. Whilst many of these activities will be applicable to a level 3 maturity project, it is clear that as new software becomes available and aligns itself with new design processes, the activities listed will require further development and refinement.

### Terms and Definitions

To gain a proper understanding of BIM it is important to be aware of the commonly used terms and definitions. The descriptions below set out some of the key BIM terms and how certain current tools or processes that are currently

## Supplementary Guidance (Continued)

used might be redefined for use in the BIM environment. Due to the infancy of the subject, a number of terms are used to discuss the same item. Where possible, variants have been listed to assist with the interpretation of these terms with the more prevalent and appropriate terms identified.

### Common BIM Terms

#### Lonely BIM

Lonely BIM is used in reference to early level 2 projects where only one party uses BIM technologies.

#### Collaborative BIM

Collaborative BIM is the converse of Lonely BIM and can be construed as being when all designing parties are utilising BIM. There is, however, no agreement as to whether level 2 BIM is truly 'collaborative', although if all parties are producing 3D models and working collaboratively then there is no reason for this not to be the case. 'Social BIM' and 'Integrated BIM' (iBIM), are also used to describe the same activity.

#### Social BIM

See Collaborative BIM.

#### Integrated BIM (iBIM)

See Collaborative BIM.

#### 4D (time) BIM

By adding 'time' to the information in the project model (by linking attributes in the model to a construction programme), it is possible for the contractor to review the construction of the building. For large complex projects or those on challenging sites, this can be a particularly useful tool as it can be used to examine critical path activities, logistical issues such as deliveries and craneage, and to generally discuss and refine how the building is to be constructed. As Interoperability improves, it will become more straightforward to consider different buildability options, allowing a number of construction options to be prepared and rapidly translated into a 3D representation of the construction process.

If the model is updated to reflect activity on site, it can also be a useful tool for reviewing progress against the programme and highlighting where progress is behind. The model and project schedule can also be used to examine ways to make up time. Conversely, the contract administrator will be able to use the programme for assessing delays and any applications for an extension of time.

#### 5D (cost) BIM

The ability of BIM models to contain cost information and quantity schedules will allow the costs for a given design to be produced faster. This will allow option appraisals at the concept stage to be more accurately assessed, and with designers having cost information 'at their fingertips', the iterative design process will be accelerated, making it more likely that the designs are aligned with a client's budget.

How cost consultants provide and integrate cost information into the model will need consideration along with common methods of outputting area and quantity information in a manner which can be converted into a robust cost plan that also takes due cognisance of project-specific cost drivers and market trends.

#### 6D (FM) BIM

For the Facilities Management (FM) teams of many clients, 6D is the most innovative and useful aspect of BIM. By harnessing the data in the model, the client will have a powerful tool that enables them to manage their assets. The principal means of achieving this is by adding data to the model as the project develops.

For example, if the doors are specified descriptively then the performance data will be contained in the model at the outset; however, this will be replaced by the prescriptive data once the actual door to be used has been agreed. The door data tag will also contain information on the ironmongery and the maintenance information in relation to the door and each element contained in it. To expand further on this scenario, if a trolley damages a door in a back of house corridor, the FM team will be able to use the model to ascertain the supplier of the damaged kick plate, to order a new one, and to use the supplier's operating data to repair the overhead door closer.

## Supplementary Guidance (Continued)

This is, of course, a practical example. At a more strategic level, the model might be used to hold energy performance data and be used as part of a data-driven post-occupancy evaluation process or Soft Landings process.

As standardised asset coding systems are aligned to FM management systems, project asset registers will become the norm. The first steps toward this are occurring with the development of COBie data which will be one of the principal tools in enabling 6D data on projects.

### Clash Detection

Many BIM software packages are compatible with clash detection software. This software can be utilised to discuss clashes that exist in the building, particularly between structure and engineering elements. Such software should be used as part of a QA (Quality Assured) process in relation to co-ordination and not as part of the design process per se.

### COBie

COBie stands for 'Construction Operations Building Information Exchange'. The primary stated objective of COBie information is to simplify the work required to capture, record and disseminate project information for handing over to the client. Designers add spaces and equipment locations to the COBie subsets in the project model, and contractors and their appropriate subcontractors, including the commissioning manager or company, provide manufacturers' information, installed product data, warranty and maintenance information. COBie will not necessarily change current deliverables but it will change the format of these deliverables. COBie is a standardised format but its contents are configurable for project-specific purposes.

### Common Data Environment (CDE)

A single location (typically a server or extranet) for storing information that can then be collated, managed and disseminated amongst multi-disciplinary teams working collaboratively.

### Construction Project Information Committee (CPIC)

CPIC is an organisation sponsored by construction industry institutions. See [www.cpic.org.uk](http://www.cpic.org.uk). Their mission statement is 'the Construction Project Information Committee, responsible for providing best practice guidance on the content, form and preparation of construction production information, and making sure this best practice is disseminated throughout the UK construction industry'.

### Co-ordinated Design

The Co-ordinated Design is the set of architectural, mechanical & electrical and civil & structural engineering drawings, specifications and other information that are all substantially aligned with each other. At present this would occur during RIBA stages E and F.

### CPix Protocol

Construction Project Information eXchange (CPix) is a set of guidance notes, forms and checklists to assist teams in the preparation of their CPix protocols.

### Data Drops

Rather than issuing stage reports, Data Drops (or Information Drops) will take place. At present there is no clear definition regarding the specific information that is issued as part of a stage report. It is the Government's intention that this changes and work is underway to clarify the information required at each Data Drop, with these being aligned to the project stages. To ascertain the right level of information, the Government is considering the questions that need to be answered at each stage which will enable the construction industry to consider what the Building Model must contain and its level of refinement at a given stage. The American Institute of Architects (AIA) document E202 gives some guidance regarding the appropriate level of detail, although this guidance might be developed in line with UK procurement routes.

### Integrated Design

The Integrated Design is the completed set of design information on a project, including the work of all designing subcontractors (Performance Specified Work) that is substantially aligned. The design can be said to have been

## Supplementary Guidance (Continued)

integrated when all of the subcontractor design is completed. Subcontractor design can be utilised on all forms of procurement and is typically referred to as CDP (Contractor Design Portion) or PSW (Performance Specified Work). Whilst the work of subcontractors is being integrated into the design, there are possibilities that the co-ordinated design may need to be amended. This needs to be carefully dealt with, particularly when several designing subcontractors are working concurrently.

### Integrated Project Delivery

Integrated Project Delivery, or co-ordinated Project Information, are terms used by initiatives aiming to produce a higher degree of Integrated Design on projects using Integrated Team models.

### Interoperability

One of the major benefits of BIM, particularly at level 3 maturity, are the possibilities created by different designers being able to import other designers 3D BIM files into their own analysis software, or for others to use the information for costing, programming or other purposes. At present, if the output of one software package is not compatible with another, these opportunities are limited. As software packages become more interoperable using Industry Foundation Classes (IFC), this may be the case less often.

However, whilst level 0 BIM information was typically 2D and 'data dead', the level 2 and level 3 3D information is 'data rich' and can be used for many other purposes than just referencing. Examples would include the:

- use of the architect's information for the environmental modelling in the early schemes;
- early analysis of the design model to determine structural stability;
- real time integration of the model data into the cost planning model;
- development of the structural frame model by the fabricator to create connection designs; and
- use of the curtain walling contractor's model to develop CAD/CAM files, allowing rapid shift from design to fabrication.

It can be seen that when software packages become interoperable that many more possibilities to enhance the design process are possible.

### Industry Foundation Classes (IFC)

Industry Foundation Classes (IFC) utilise open software specifications that are not controlled by a single software vendor. By using shared and open specifications, greater Interoperability between software platforms is achievable as software development is shared and not restricted to a single vendor.

### Parametric Design

When components of a building are designed parametrically, they are assigned parameters which have limits or boundaries. When these boundaries change (elements within a repeated component in the model, for example), the parameters assigned to adjacent elements allows them to be automatically adjusted and changed. For example, if a classroom design incorporates the furniture layout and the classroom size changes, the parametric design would automatically adjust the seating layout based on the parameters assigned to the seats.

### Single Model

Reference to a Single Model refers to the scenario where all of the project BIM information files are held in a Single Model, probably held on a single server, and accessed by all designers or other members of the Integrated Team, utilising new processes and software tools to enhance the design and construction process.

### Soft Landings

The Soft Landings initiative by BSRIA (see [www.softlandings.org.uk](http://www.softlandings.org.uk)) has been developed to assist clients during the first months of their occupation and operation of their buildings and beyond, to help fine-tune the systems and ensure the occupiers understand how to control and best use their buildings. To facilitate the process, designers and constructors will remain involved with buildings beyond practical completion until the building systems are working as envisaged. The Soft Landings initiative also places emphasis on better briefing which is required to deliver the desired outcomes.

## Supplementary Guidance (Continued)

### Design Leadership

Establishing exemplar methods of structuring model information will be critical to the success of the next generation of projects; however, Design Leadership will be of greater importance. In order to work collaboratively, new approaches to teamwork will be required but these can only be successful if they are aligned with redefined roles and responsibilities that precisely clarify who is doing what and when. Without this clarity, it will not be possible for each party to determine fees, but more importantly it is not possible to establish collaborative working methods if there are ambiguities in relation to roles or responsibilities. This section will consider how current roles and responsibilities might evolve in a BIM environment.

### Roles and Responsibilities

The roles of each designer and the management roles of the Lead Designer, lead consultant, contract administrator and project manager are defined in the Services Schedule of the RIBA Standard Form of Agreement for the Appointment of an Architect 2010. These roles have not changed significantly in recent years. Whilst the 2012 review of the RIBA Plan of Work will consider how these roles might evolve, the review will also need to consider how new roles such as the Model Manager and established roles such as the design manager (frequently employed by contractors) are defined in future RIBA Appointment Agreements.

Scope of services and the roles of each consultant need to be clearly defined in a BIM environment. Several standard forms exist to assist parties in the definition of these. For example, the latest version of the BSRIA documentation suggests ways in which the mechanical and electrical designers progress their designs and the information required by the specialist M&E subcontractors in order to successfully develop these aspects of the design process. Also, the Specific Scope Schedule of the CIC Services Handbook can also be used to allocate the primary design responsibility for each component in a building. However, whilst these documents are useful, they are blank templates which need to be completed. This leaves the potential for a wide ranging set of interpretations. Of greater concern is the fact that there is no definitive guidance on how these documents might be used from the Lead Designer's perspective.

The next generation of RIBA Appointment documents will need to consider if these documents are appended or incorporated and how new schedules might assist in the management of the design process. Any new schedules will also need to consider more accurately the information that is delivered at each stage.

### Integrated (or Collaborative) Team

The traditional design team consists of a number of professionals used to working together in a particular way. The development of contractor design, or performance specified work, created the need to integrate this detailed design work into the Co-ordinated Design. However, the complex nature of the contractual relationships between the various parties and conflicting goals in relation to design of the completed building created dysfunctional teams in many instances. The need for Collaborative Teams arose from this shift, not from the arrival of BIM. It was concluded that if parties could not work successfully in a contractual way, that other means would have to be devised to ensure the success of a project. Collaborative working was therefore a means of forming a team aware of the client's goals and one that would work together in achieving them in a constructive and creative manner, resolving differences of opinion as they arise.

As design work becomes more concurrent and seamless by using BIM, collaborative working will be essential and training will be required in collaborative working methods as well as bringing clarity to roles and responsibilities.

### Lead Designer

Whilst new ways of working aligned with new design processes will greatly assist the aim of producing more efficiently designed buildings, there will still need to be a Lead Designer responsible for co-ordinating the designs of the various designers, checking their information as it is produced and generally ensuring that design work is co-ordinated as it is produced. How this important role is reinvigorated and redefined for BIM projects will be an important task towards enabling effective design decision making in a Collaborative Team. It will also be important to clarify how this design leadership role differs from the design management role: the Information Manager.

## Supplementary Guidance (Continued)

### Information Manager

The term Information or Model Manager is frequently used in relation to BIM. There is lack of clarity regarding this role, but if the Lead Designer role remains, it is clear that the Information Manager's role cannot conflict with the design responsibilities of this role. A sensible interpretation is that the Information Manager becomes responsible for managing the inputs of each designer into the project model and for ensuring that all of the designers are utilising compatible software using a software sharing matrix. The role might also entail ensuring that the right party is working on the right aspect of the design at a given time by managing the Design Programme that dictates when each party enters their Shared Information into the project model.

### Performance Specified Work

Those responsible for determining roles and responsibilities will also have to ensure that the appropriate level of performance specified work is selected as the concept design emerges and is allocated to the appropriate designing contractor, and for ensuring that the Integrated Team is expanded accordingly.

### The Client

With recessionary pressures reducing in-house resources, it is likely that client teams will evolve to include more advisors who can add specific value to the design, construction and in-use process in order to ensure the success of BIM on each project. A team might comprise:

#### *Client Representative*

A representative from the client body, who has the delegated authority to make key project decisions, to appoint Technical Advisors and a Delivery Manager and to act on the advice of these advisors, on behalf of the client.

#### *Technical Advisors*

Advisors appointed by the Client Representative to provide them with specific advice on key technical items such as the development of an intelligent brief that considers Soft Landings and other in-use aspects, the preparation of the Project Programme or specific aspects of the project that may require strategic advice. RIBA Client Advisors may perform this role.

#### *Delivery Manager*

The Delivery Manager will be accountable to the Client Representative and their role will include ensuring that the supply chain is progressing in line with the Project Programme, evaluating supplier assessment forms submitted at tender stage and preparing and revising the Delivery Plan as information is received from the supply chain.

## Design Management

Good design management and any associated processes aligned with excellent design leadership as outlined in the last section are the essential ingredients of a successful BIM project.

### The Client's Delivery Plan

To ensure that projects start on the right path, it is likely that the Client Representative and their advisors will prepare a Delivery Plan at the commencement of the project. This would be the primary plan for setting out how project information is to be prepared, who does so, and what protocols and procedures to use. The document would be owned by the client but may be updated and managed using change control as the supply chain procedures and protocols are expanded and agreed. It might contain details of:

- roles, responsibilities and authorities with relevant organograms;
- standard methods and procedures;
- the Employers Information Requirements (EIR); and
- the Project Programme (PP).

### Project Programme

Programme setting out the client's key milestone dates and overall programme objectives.

## Supplementary Guidance (Continued)

### Employers Information Requirements (EIR)

Document setting out the information to be delivered by the supply chain as part of the project. The document would set out the Data Drops required by the client.

### The Lead Designer's Delivery Plan

#### Project Quality Plan (PQP)

The Integrated Team will need to develop their own more detailed plans and procedures as part of any tendering/ appointment process and some of the documents noted below will become contractual and/or may replace elements of the client's Delivery Plan. The designer's documents may remain standalone, managed and edited by the Lead Designer, or they may be incorporated in a broader supply chain document.

At present the RIBA's Architect's Job Book sets out the requirements of the Project Quality Plan, which some refer to as the Project Execution Plan (PEP) and this will continue to be a core design management document. The need for a Project Quality Plan becomes greater on a project utilising BIM where communication, information flow and collaboration become of much greater importance. A Project Quality Plan should currently include:

- definition of the client's brief;
- definition of the Scope of Services;
- record of any critical processes/procedures;
- definition of approval/verification activities;
- record of changes and updates on progress;
- record of any other special actions; and
- methods of measuring achievement.

There are a number of points to consider in relation to the current contents of the plan and a number of additional items that may need to be added to the plan. Some of these additional items may become standalone documents and others may prefer these to be imbedded into a single project protocol and procedures document.

#### Client's Brief

Better briefing will be an essential part of future projects as the brief will need to be more holistic in setting out not just the functional requirements of the building but also:

- the overall project goals, including the desired outcomes. For example, on public sector projects these may be reduced reoffending rates for prison projects or reduced recovery times on healthcare projects; and
- operation data and post-occupancy requirements which will be essential in determining if the building has performed in accordance with the environmental and energy targets and to assist the Soft Landings process.

#### Scope of Services

The Outline Plan of Work is a 'broad brush' document that has successfully conveyed how to organise the design processes on projects. It is acknowledged that in a BIM environment greater clarity is required regarding who is undertaking what and when. As noted above, greater clarity on the specific duties of each designer will be required and it will also be important to define what each designer needs to produce to achieve consistent Data Drops from project to project.

There may also need to be new components to the Project Quality Plan, including:

#### *Delivery Index*

Commonly referred to as a Deliverables List, this document would set out all of the design information to be prepared on a project, when it will be delivered, who will author it and the format it will be provided in. The document would also be used to assist with the monitoring of design progress.

## Supplementary Guidance (Continued)

### *BIM Execution Plan*

This document, prepared by the Lead Designer, would set out all of the key processes in relation to design activities in the BIM environment, including:

- model origin and orientation;
- file naming convention and drawing sheet templates;
- annotation, dimensions, abbreviations and symbols;
- approval of Information and authorisation process;
- software versions and exchange formats;
- project collaboration and EDMS (Electronic Document Management Systems).

### *Construction Programme*

The Construction Programme prepared by the contractor would identify the date that work starts on site, any lead-in periods and the date for practical completion, and be aligned with the Project Programme. The programme information can be linked to the project information model as described above in 4D BIM.

### *Design Programme*

The Design Programme should be prepared by the Lead Designer with the assistance of the other designers in the Integrated Team, including any subcontractors with design responsibilities. Ways of linking the programme with the Deliverables Index might assist in the monitoring of design activity. The Design Programme would be aligned with the Project Programme.

There are a number of important terms derived from BS 1192 that are important to understand as it becomes clear that information has to be categorised to enable each party to understand its status and its suitability for use by others in the team. The key terms are:

#### *Work in Progress (WIP) Information*

Information being prepared by each designer that has not been sufficiently finalised, or checked, to allow it to be shared with other designers.

#### *Shared Information*

Information that has been prepared by the various designers and approved by the Lead Designer for issuing into the shared area of the Common Data Environment (CDE).

#### *Published Information*

Information authorised by the Lead Designer and/or the Delivery Manager for a specific function such as tendering, costing, contractor design, manufacturing or construction.

## Procurement

It is anticipated that future forms of Integrated Team working and the associated design processes will result in more efficient designs and that these designs will be completed to a higher degree of co-ordination and integration. The scope of this document does not include analysing potential new procurement routes in detail, but as the RIBA's review of the Plan of Work develops, further information on the most effective routes will be published and made available for review.

## Supplementary Guidance (Continued)

### Commonly Used Acronyms:

<b>AIM</b>	Architectural information model
<b>SIM</b>	Structural information model
<b>FIM</b>	Facilities information model
<b>BSIM</b>	Building services information model
<b>BrIM</b>	Bridge information model
<b>CPIC</b>	Construction Project Information Committee
<b>iBIM</b>	Integrated BIM
<b>IFC</b>	Industry Foundation Classes
<b>IFD</b>	International Framework Dictionary
<b>IDM</b>	Information Delivery Manual
<b>ISO</b>	International Standards Organisation
<b>BLM</b>	Building Lifecycle Management
<b>PLM</b>	Product Lifecycle Management

### Further Reading

The following documents provide further background reading on BIM:

- BS 1192:2007
- Avanti BIM Guide
- The Business Value of BIM – McGraw-Hill Construction, 2009
- Low Carbon Construction – BIS, March 2010
- Strategy for Sustainable Construction – BIS, Sept 2009
- BIM in Australia – Report on BIM/IPD Forums Held in October/November 2010
- State of Ohio – Building Information Modeling Protocol
- BIM – Project Execution Planning Guide – CIC Research Group at The Pennsylvania State University (USA)
- AEC (UK) BIM Standard for Revit
- AIA – Integrated Project Delivery: A Guide
- AIA – Document E202 – 2008 (Building Information Modeling Protocol Exhibit)
- The American Institute of Architects (AIA) and AIA California Council. Integrated Project Delivery: A Guide. Version 1, 2007. ([www.aia.org/ipdg](http://www.aia.org/ipdg))
- AIA California Council. Integrated Project Delivery – A Working Definition. June 2007
- Charles Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston. BIM Handbook: A Guide to Building Information Modeling

## Supplementary Guidance (Continued)

### Credits

The BIM working group for the production of this document included:

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- Phil Holden – Pascall + Watson Architects
- Richard Fairhead – bblur architecture (3DReid, when group was formed)
- John Orrell – DLA Design
- Bruce Calton – Scott Brownrigg
- Paul Hewes – Nightingale Associates
- Adrian Dobson, RIBA Practice Department
- Stuart Chalmers, RIBA Practice Department

### Feedback

As stated in the introduction, the BIM Overlay to the RIBA Outline Plan of Work is part of the preparatory work prior to the fundamental review of the RIBA Plan of Work that will take place in 2012-2013. If you have any specific views on the contents of this document, or on the current RIBA Plan of Work or the Green Overlay, your comments would be appreciated and should be sent to [practice@riba.org](mailto:practice@riba.org).



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