KEY TERMS YOU SHOULD KNOW

BIM PROTOCOLS

Not just for buildings: BIM is also effective in large-scale projects like Airports, bridges and tunnels.

A BIM protocol is a legal agreement that keeps everything on a BIM project moving smoothly. It sets up the role of the Information Manager and any incorporated standards for all team members to follow. It then obliges suppliers to provide BIM data at specified levels of detail and provides necessary protections for producers of information by way of BIM-specific licenses.

“It encourages the creation of an infrastructure whereby different parties appointed by an employer are encouraged to share digital information,” said Simon Rawlinson, head of strategic research and insight at Arcadis UK and member of the Construction Industry Council and the BIM Task Group.

“It gives licenses for people to use drawings and documents,” Rawlinson, who was involved in the creation of the original UK BIM strategy between 2009 and 2011, continued. “We wanted to manage some of the risks and liabilities [associated with] the data that sits underneath those models and make sure people had the rights to use the data.”

Rawlinson makes a good point: a BIM protocol helps establish a liability chain so that if there is an error in the data, it would be possible to trace back to the person who made the original error.

It’s important to note that this protocol has different requirements depending on jurisdiction. For example, according to US-based Bentley Systems the BIM protocol serves the same purpose in the US as in the UK, but isn’t considered a legal agreement.

In summary, you’ll want to set up a BIM protocol before you get started to keep your project on the rails.

EMPLOYERS INFORMATION REQUIREMENTS - EIR

This pre-tender document covers the appointment of designers and contractors.

With large-scale building projects like the Panzhihua Three-line Construction Museum, an EIR helps stipulate information requirements and data drop timing. (Image courtesy of the Sichuan Provincial Architectural Design and Research Institute.)

“Here you have a situation where an employer is trying to be really clear about the kind of information that they need from their suppliers,” Rawlinson explained. “It’s not just about specific data requirements; it’s also about how that data might be formatted, when it might be produced and what it’s going to be used for.”

“Effectively, a client is stepping up to the plate and being much more explicit about the information that they need to support all of their business processes,” Rawlinson continued.

This means that the EIR outlines stages of the project’s information delivery and any standards and processes that a supplier needs to adopt as part of this delivery. It usually encompasses three different areas:

Technical requirements can include things such as software platforms, the data exchange format, levels of detail and any necessary training.

Managerial requirements can include things such as stakeholder roles and responsibilities, security, collaboration processes and delivery strategies.

Commercial requirements can include things such as data drop timing, deliverables to be used during Design, Construction and post Site hand over and competence assessment

KEY TERMS YOU SHOULD KNOW

MASTER DELIVERY PLANS (MIDP)

Think of this as the list of tasks for a BIM project. It will tell you exactly who is doing what and when.

This plan is a required part of the EIR. It enters the picture after contracts have been awarded to suppliers and lists who will be delivering what part of the project information, when it will be delivered, and which protocols will be used for each stage.

“The Master Information Delivery Plan summarizes every document, be they models, analysis reports or written reports,” explained Rawlinson. “You’re effectively unpacking all of the information you need to deliver in order for a project to be completed.”

This includes deliverables like:

- Models, drawings or renderings
- Specifications
- Equipment
- Schedules

BIM EXECUTION PLAN- BEP

There are two kinds of BEPs: pre-contract and post-contract. Both types explain details about the implementation of various project information aspects and are extensions of the EIR.

BEPS have a role to play in a client’s selection process. They are taking into account the effectiveness of the contractors’ BIM capabilities and whether their supply chain can work and deliver effectively together.

“Rather than asking people to create another bid document, you’re saying ‘As part of your bid proposal, you’re going to demonstrate entirely in a high level of detail how you’re going to run this project from an information management and BIM management perspective,’” Rawlinson says.

Pre-contract BEPs generally outline tentative plans for development, including capabilities, competence and experience of potential suppliers and collaboration goals.

The pre-contract BEP is ‘this is what we’re going to do and how we’re going to do it’ in outline to demonstrate capability.

Post-contract BEPs are much more detailed and discuss the specific strategy for project deliverables, including roles and responsibilities, documentation like the MIDP, standard methods and procedures like notation, tolerances and IT systems.

The post-contract BEP is the detailed plan and process so that the team knows exactly how they are going to deliver and benchmark and monitor their performance.

KEY TERMS YOU SHOULD KNOW

COMMON DATA ENVIRONMENT - CDE

The CDE is where all of the BIM magic happens.

As its name suggests, the CDE is a digital collaborative area (whether it's on the cloud or an on-premise server) where all project information is stored. All team members have access and can make changes where necessary—this reduces the risk of duplication and miscommunication. The CDE is a single source of truth.

The CDE is kept and policed by the Information Manager (indicated in the BIM protocol). Information managers, usually appointed by the client, are responsible for ensuring that protocols are followed, and that data is properly secured.

DATA CLASSIFICATION

Data classification is likely a familiar topic, but BIM takes it to another level. In many cases, individual companies and organizations will have proprietary ways to classify data, which undermines the entire purpose of BIM.

There are several systems for data classification out there, including those such as MasterFormat, OmniClass Construction Classification System and UNICLASS.

Whether your team chooses one of these or something different altogether, it's imperative that a project team establishes a consistent approach to data classification and that this approach is shared across all involved stakeholders. This doesn't just apply to the design team: it includes manufacturing, construction and even international operators.

"Data classifications add structure to data, making it so that the data can be organized, queried and reported on in a systematic manner," said Andy Smith, solutions executive for buildings at Bentley Systems. "Data classification provides a structure that allows appropriate data to be connected."

KEY TERMS YOU SHOULD KNOW

PROJECT INFORMATION MODEL - PIM

Models like the PIM and AIM set up the overall plans and specifications for a building project.

The PIM model, frequently referred to as the digital engineering model, sets up the project as a whole and the requirements for this model are laid out using the EIR.

“It is a virtualization of the design for visualization and to perform engineering analysis to detail and optimize building systems,” said Smith. “All design disciplines contribute to the model, which is used from design conceptualization through contract document production."

The PIM’s first purpose is as a design intent model that demonstrates how various parties plan to implement their sections of the project. It will include both graphical and non-graphical information.

“One or more models are created by each discipline (civil, structural, architectural, MEP),” said Smith. “Models start with conceptual ideas, massing models and space reservation models that begin to form the idea of the building.”

After this stage, it becomes a virtual construction model that contains and federates every object that needs to be manufactured, installed or constructed.

The PIM is generally used during the design and construction planning phases, after which it gets developed into the AIM.

ASSET INFORMATION MODEL - AIM

This information model is generated from the PIM and is used to manage, maintain and operate the entire project as it happens. It’s important to note, however, that the AIM can be developed without a PIM if there is an existing asset information system.

AIMs are generally used during the operations stage of a BIM project.

The AIM usually includes:

- Data defining the original design intent from the PIM or another pre-existing system.
- 3D models, including documents and metadata.
- Details about ownership, rights and restrictions, surveys and other information.
- The most frequent advice given in the planning process is to start with the end in mind.

KEY TERMS YOU SHOULD KNOW

LEVEL OF DEVELOPMENT - LoD

LoD is another BIM term that can vary depending on regional preferences, but definitions are relatively similar.

LoD is frequently a reference to the Level of Development Specification published by the BIMForum. The LoD specification can be applied to all phases of a project as a framework for the graphical representation and associated data that is to be provided at each phase of completion.

In contrast, the AEC (UK) BIM Technology Protocol splits the Level of Definition into level of detail and level of information.

1. Level of detail refers to graphical content. 2. Level of information refers to non-graphical content.

BIM has a role to play in every stage of a building project, from concept to construction to maintenance. Each stage requires different levels of information.

The LoD and LoI help to better communicate the expectations of BIM content and clarify the Level of Definition at any point in the design and construction process. and is intended to control the amount of information being loaded into a project model at any given stage. This will help keep the model from becoming bloated with too much unnecessary data too soon.

There's no standard for timing data drops or LoD because it's very dependent on the type of project. However, in general it should match up with key decision points in the BIM process. For example, the briefing stage does not require information about Energy requirements and maintenance, but the design and operation stages may.

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KEY TERMS YOU SHOULD KNOW

DIMENSIONS

Because BIM handles so many aspects of a building project, it needs a few extra dimensions. While it generally goes up to 6D, there are as many dimensions as there are ways people can think of to use data.

In terms of BIM:

4D refers to **time**—or specifically, to the scheduling involved in the BIM process. With these schedules, project members and building owners can analyze a project to see how it will function over time. This includes simulations conducted within the BIM model to test a structure's longevity.

5D brings **Costing & finances** into the picture. This is the aspect of BIM that analyzes the pricing of components and services to construct an accurate budget and Bill of Materials.

6D refers to **Facilities Management & Maintanance**. When it comes to a building project, this can cover a wide range of things including estates strategies, asset management, master-planning and even renovations.

INDUSTRY FOUNDATION CLASS - IFC

IFC is an international standard developed and maintained by **buildingSMART.** It's designed to describe building and construction industry data and to facilitate information exchange between various collaborators and types of software.

IFC is an official standard, referred to as ISO 16739. The standard is continually in development, so make sure you have the most recent version!

As of 2013, IFC covers:

Exchange formats required for a building's lifecycle phases.

Exchange formats required by any disciplines involved in these lifecycle phases.

However, it does not cover exchange formats outside of construction, facility maintenance, building engineering or behavioural aspects.

Many types of BIM software such as Revit, AECOsim Building Designer and ARCHICAD provide support for import and export of data to and from IFC.

KEY TERMS YOU SHOULD KNOW

CONSTRUCTION INTO OPERATION OF BUILDING INFORMATION EXCHANGE - COBIE

COBie is a UK Government structured, non-proprietary data format that focuses on the asset data of a BIM project rather than geometric data. Officially, it's a subset of the IFC that structures data for handover to an employer or operator in order to facilitate decision making, facilities management and asset management.

This spreadsheet-style database usually includes:

- Equipment lists
- Product data sheets
- Warranties
- Spare parts lists
- Preventative maintenance schedules

COBie is meant to make management of BIM data easy for anyone, regardless of IT capability. However, it is possible that not every BIM software will support this format—so be sure to check your software before deciding on COBie or any information exchange format as your delivery tool.

DIGITAL TWIN

A digital twin is essentially a digital representation of a real-world entity – A Building, an engine, a bridge, a rail network, even an entire city - aimed at making the curation of that entity safer, more efficient, and more resilient to change. Digital twins are undergoing a period of rapid innovation as new means of integrating sensors and controllers develop and allow for live integration directly into Digital Twin models.

A digital twin has the potential to transform the design, management and maintenance of assets across the built environment or the built environment itself.

A digital twin enables organisations to make informed decisions about the design, management and performance of their assets, helping them to be more sustainable and resilient to change and disaster management.

It is our aim to bring the industry together towards the meaningful development of digital twins in the built environment and integrate you with all the possibilities both current and with a view into the future.

NIKO@BIM-CONSULTING.NET

KEY TERMS YOU SHOULD KNOW

ISO 19650

The publication of ISO 9650-1 and ISO 19650-2 represents a significant step forward in standardizing information management requirements on projects using BIM (building information modelling) within an internationally agreed set of concepts and principles. These principles and requirements are clearly based on the UK's standards BS 1192:2007+A2:2016 and PAS 1192-2:2013.

ISO 19650 Part 1 document sets out the recommended concepts and principles for business processes across the built environment sector in support of the management and production of information during the life cycle of built assets (referred to as "information management") when using building information modelling (BIM). These processes can deliver beneficial business outcomes to asset owners/operators, clients, their supply chains and those involved in project funding including increase of opportunity, reduction of risk and reduction of cost through the production and use of asset and project information models. This document is primarily intended for use by: — those involved in the procurement, design, construction and/or commissioning of built assets; and — those involved in delivering asset management activities, including operations and maintenance. This document is applicable to built assets and construction projects of all sizes and all levels of complexity. However, the concepts and principles included in this document should be applied in a way that is proportionate and appropriate to the scale and complexity of the asset or project. This is particularly the case where small and medium sized enterprises are mainly appointed for asset management or project delivery. It is also important that procurement and mobilization of asset or project appointed parties should be integrated as far as possible with existing processes for technical procurement and mobilization. The concepts and principles contained in this document are aimed at all those involved in the asset life cycle. This includes, but is not limited to, the asset owner/operator,

ISO 19650 Part 2 is designed to enable an appointing party to establish their requirements for information during the delivery phase of assets and to provide the right commercial and collaborative environment within which (multiple) appointed parties can produce information in an effective and efficient manner. This document is applicable to built assets and construction projects of all sizes and all levels of complexity. However, the requirements included in this document should be applied in a way that is proportionate and appropriate to the scale and complexity of the asset or project. Appointed parties should be integrated as far as possible with documented processes for technical procurement and mobilization. This document makes wide use of the phrase "shall consider", This phrase is used to introduce a list of items that the person in question needs to think about carefully in connection with the primary requirement. The amount of thought involved, the time taken to complete it and the need for supporting evidence will depend on the complexity of the project, the experience of the person(s) involved and the requirements of any national policy on introducing building information modelling. On a relatively small or straightforward project, it can be possible to complete, or dismiss as not relevant, some of these "shall consider" items very quickly. This document defines the information management process, containing the activities through which delivery teams can collaboratively produce information and minimize wasteful activities. This document is primarily intended for use by those involved in the management or production of information during the delivery phase of assets; — those involved in the definition and procurement of construction projects; — those involved in the specification of appointments and facilitation of collaborative working; — those involved in the design, construction, operation, maintenance and decommissioning of assets; and— those responsible for the realization of value for their organization from their asset base. This document contains the requirements associated with the management of information during the delivery phase of built assets, which will need to be reviewed and revised on a regular basis until the best practice is established.

KEY TERMS YOU SHOULD KNOW

PAS 1192

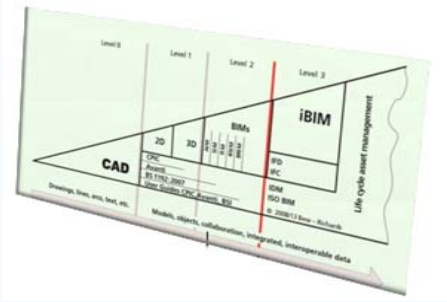
PAS 1192 is a Publicly Available Specification sponsored by the Construction Industry Council. Its main role is to serve as a framework supporting BIM objectives in the UK.

To do this, PAS 1192 specifies the requirements for reaching BIM standards and sets the foundation for collaboration on BIM-enabled projects, including consistent information standards and data exchange processes.

While it is/was a UK standard and it being a PAS, it's actually the first stage in developing a international standard and as of 2020 has gone on to becoming the basis of an internationally accepted ISO standard. ISO 19650 Part 1 & 2

PAS 1192 has multiple parts that apply to various stages of overall BIM adoption. The standard can be downloaded for free but as ISO 19650 Part 1 & 2 based on Pass 1192 have been Internationally accepted and released as of 2020, there is almost no requirement to follow PAS in place of ISO 19650, where unique regional requirements could not be agreed to and accommodated into ISO 19650 part 1 & 2, bespoke Regional allowances have been allowed for in ISO Regional addendums.

The Bew-Richards BIM Maturity Model, referenced colloquially as the "BIM wedge," illustrates the maturity levels of BIM adoption. The four levels, conveniently numbered 0-3, each come with increasing requirements.



Level 0 describes a 2D CAD workflow that doesn't incorporate collaboration.

Level 1 depicts a combination of 2D and 3D CAD with occasional file-based collaboration within disciplines.

Level 2 incorporates interdisciplinary file-based collaboration and incorporates other aspects of BIM, including the CDE and Data exchange systems (eg COBie). In this stage, a project might still be hosted in numerous silos and would need to be federated and co-ordinated manually for proper collaboration integration.

Level 3 doesn't have exact specifications as of this writing, but it will describe a fully integrated BIM workflow. This will include aspects such as real-time data for one central model hosted on the cloud. IPD Ideal.