BUILDING INFORMATION MODELLING (BIM) GUIDANCE

NHSScotland

Abstract

A guide to help NHS Boards understand, get started on and implement Building Information Modelling (BIM) on their projects.

About this guide and how to use it

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Over the last few years Health Facilities Scotland (HFS) has led on the introduction of Building Information Modelling (BIM) across NHSScotland through a number of pieces of work and the introduction of an NHSScotland BIM Development Group.

This guide has been developed to help NHS Boards get started on and undertake a BIM project and understand what it is you need to do. It is recommended that the document is read in a linear order, working your way through the sections to gain a good grounding and overall understanding. The implementation of BIM is now a key priority for HFS and NHSScotland with the introduction of the Scottish BIM policy.

Roles

Depending upon your role within NHSScotland, certain parts may be more applicable than others. To help you the document categorises a number of different personas and highlights the areas that you should read (these have been colour coded for ease of identification).

Senior leadership team & senior stakeholders	Project Managers & project delivery team	Property services, Estate and facilities management	I.T and support services

Checklists

At the end of the guide is a handy checklist highlighting key tasks you should consider together with useful links.

Senior leadership team & senior stakeholders	Project Managers & project delivery team	Property services, Estate and facilities management	I.T and support services

Section 1

What is BIM and why should I care?

This section explores the key drivers for BIM adoption within NHSScotland and looks at the HFS BIM journey. It considers what BIM means for NHSScotland boards as well as the wider estate.

Section 2

BIM Grading and Return on Investment

This section explores the difference between BIM level 1 and BIM level 2 and the concept of BIM maturity. It gives a high level overview of the supporting standards and enabling tools you will need to follow and the benefits of using them. Finally it introduces you to the SFT BIM Portal which enables you to understand the when BIM should be adopted and to what level (BIM Grading tool), why you should adopt (Return on Investment tool) and how you should implement BIM (BIM navigator tool).

Section 3

Information Management and Common Data Environment (CDE) strategy

This section considers your information strategy. It explains how you share information through an online central resource to enable collaborative working and the role used to manage information known as an Information Manager. Finally it consider how you produce and deliver information, using a common approach and understanding of Roles and responsibilities (Who is doing what?) naming conventions (What are things called?) and Classification systems (Where can I find things?)

Section 4

Determine your strategy for Built Asset Security

This section outlines things you need to consider to determine your approach to a holistic security and risk management based approach to identifying security issues. It introduces you to the role of Built Asset Security Manager and your obligations as a client to appoint one.

Section 5

Determine your Soft landings approach

This section explores the concept of Soft landings. It considers the key tasks you should follow throughout key project stages to ensure that you bridge the gap between the design, construction and operation of the asset, so that it performs as intended.

Section 6

Creating the Client Information Model (CIM)

This section outlines what you need to consider to define your project information strategy. It explores the Client Information Model or CIM which defines the strategy for how data will support the operational and capital expenditure strategy and informs decision making through the project lifecycle. It considers your strategy for developing your 'why' questions which help support the development of a range of NHS Boards information requirements.

Section 7

Creating the Employers Information Requirements (EIR)

This sections considers how your information requirements are articulated to the supply chain via the Employers Information Requirements, a key document that forms part of the appointment and tender documents on a Project to enable suppliers to produce their initial BIM Execution Plan (BEP).

Section 8

The supply chain response and the BIM Execution Plan (BEP)

This section explores the supply chains response in the form of a BIM Execution Plan. This is used to answer the questions set out in your EIR and explains how the supply chain intend to produce the information and meet your expectations. It outlines the key tasks you need to carry out upon receipt of the BEP.

Section 9

Considering enabling technology

This section explains the fundamental role technology plays in facilitating the effective, accurate exchange and reuse of data and information. As a key enabler for BIM and collaborative working, this section considers the key aspects of your I.T. strategy that need to be considered as part of your wider BIM strategy.

Terms you may hear

Archive component of the common data environment (CDE) [from PAS 1192-2]

As-built as-constructed, component of the common data environment (CDE) [from PAS 1192-2]

Asset information data or information relating to the specification, design, construction or acquisition, operation and maintenance, and disposal or decommissioning of an item, thing or entity that has potential or actual value to an organization [from BS 1192-5]

AIM (Asset information model) maintained information model used to manage, maintain and operate the asset [from PAS 1192-2

AIM (Asset information model) data and information that relate to assets to a level required to support an organization's asset management system [from PAS 1192-3]

AIR (Asset information requirements) data and information requirements of the organization in relation to the asset(s) for which it is responsible [from PAS 1192-3]

BEP (Building information modelling execution plan) plan prepared by the suppliers to explain how the information modelling aspects of a project will be carried out [from PAS 1192-2]

BIM (Building information modelling) process of designing, constructing or operating a building or infrastructure asset using electronic object-oriented information [from PAS 1192-2]

Built asset building, multiple buildings (e.g. a site or campus) or built infrastructure (e.g. roads, railways, pipelines, dams, docks, etc.) that is the subject of a construction project or where the asset information is held in a digital format [from BS 1192-5]

Built asset security manager individual reporting directly to, or employed by, the employer or asset owner and undertaking the role of security management [from BS 1192-5]

Capital/delivery phase major works where information is managed using PAS 1192-2:2013 and an asset is designed, procured and delivered [from PAS 1192-3]

Classification systematic arrangement of headings and sub-headings for aspects of construction work including the nature of assets, construction elements, systems and products [from PAS 1192-2]

CIM (Client Information Model) defines the strategy for how data and information will support the operational and capital expenditure strategy and inform decision making throughout the project life-cycle

COBie (Construction Operation Building information exchange) structured asset information for the commissioning, operation and maintenance of an asset often in a neutral spreadsheet format that will be used to supply data to the organization to populate decision-making tools and asset management systems [from PAS 1192-3; adapted from PAS 1192-2:2013 to refer to an asset rather than a project]

CDE (Common data environment) single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multi-disciplinary teams in a managed process [from PAS 1192-2]

Data information stored but not yet interpreted or analysed [from PAS 1192-2]

Design intent model initial version of the project information model (PIM) developed by the design suppliers [from PAS 1192-2]

dPoW (Digital Plan of Work) generic schedule of phases, roles, responsibilities, assets and attributes, made available in a computable form [from BS 1192-4]

EDMS (Electronic document management system) system for storing, retrieving, sharing and otherwise managing electronic documents [from PAS 1192-2]

Employer individual or organization named in an appointment or building contract as the employer [from PAS 1192-2]

EIR (Employer's information requirements) tender document setting out the information to be delivered, and the standards and processes to be adopted by the supplier as part of the project delivery process [from PAS 1192-2]

End user person receiving asset/facility related services [from BS 8536-1]

Gate (stage) division of a standardised process map for the acquisition of a facility, at some of which the requirements can be delivered [from PAS 1192-2]

Graphical data data conveyed using shape and arrangement in space [from PAS 1192-2]

GSL (Government Soft Landings) Cabinet Office interpretation of 'Soft Landings'. The interpretation by the Government Property Unit is designed to cater for the procurement needs of central government departments. See 'Soft Landings'

Handover the stage of a capital/delivery project where the asset is made available for use or occupation [from PAS 1192-3]act of passing responsibility for, and control over, an asset/facility to the owner or operator following testing and commissioning [from BS 8536-1]

Information representation of data in a formal manner suitable for communication, interpretation or processing by human beings or computer applications [from PAS 1192-2] data arranged and processed into meaningful patterns, put into context [from PAS 1192-3]

Information exchange structured collection of information at one of a number of pre-defined stages of a project [from BS 8536-1]

Information manager organizational representative appointed by the employer or asset owner, who is responsible for establishing governance and assuring data and information flow to and from the common data environment (CDE) during the design, construction, operation and maintenance, and disposal or decommissioning of a built asset [from PAS 1192-5]

IMP (Information management process) process to manage information related to the operational phase of an asset [from PAS 1192-3]

Information model model comprising: documentation, non-graphical information and graphical information [from PAS 1192-2]

Level of definition collective term used for and including "level of model detail" and the "level of information detail" [from PAS 1192-2]

MIDP (Master information delivery plan) primary plan for when project information is to be prepared, by whom and using what protocols and procedures, incorporating all relevant task information delivery plans [from PAS 1192-2]

Model collection of containers organized to represent the physical parts of objects, for example a building or a mechanical device [from BS 1192]

Non-graphical data data conveyed using alphanumeric characters [from PAS 1192-2]

Organizational information requirements (OIR) data and information required to achieve the organization's objectives [from PAS 1192-3]

PLQ (Plain language questions) questions asked of the supply chain by the employer to inform decision-making at key stages of an asset life cycle or project [from PAS 1192-3]

Sensitive built asset built asset, as a whole or in part, that may be of interest to a threat agent for hostile, malicious, fraudulent and/or criminal behaviours or activities [from PAS 1192-5]

Soft Landings (SL) process for the graduated handover of a new or refurbished asset/facility, where a defined period of aftercare by the design and construction team is an owner's requirement that is planned and developed from the outset of the project [from BS 8536-1]

Soft Landings Champion (SLC) Role that leads, promotes and champions the SL process on behalf of the client.

Stage division of a standardized process map for the acquisition of a facility, at some of which the requirements can be delivered [from BS 8536-1]

SMP (Standard method and procedure) set of standard methods and procedures covering the way information is named, expressed and referenced [from PAS 1192-2]

POE (Post occupancy evaluation) process of evaluating an asset/facility after it has been completed and is in use to understand its actual performance against that required and to capture lessons learned [from BS 8536-1]

PIP (Project implementation plan) statement relating to the suppliers' IT and human resources capability to deliver the EIR [from PAS 1192-2]

PIM (Project information model) information model developed during the design and construction phase of a project [from PAS 1192-2]

TIDP (Task information delivery plan) federated lists of information deliverables by each task, including format, date and responsibilities [from PAS 1192-2]

Trigger planned or unplanned event that changes an asset or its status [from PAS 1192-3]

Trigger-related event response to a trigger and the reflection of the altered state of the asset in the AIM [from PAS 1192-3]

Virtual construction model subsequent version of the project information model developed from the design intent model by the construction supplier and their supply chain [from PAS 1192-2]

Contents

1   What is BIM and why should I care?

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1.1   Introduction

Scotland's Digital strategy 'realising Scotland's full potential in a Digital World' sets out how the Scottish Government intends to place digital at the heart of everything it does from reforming public services to delivering economic growth. Digital technology is playing an increasingly important role in addressing the challenges faced by the National Health Service (NHS). The Scottish Government and NHSScotland have had a national eHealth Strategy in place for many years to support key health policy aims such as improving the quality of care, enabling shared decision-making with patients and integrating health and social care.

As Scotland moves towards a digital built environment, Building Information Modelling (BIM) is seen as a key part for the future of the Scottish construction industry and the NHSScotland estate, one of the largest asset owners in the UK with more than 2,000 assets under operation and management with much of the work relating to backlog and maintenance repairs.

While there is a colossal amount of data available to many within NHSScotland estates as well as broader management teams within Boards, much of the data is living in silos. It is not centralised or digitised making searching for data very much a manual time consuming process.

In recent times, consequently trigger events leading to tragic situations such as the Grenfell Fire and the falling masonry at Oxgangs Primary school in Edinburgh have highlighted the need for centralised, indexed and searchable data.

NHSScotland have significant annual revenue costs directly associated with property asset ownership. A high proportion of this is property maintenance - regular day to day maintenance including revenue expenditure on backlog but excluding major capital expenditure on upgrading/refurbishment and backlog works. This regular renewal and maintenance regime helps assets continue to add value to the NHSScotland estate portfolio.

Q&A

What is BIM?

BIM uses digital technology to improve the sharing and analysis of data and information within a construction project. Through improving data, information management and collaboration within projects, this supports the industry to deliver greater efficiencies through the design, construction and operational stages of a project. More efficient assets that are cheaper to run and operate means we can run more assets.

The construction industry delivers the functional performance and estates to allow NHSScotland to function. BIM aims to unlock savings across the whole project life-cycle, including capital expenditure as well as savings across the operational stages, arguably where NHSScotland spends the majority of its property budget and therefore arguably the area with the most potential.
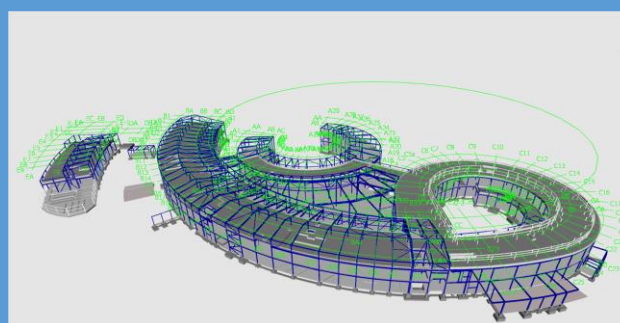
Image: New Orkney Hospital model

The question then exists. How do NHS Boards getting better at procuring and managing information that will help them make better informed decisions?

1.2 Health Facilities Scotland (HFS) BIM Journey

The implementation of BIM is now a key priority for HFS and NHSScotland with the introduction of the Scottish BIM policy note in April 2017 setting out how BIM should be adopted within public sector procurement. Over the last few years HFS has led on the introduction of BIM across NHSScotland through a number of pieces of work and the introduction of an NHSScotland BIM Development Group. The group, in conjunction with HFS and consultancy support, have developed a BIM strategy, supporting documents, templates and a training programme for NHS Boards to ensure the creation of a digitised information management process which all Boards and people working on NHSScotland programmes should follow to maintain consistency and facilitate collaborative working, which will in turn reduce waste and non-conformances. (Figure 1-1)
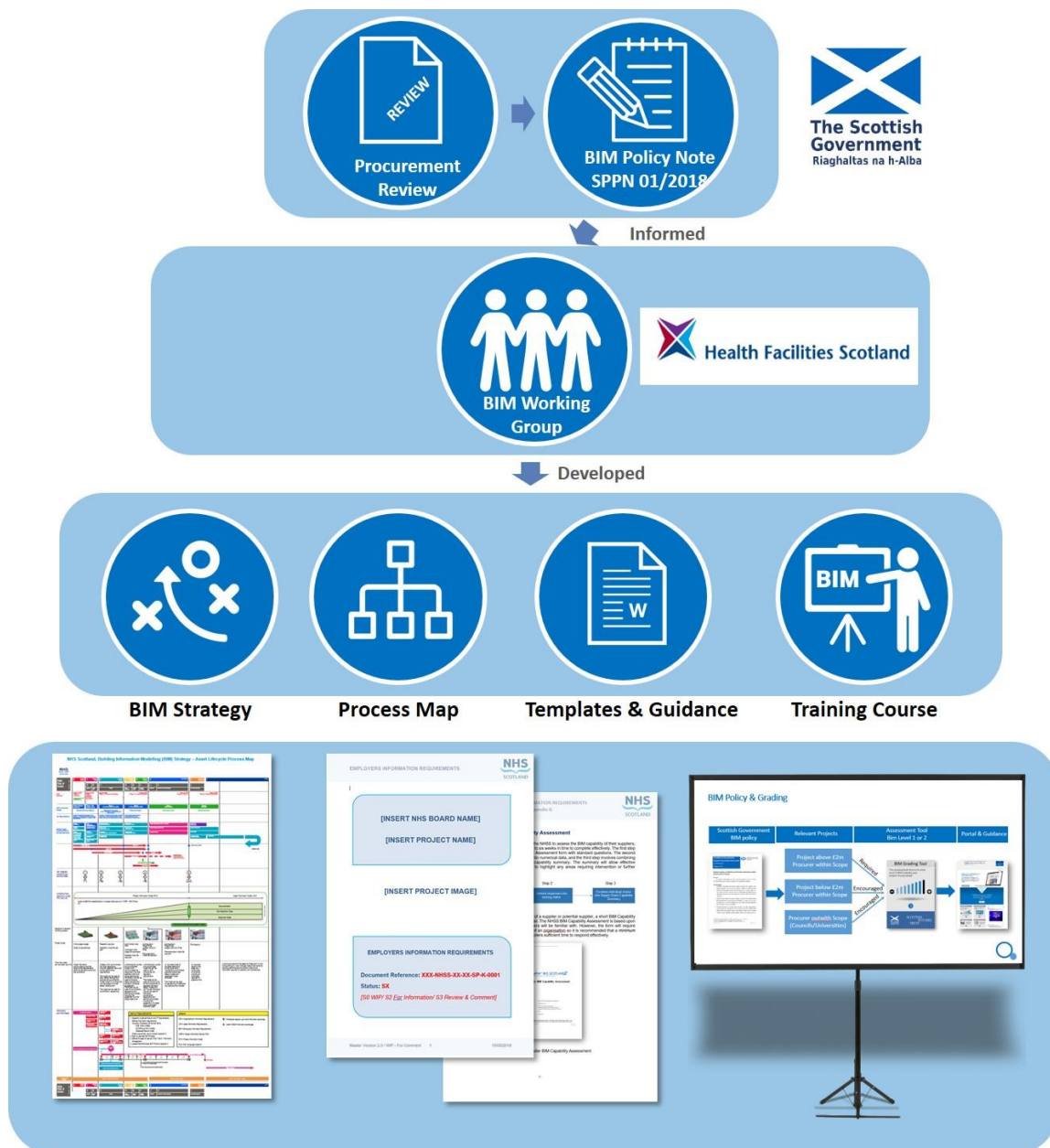
Figure 1-1 HFS BIM Journey

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1.2.1 Key Drivers

Table 1-1 outlines the key drivers for the adoption of BIM in NHSScotland.

Table 1-1 Key drivers for the adoption of BIM in NHSScotland

No.	Driver
1	Ensure data is bought only once and that needs are clearly and consistently defined in the contract documents as early as possible
2	Availability of validated useful information to improve the efficiency of NHS Boards and its delivery organisations such as PSCPs (or Main Contractors)
3	Better user engagement – clear, easier understanding through data rich environment
4	Elimination of waste from the design, construction and commissioning process
5	Use 3D models to inform and optimise the clinical planning process
6	Improve clinical excellence through well informed decision making
7	Encourage collaborative working including early engagement of FM and Operational Estates
8	Visualisation & Lifecycle solution testing & preconstruction stage
9	Accurate and complete data improving quality of bids, reducing risk allowances in target prices and lump sum bids
10	3D model input into the assessment of the impact changes at all stages in a project lifecycle
11	Input of a populated asset data set into Computer Assisted Facilities Management (CAFM) systems – saving time and avoid duplication

1.2.2 What is BIM? A definition.

BIM is a 'collaborative process that adds value throughout the lifecycle of a built asset. 3D information models and intelligent, structured data is created, collated, shared and exchanged throughout the life of a project. (PAS 1192:2)

The *Home Nations BIM working Group (HNWG) defines BIM as:*

'a collaborative way of working underpinned by digital technologies. Information Management processes sees the creation, collation and exchange of shared electronic information models and structured data. These processes allow for more efficient ways of procuring, creating and maintaining physical built assets throughout their entire lifecycle. These information models form a digital representation of the physical and functional characteristics of projects and or estates.'

In other words, BIM is a combination of collaborative processes and digital technology, supported by people. Standards, frameworks and protocols help us define our information requirements. Technology acts as the enabler for collaborative working, while defined roles and responsibilities allow the right information to be delivered to the right people at the right time. (Refer to the Video '10 BIM Acronyms Explained' for more information)

1.2.3   Parametric Components

Information models are made up of a series of objects known as BIM objects. Think of these as intelligent, parametric digital containers of information representing the real-life construction products. Objects carry a mixture of graphical and non-graphical information to communicate what the object is, what it looks like, how it performs and how it should be cared for and maintained.

To understand this concept consider for a moment a cup of coffee. (Figure 1-2) The cup is a container of information, not only about its contents (Coffee, milk, 1 shot) but also information about the cups material (Paper, plastic and cardboard), when it was manufactured, Warnings and safety information (Hot contents) its size and volume (24 oz) and accreditations (Fairtrade, Rainforest Alliance)

Figure 1-2 Properties of a cup of Coffee

Information associated with the BIM object is progressively added during the project lifecycle, as they develop from generic description to manufacturer prescriptive description for example 'an automatic high velocity air hand dryer that perform to BS EN 60555-1' to a 'Dyson Airblade VAB08'. (Figure 1-3)
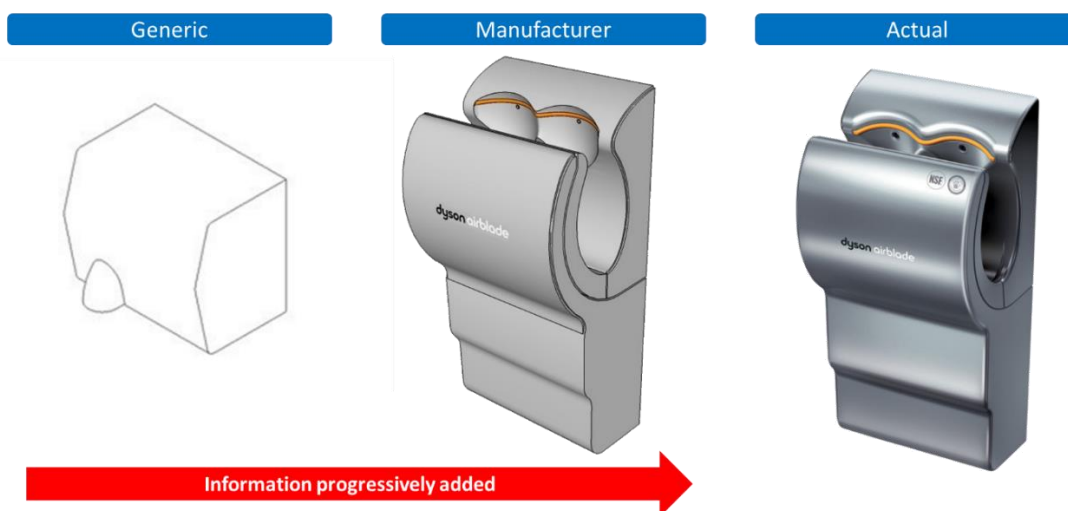
Figure 1-3 Object progression

Geometrical shape information such as the hand dyers physical dimensions may be modelled graphically, while specification information such as 'motortype', 'noise level' and 'operating temperature' will typically be described via text, such as in the objects attributes or within a project specification. Not all information needs to 'live' within the object, but it is important that information is coordinated. For example PDF product data sheets or operating manual about the hand dryer may be located on a manufacturers website or on a project server and are accessed via a hyperlink within the object. Regardless of where the information is stored it is important to ensure information is not duplicated to reduce the potential of errors and waste. (Figure 1-4)
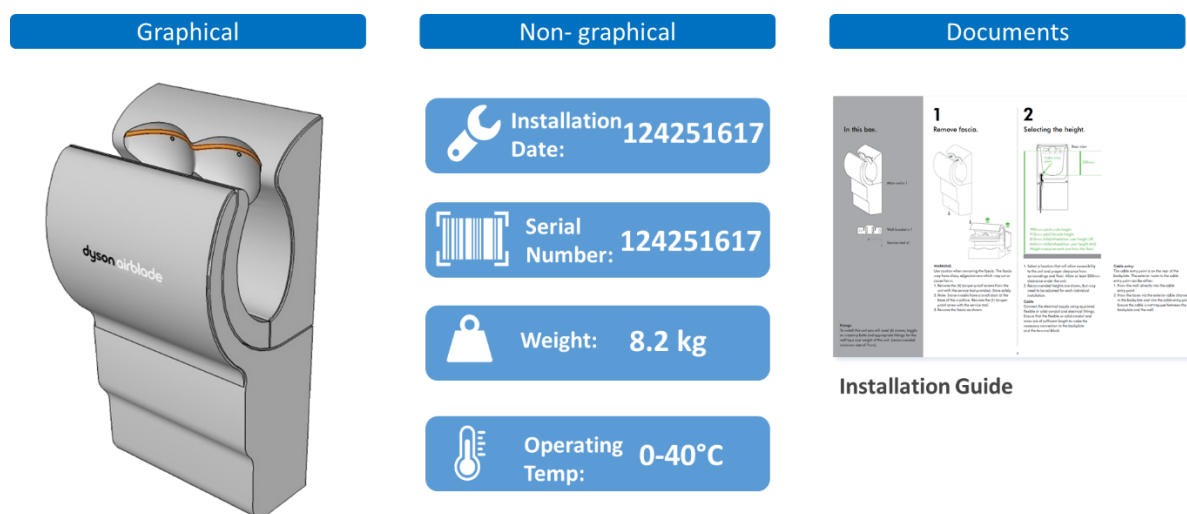
Figure 1-4 Graphical, non-graphical and documents

Using libraries of parametric components or objects, means that information can be brought together quickly to allow rapid modelling and various scenarios to be tested as part of collaborative modelling workshops. For example ensuring that safe access and operational efficiency can be demonstrated throughout the life cycle of a proposed asset.

Parametric components also facilitate the adoption of mass customisation, whereby the benefits of a standard library of BIM objects can be allied with the benefits of context-specific bespoke design. Because the parametric assemblies can be enriched with rule sets governing visibility distance,

maximum distance between components, interaction with other assemblies etc. the base context model can be automatically populated. (Refer to the Video 'Understanding BIM Objects' for more information)

1.2.4 Better validated information

BIM offers the opportunity to better validate information. Information within the model is cut from a central source, resulting in increased efficiency and less errors. Take for example a common piece of data such as a door reference (figure 1-5). This information can be seen within the floor plan, section, object attributes and exported out into door schedules and Construction Operation Building information exchange (COBie) data.
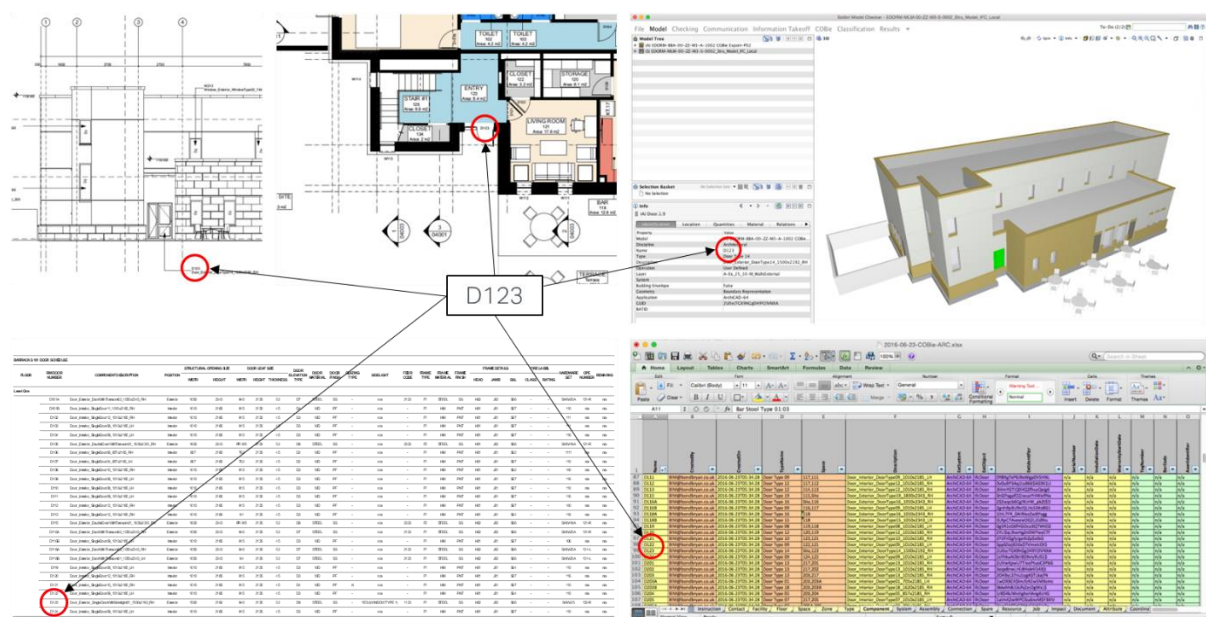
Figure 1-5 Door reference

The result is that the NHS board have a complete organised data set to assist with asset management. Handover of usable, digital, indexed design and construction documentation makes searching and retrieving information, quicker and more efficient. This is of particular importance when trying to locate information following a trigger event for example. (Figure 1-6)
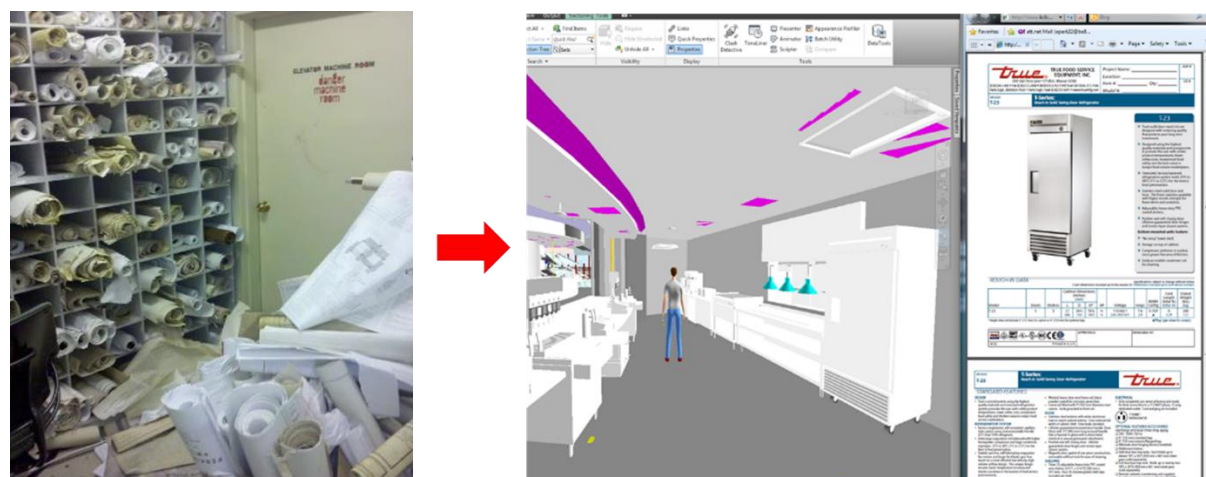
Figure 1-6 Documents to data

1.2.5   Better upfront decision making

The use of 3D models help to inform and optimise the clinical planning process. Clear, easy to understand models through a data rich environment lead to better user engagement. Figure 1-7 shows how the model can be used for Visualisation & Lifecycle solution testing, simulation and prototyping. Furthermore, digitization allows us to test many scenarios, make well informed decisions about the future, optimize processes, improve asset performance, usability and learn from real-time data.
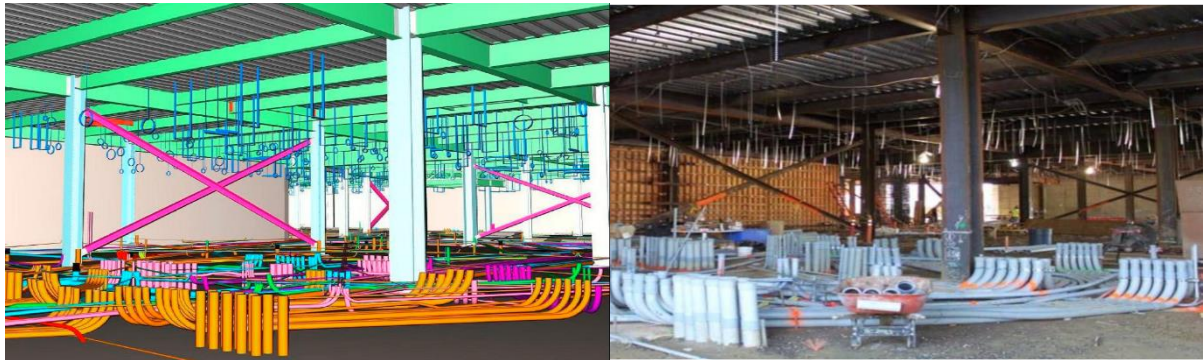
Figure 1-7 Digital prototype example

1.3   The Information Delivery Cycle

During the BIM process, information progresses through a series of stages. To understand how this works, a key concept known as the Information Delivery Cycle provides a framework for the production of information across the project lifecycle, illustrated in figure 1.8. The blue line is our race track of information. It is a 360 degree process which starts off with the end in mind, meaning you should consider what it is you require at the end of the project.
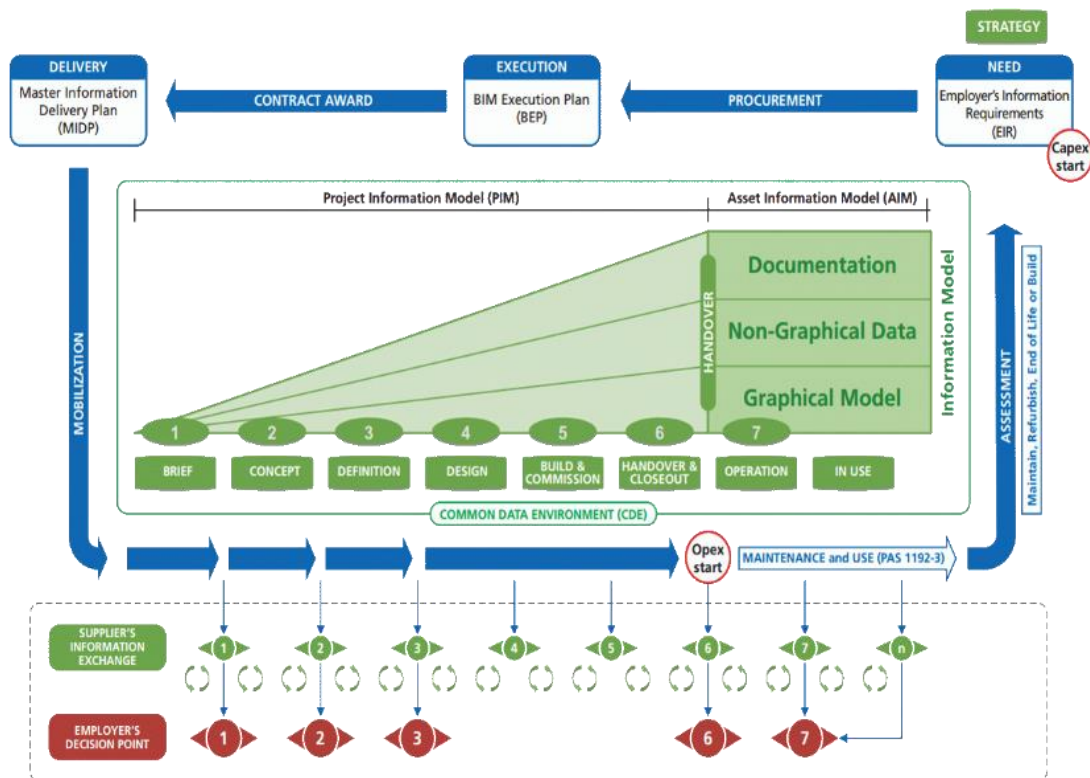
Figure 1-8 Information Delivery Cycle (Taken from PAS 1192-2)

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NEED: Employer's Information Requirements We start off on the right hand side of the diagram. During this strategy phase, you will be considering many possible solutions to resolve a problem that you need to address. For example an existing hospital may be struggling to cope with the demands placed upon it due to its size. A potential solution may be to extend the hospital, demolish and rebuild or even construct a new hospital elsewhere. Once a strategy is in place you will need to consider the site. This site may already have digital information for example in terms of survey information such as utility information or capacity of services and existing drawings.

At the start of the capital phase, which could be a new project, refurbishment or reconfiguration, you as a client will put together your Employer's Information Requirements. This is a key activity you do as a board and sets out the standards you want the PSCP to follow, what you want from models and information, who is responsible for it and when you want it delivered. It is a document that goes in as part of your overall Employer's Requirements and tender enquiry process. The standard EIR body is easy to adapt, what will take the time and be the main work is in completing the appendices. Section 7 explores the EIR in more detail

EXECUTION: BIM Execution Plan With the EIR complete, you now go out to procurement. The EIR goes out to your tendering contractors, who will each prepare a BIM Execution Plan (BEP). Think of this as a method statement. The initial plan is known as the pre-contract BEP, and will be coming back from the PSCP or lead designer depending on how you are procuring. You may have a lead designer first then a main contractor or you may have a PSCP doing both design and construct. Essentially they are coming back with their method statements to say this is how we will create a response to your EIR, and outline the tools, resource and systems they will use to create the information.

DELIVERY: Master Information Delivery Plan The next step is to procure someone and award the contract. As part of the contract the PSCP will create a Master Information Delivery Plan (MIDP). This is not anything new and is essentially a schedule of all your models and information, related back to when you require it. Section 6 looks at the MIDP in more detail.

Historically you may have requested a drawing at a scale of 1:50 for each room, together with a section. This is the same thing however rather than requesting a 1:50 drawing and section you are asking for a model that includes a defined level of information. The important thing to note here is that it is now contractual. Section 6 explores how you articulate your Information Requirements to the supply chain.

MOBILZATION By this stage you will have a PSCP in place, the process of starting to produce the model, known as the Project Information Model (PIM), begins. You will notice the stages running along the bottom of the diagram, these indicate that information will follow a Plan of Work such as the CIC or RIBA Plan of work and that information is within a common data environment (CDE). Its important to note that both BIM level 1 and BIM level 2 requires a CDE for it to operate in. Section 6 looks at Plans of Work in more detail while section 3 considers your information management and CDE strategy.

As information is passing through the CapEx stages, the PIM is progressively developed. Notice the Red circles, these are your key decision points. These decision point generally relate to the SCIM process that goes through a series of gateways. As an example, at the end of the concept design stage, you will have a series of key questions, known as Plain Language questions or PLQs. Does the concept design meet my accommodation schedule target? From the information exchange you would pull out both graphical and non-graphical information such as COBie data to answer the question. You may have a target of 20,000 sqm and the current model shows 21,100 sqm. This information is then interpreted by the design team, for example the COBie information may show that there are too many

plant rooms, or that corridors could be reduced. With this information to hand, as a client you can then decide to proceed to the next stage, knowing that it does not pass, or you go back to modify the design. The important thing is that you have the data to support your SCIM decision making process.

Notice the green circles. These are the information exchanges that will be happening between the PSCP and their design teams.

MAINTENANCE AND USE Information within the PIM is progressively developed until we get to the point of handover where information is transferred across into 3i studio and your CAFM systems to begin the Asset Information Model (AIM).

During the capital phases we typically have defined information points. During the Operational stages these are called trigger events because they can happen at any time. For example, if a component fails you will need information about it. Some clients may set up what their trigger events are, for example, an airport may have a trigger event if an air bridge or baggage carousel fails. When considering your own trigger events it is important to involve the FM team to help determine what information is needed in the event of a trigger event.

SUMMARY The key concepts of the Information Management Lifecycles are as follows:

- Clients put together their EIR
- The PSCP puts together their response to the EIR in the form of a BEP
- Collaborative signing off a MIDP
- PSCP builds the model to test the key questions within the clients EIR
- PSCP handing the models back to the client to maintain for the next 30 - 50 years.

1.4   What is a Digital Estate?

While the BIM process benefits NHS Boards individually, getting better at information management at a project level has a great impact at an overall organisational level. The longer term vision is to move to the concept of a digital estate alongside the physical. Think of the digital estate as a 'Digital Twin', of the NHSScotland Estates Assets. A digital Model that is a mirror of the physical that contains data and information. Over time, the Digital Estate will help NHSScotland with future investment and better decision making.

The digital estate can be thought of as a portfolio wide collection of Asset Information, comprising of 3D models, CAD and digitised paper copy information. Information may be linked within different databases. The use of meta data tags, structured information and common naming and classification conventions make information indexable and searchable. The Digital Estate will make it easy for a board to search, retrieve and make sense of their existing information.

1.5   Section Summary

Central to the BIM proposition is working collaboratively, in order to improve productivity, efficiency, cost and reduce waste. This is all achieved by better Information Management and adopting a managed approach to the collection and use of information developed throughout the built asset lifecycle. This enables better outcomes and decision making by having access to the most up to date data.

The next section explores the different Levels of BIM maturity and gives a high level overview of the supporting standards and enabling tools. It explores how the Scottish FuturesTrust (SFT) BIM portal should be used as a tool to allow NHS Boards to determine when, why and how they should adopt and implement BIM and to what Level.

2 BIM Grading & Return on Investment

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2.1 Introduction

BIM can mean different things to different people. A simple diagram known as the BIM Maturity model (Figure 2-1) devised four levels from 0-3 along with the required standards, processes, tools and techniques to support it. Although nearly a decade old, the diagram has been a useful way in which to communicate to the supply chain, what is expected of them, while helping the client understand what the supply chain is offering. In essence the BIM Maturity model is about communicating expectations. (Refer to the Video 'BIM Maturity Explained' for more information)
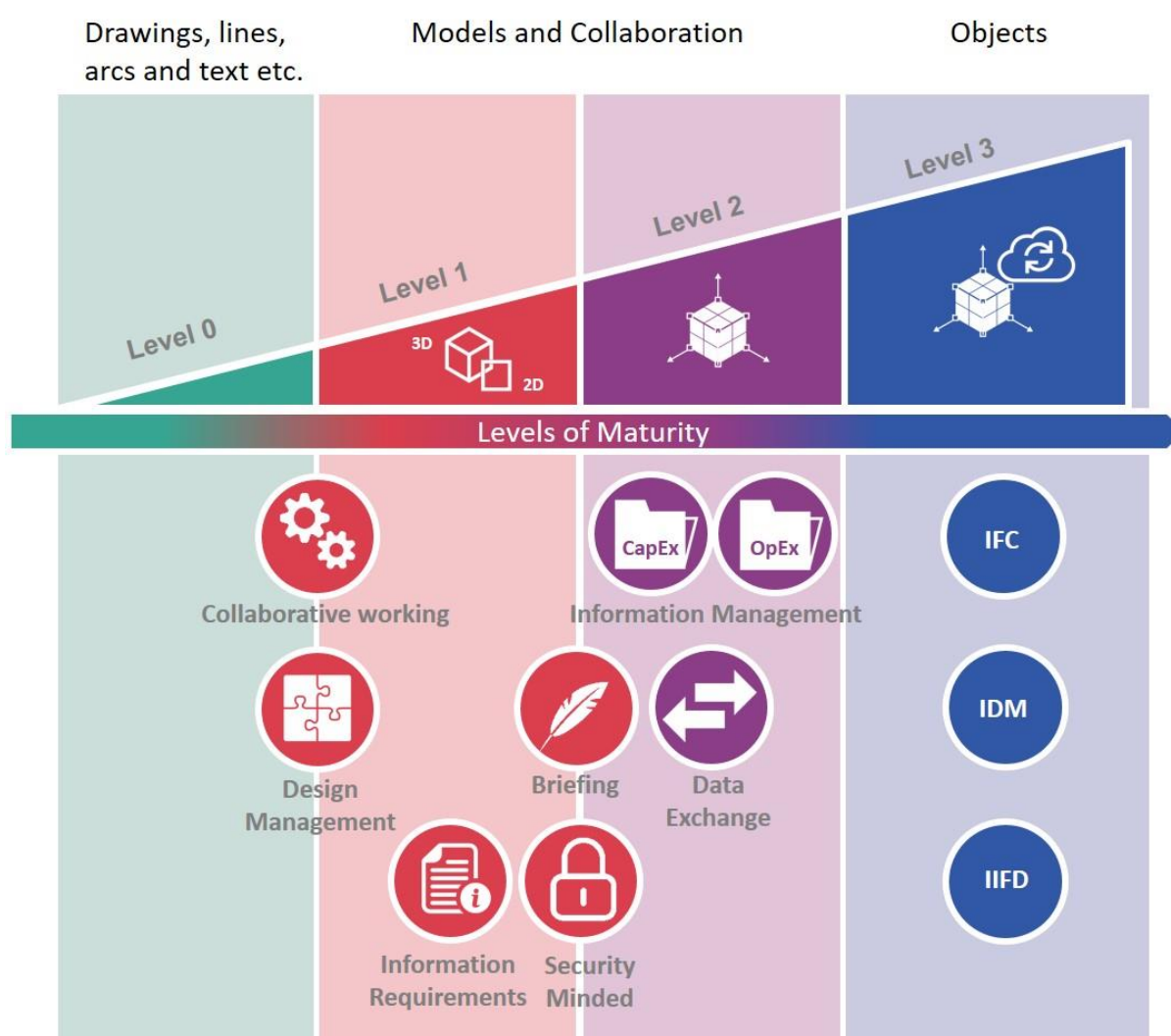
Figure 2-1 BIM Maturity Model

2.1.1.1 BIM Level 1

Moving on from Level 0 where no collaboration is taking place, BIM Level 1 maturity uses a mixture of 2D or 3D CAD to a standardised data structure and format. Information is managed within a central digital place known as a Common Data Environment. (CDE) 2D and 3D models are still used at BIM level 1, however the important thing to note, which separates it from BIM Level 2, is that the outputs are digital ink (such as 2D and 3D CAD drawings) whereas Level 2, the outputs are derived from 3D parametric models.

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A key requirment of Level 1 BIM maturity is for 'file-based collaboration' a CDE. (see section 3) The originator of information remains responsible for the files that they have authored, attaining clarity of responsibility of who is responsible for which sections of work.

Level 1 BIM greatly enhances productivity by the following key elements:

- Collaborative production and sharing of information and data within the context of a CDE
- Disciplined design and information management processes
- Defined information and data requirements and exchanges
- Defined roles and responsibilities for information management
- Security mined approach
- Better briefing through a soft landings (SL) process

2.1.1.2   BIM Level 2

BIM Level 2 Maturity is a series of domain and collaborative federated models. Information models, consisting of both 3D geometrical and non-graphical data, are prepared by different parties during the project life-cycle within the context of a common data prepared, progressed and exchanged throughout the project lifecycle, according to a defined framework.

Domain specific models (focused, on architectural, structural, services and landscape

What is a CDE? **Q&A**

The fundamental principles of a collaborative process requires information to be shared within a Common Data Environment (CDE) together with a suitable information hierarchy to be agreed upon which supports the concept of the CDE and the document repository. Essentially a CDE is simply a digital place in which the information comes together.

With vast amounts of digital data being created and shared during a project's lifecycle, the CDE becomes an ideal environment in which to promote a collaborative working culture.

Regardless of the Level of BIM Maturity, the CDE should be a main software priority within any organisation wishing to work within a BIM enabled environment. A project may have a couple of CDEs. Designer and contractor for work in progress and shared. Client receiving data when published and completed.

aspects for example), including both 3D geometrical and non-graphical data, are 'federated' together at defined points as information exchanges within a CDE.

In reality the differences between BIM level 1 and BIM Level 2 are very subtle. Regardless of level both approaches require defined information requirements and the disciplined management of information within a CDE. The main difference between the levels is that one is focused on digital information generated from 2D or 3D CAD systems, while the other is focused on models.

These models are known as a Project Information Model (PIM), which relates to data / information generated and managed during the design and construction of a project, and the Asset Information Model (AIM) which is used during the operational and in-use phase. The information model concept encapsulates the idea of having all

Figure 2-2 Information Models

relevant information in a single place or, where required for security reasons, in a series of linked files, rather than in separate professional or contractual silos. It is never intended to be a single digital file containing all of the project data, rather a repository of models, analysis and reports.

Figure 2-3 illustrates that in both approaches information increases over time as the project progresses. The amount of information needed at each project stage or milestone will be dictated by how much information NHS Boards need to answer a business question at a particular point in time including information needed to answer questions relating to the SCIM process. For example at the Initial Agreement (IA) SCIM stage (which aligns to RIBA Plan of Work 2013 stage 1) boards will need to consider any indicative costs as part of the SCIM Options Appraisal Guide and will require information to prepare and evaluate indicative costs for each proposed solution (Capital, Whole life capital, whole life operating). They will also need to understand the requirements for soft landings (SL) and commissioning. This requires information such as a Soft landings/ commissioning requirements brief that includes any processes and protocols to be implemented.
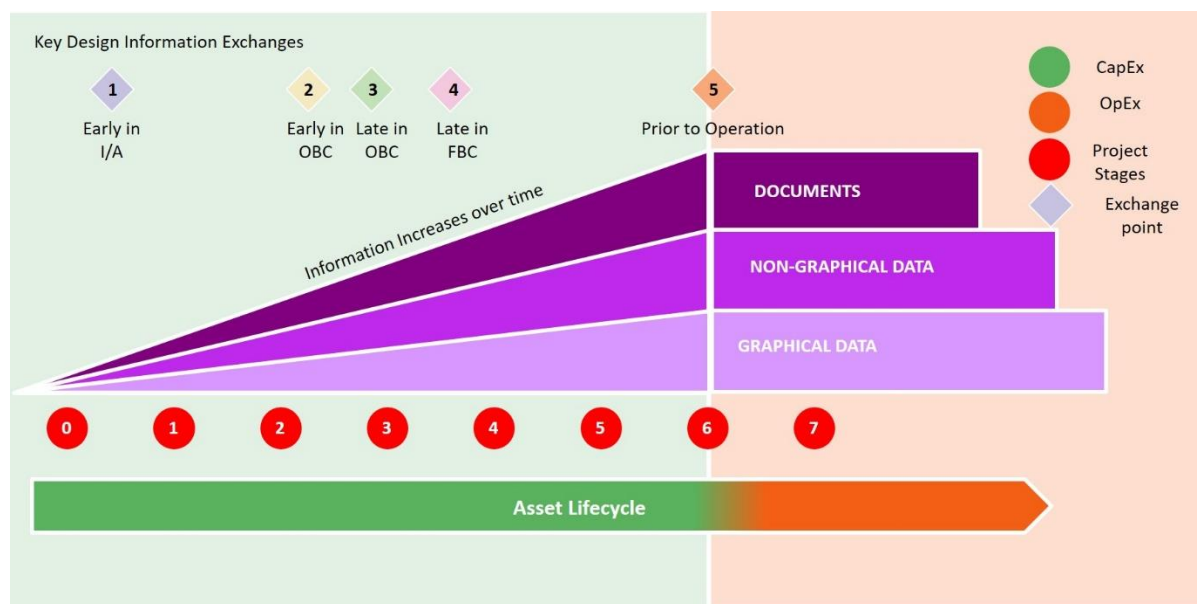
Figure 2-3 Information progresses over time

2.1.1.3   Level 3 and beyond (Digital Built Britain)

BIM Level 2 was never a final destination, rather it is part of a much wider implementation strategy and journey. Building upon the Level 2 programme, the Cambridge Centre for Digital Built Britain (CDBB) is a partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge that seeks to 'deliver a smart digital economy for infrastructure and construction for the future and transform the UK construction industry's approach to the way we plan, build, maintain and use our social and economic infrastructure.' Refer to the CDBB website www.cdbb.cam.ac.uk for more information.

2.2   Meeting the standards and supporting tools

The UK BIM strategy has a focus on end deliverables (and who is responsible for these deliverables via specific contractual requirements). This led to the UK BIM Task Group on behalf of the UK Government's Department for Business, Energy & Industrial Strategy (BEIS) funding the development of a series of standards, Processes and tools to help clients become more effective in communicating their information requirements and to remove barriers to BIM adoption. It is important that all

participants are working from the same consistent set of standards and processes to fully reap the rewards of a BIM approach.

Table 2-1 shows the a core set of standards backed with common processes and a suite of enabling tools that, in combination, are responsible for bringing BIM deliverables to life. They help support key processes that form the basis of consistently defined project stages and clearly communicate information requirements that relate to the client need. The BIM Level 1 standards (indicated in purple) are extended with the use of the standards (indicated in red) for BIM Level 2. Standards (indicated in green) are not mandated but are used as required. The standards are available for the BSI BIM Level 2 website. The resource acts as a point of reference for clients, designers, contractors, trade suppliers, manufacturers, maintainers, operators and users to understand how to use BIM and data to improve productivity and reduce waste. These standards are available from www.bim-level2.org/en/standards. (Refer to the Video 'BIM Standards Explained' for more information)

Table 2-1 BIM Standards

Title		Collaborative working	Design Management	Library objects	Briefing/ Soft-landings	Information requirements	Data Exchange /COBie	Security	Health and Safety	Legal	Classification	Levels of Definition
SFT BIM Level 1 Implementation Requirements	BS 1192:2007 + A2:2016	●									●	
	BS 8536-1:2015				●	●						
	BS 8536-2:2015				●							
	PAS 1192-5:2015					●		●				
	BS 7000-4:2013		●									
SFT BIM Level 2 Implementation Requirements	PAS 1192-2:2013					●						●
	PAS 1192-3:2014					●						●
	BS 1192-4:2014						●					
As required Standards	PAS 1192-6:2018								●			
	BS 8541-parts 1 to 5			●								
Supporting tools [Non-Mandatory]	CIC BIM Protocol									●		
	CIC Outline Scope of services for role of Information Management									●		
	Uniclass 2015										●	
	NBS BIM Tool Kit											●

In addition to the above, NHSScotland have developed a number of documents and supporting templates. We explore these in more detail within this guide, which include:

- NHSScotland Asset Lifecycle Process Map
- NHSScotland Employer's Information Requirements Template – including Appendices
- NHSScotland Assessment Form – Including Matrix and guide
- NHSScotland BIM Execution Plan – Pre and post contract – including appendices

(Refer to the Video 'NHS Scotland Supporting BIM Templates' for more information)

2.3 Level 1 Standards

Before you move to BIM Level 2, you require a good understanding of the BIM Level 1 standards. These are the foundations upon which you will be able to meet Level 2. Below we take a high level look at the BIM Level 1 standards. If you are already familiar with the supporting standards, you may wish to proceed to section 2.6.

2.3.1 Defined Information Requirements (BS 8536-1:2015)

Starting with a well-defined brief, results in better data and performing assets. Compared to traditional processes BIM provides a more effective and transparent basis for briefing. Briefing for design and construction is supported by a standard, BS 8536-1:2015 Briefing for design and construction. Code of practice for facilities management. This document is focused on building infrastructure, while its sister document part 2 is focused on Linear and geographical infrastructure. They focus attention on the information and data that is needed for the asset to operate and perform.

Key to these standards are the Employer's Information Requirements (EIR), which set out the information to be delivered, and the standards and processes to be adopted by the design and construction team including its supply chain, as part of the project delivery process. The EIR covers a lot of ground and contents and therefore there is a benefit in having all of these requirements in a single document. You will reap the rewards of investing time to clearly explain your requirements to the supply chain by receiving better aligned digital deliverables.

It is worth noting that if working at Level 2, PAS 1192:2 extends the scope of the EIR, providing its contents, structure and what it should contain. Section 6 looks at information requirements in more detail and the EIR in section 7.

BS 536-1 also has a component relating to soft landings (SL), where it gives recommendations for briefing so that designers consider performance in use. This is intended to ensure that the operator, operations team and their supply chain are involved from the outset and that the project delivery supply chain continue to be involved through the operational phase and defined periods of aftercare. See section 2.3.5.

2.3.2 Collaborative Working (BS 1192:2007 + A2:2016)

Central to BIM Level 1 is BS 1192:2007+A2:2016; Collaborative production of architectural, engineering and construction information. Code of practice.

This document provides best practice for managing the production of information and is the foundation for moving onto BIM Level 2.

It sets out the standard methods and procedures or SMP such as the approach to a Common Data Environment (CDE), defined naming conventions and a data exchange plan. Section 3 looks at the key considerations as part of your SMP.

It is worth noting that this standard will be superseded by ISO 19650 in 2019 together with a UK national Annexe and transition guide, however it shall still be applied for the foreseeable future.

2.3.3 Security Minded digital working (PAS 1192-5:2015)

As the use of digital data increases, so does the threat to security. It is becoming more important, not only with respect to physical controls and security-minded behaviour of staff but also how we manage risks that can arise from unauthorised access, manipulation and sharing of data, information and systems. We need to consider the security of NHS staff and patients, NHS built assets, the services delivered from those built assets and the data and information that they hold or have access to.

To ensure that information is safe and secure, you should be mindful that sensitive projects and information will require a strict policy to be implemented regarding access and permissions. Similar to health and safety, security should be an ongoing consideration throughout the whole project timeline.

PASb1192:5 'Specification for security-minded building information modelling, digital built environments and smart asset management' details the approach you should take to applying appropriate and proportionate measures to managing the security risks that affect a built asset, in whole or in part, asset data and information.

It is applicable to built or portfolio of assets which is deemed 'sensitive'. This is defined as one which, as a whole or in part, may be of interest to a threat agent for hostile, malicious, fraudulent and criminal behaviours or activities.

It includes aspects such as, the concept of security, security issues, a holistic approach to security, understanding the overall security threat to a built asset and Sources of security advice. A key aspect you will need to consider as a board is the appointment of a Built Asset Security Manager, which is explored in section 4. Further details can also be found in the *NHS Scotland Mindful Security Guidance* document.

2.3.4   Design Management (BS 7000-4:2013)

A successful BIM workflow requires collaboration during the design process and for new processes to be adopted. This means that there is a greater demand for design management. You should consider BS 7000-4:2013 Design management systems. Part 4. Guide to managing design in construction. Similar to BS 1192, this standard is fundamental to achieving BIM Level 1, however is often a forgotten element. The standard highlights the need for an EIR and that consideration should be given to its early preparation at the start on the initial briefing stage.

Unlike some of the other BIM standards BS 7000-4:2013 is a paid for document. It can be purchased for the BSI shop (https://shop.bsigroup.com).

As part of Design Management you need to consider the following:

- **Project Implementation Plan** - The Project Implementation Plan (PIP) allows you to assess the capability, competence and experience of design task teams in IT, CAD, BIM and other resources. The Plan should also establish project costs and when the client is required to provide funds. (See section 7 for more details on assessing the supply chain)
- **Project Communications Plan** - Develop a project communications plan that identifies all communication channels and the procedures to be used for preparing, identifying, distributing, storing and clearing of all communications.
- **Secure storage of backup** - Procedures for the control and secure storage of backup copies of CAD and BIM system data should be defined and strictly enforced.
- **Classification system** - Adopting a common language is essential when coordinating construction project information across a project or NHSScotland estate. Classification provides a common language or 'reference dictionary' that is used to accurately describe things.

2.3.5   Better briefing through a soft landings process (BS 8536-1:2015 & BS 8541-2:2016)

Better briefing involves getting those that are involved in the operation and use of an asset, such as facilities managers and clinicians for example as well as potentially involving other health boards to understand any lessons learnt from other projects. The idea is to bridge the gap between the design, construction and operation of the asset, so that the asset performs as intended. This concept is known as Soft Landings (SL) and is explored in more detail in section 5. In essence, soft-landings is about a smooth transition from the design and construction into operation and use of an asset, to make sure that its operational performance is optimised. It is important that these transitions are considered early in and right throughout the project, rather than just at the handover stage.

2.3.6 Health and Safety (PAS 1192-6:2018)

While not a mandated requirement of BIM Level 1 or 2, it is good practice to follow the methodology and guidance set out in this document. The principles and requirements set out in the PAS can and should be applied to projects regardless of BIM. They should also be applied in conjunction with NHSScotland's own management systems, polices and arrangements.

The standard known as PAS 1192-6:2018 'Specification for collaborative sharing and use of structured Health and Safety Information using BIM'. The PAS sets out how H&S information can be identified, shared and used by the key players in the construction process throughout the project and asset life cycles. A key aim is that health and safety information is considered from the outset.

The PAS builds on current practices in the UK construction industry, where the most advanced digitally enabled projects are using modelling tools and information systems to improve the design and construction; whilst recognising there are very few examples yet where feedback shows that management of the built asset has equally benefitted. The document sets out a frame work referred to as the 'risk information cycle' for applying H&S information through BIM processes and applications.

The standard applies to a number 'Participants'. A participant is a person or an entity (Such as an NHS Board) that is fulfilling an active role in the use and sharing of H&S information and the risk management process. Depending upon the procurement route, an NHS Board may cover a number of different participant roles. Section 7 discusses the Health and Safety and Construction (Design and Management) Regulations considerations as part of the EIR.

2.3.7 Library objects (BS 8541-parts 1 to 5)

To help with a consistent approach to BIM objects, a series of standards BS 8541 gives guidance and recommendations around their content. The six part series for Library objects for architecture, engineering and construction cover key aspect such as:

- Identification and classification;
- 2D symbols;
- Shape and measurement;
- Attributes;
- Assemblies; and
- Product declarations.

2.4 Level 2 standards

The level 1 standards are extended by a number of other documents when working at BIM Level 2. The following takes a high level look at these.

2.4.1 Information Management – Using BIM (CapEx) (PAS 1192-2:2013)

At the core of BIM is collaboration. To enable collaborative ways of working, everyone needs to be working from the same hymn sheet, or in this case from the same consistent set of standards. PAS 1192:2 or to use its full name – specification for information management for the capital/delivery phase of construction projects using building information modelling – is a key supporting document for achieving BIM Level 2.

Think of PAS 1192:2 as a framework which is aligned to the stages of work. The document introduces you to the project information model (PIM) which is a combination of graphical data (geometry) non-graphical information (attributes) and associated documentation (such as a specification). Information increases and matures during the design and construction stages before the PIM is handed over to the client to allow them to operate their new asset. Information is then delivered to the client by the information manager along the way via information exchanges.

These information exchange points are usually defined within the employer's information requirements (EIR) and are important as it enables the client to make informed decision along the way. As a board you may have a number of exchange points that relate not only to an RIBA project stage but also to Scottish Capital Investment Manual (SCIM) and Office of Government (OGC) Gateways.

2.4.2 Information Management (OpEx) (PAS 1192-3:2014)

In contrast to PAS 1192:2, its companion document PAS 1192:3 considers the operation and in-use stages, or to use its full name PAS 1192-3:2014 'Specification for information management for the operational phase of assets using building information modelling (BIM)'. This document looks at the asset information model (AIM) which is a single source of validated and approved information that relates to the built asset which can be used by clients, end users, and facility managers during to the operation and in-use phases.

NHS Boards should classify the data and information being put into the Asset Information Model (AIM) according to an agreed classification system or through structures of the data store and or file store. To help determine the content structure and methodology of the AIM, NHS Boards should determine their Asset Information Requirements (AIR). AIRs help support NHSScotland's portfolio by defining the data and information required throughout the asset lifecycle, and will include information relating to Statutory requirements, such as buildings regulations and H&S files, as well as the information you need for your CAFM system and for 3i studio.

We look at AIRs in more detail in section 6 but essentially, AIRs help support NHSScotland's portfolio by defining the data and information required throughout the asset lifecycle.

2.4.3   Data Exchanges (BS 1192-4:2014)

BIM Level 2 is supported by standards that defines the expectations for the exchange of data throughout the lifecycle of an asset, and includes requirements for reviewing and checking for compliance, continuity and completeness. The standard is known as BS 1192-4:2014, 'Collaborative production of information – Part 4: Fulfilling employer's information exchange requirements using COBie – Code of practice' and it outlines the usage of Construction Operation Building information exchange (COBie), an internationally agreed information exchange schema for exchanging facility information between the employer and the supply chain. Essentially a schema just means the organisation or structure of data so that it can go into a data base.

The purpose of COBie is to ensure that information can be prepared and used without the need for knowledge of sending and receiving applications or databases. Using a data schema such as COBie helps support NHS boards by allowing a seamless flow of information into operational and maintenance systems. For example the COBie schema captures data about 'managed assets', those being assets that need to be maintenance, inspected and serviced for example a boiler. Using the COBie schema, data such as serial number, warranty details, model numbers in a structured way allowing information to be mapped or imported into the national NHSScotland facility/ estate asset management system (EAMS), 3i studio.

Section 7 considers Data exchange formats, Data exchanges and project deliverables in more detail.

2.5   Supporting Tools

Alongside the core standards are a series of supporting tools which when used in combination bring the BIM deliverables to life. These tools address the following key areas:

- Legal = NHSScotland BIM Protocol
- Common Language = Classification
- What information is required and when = Digital Plan of Work

2.5.1   Legal (BIM Protocol)

Working at Level 1 and Level 2 BIM maturity requires very little change to the fundamental building blocks of copyright law, contracts or insurance. The NHSScotland Protocol for Building Information Modelling (BIM), based upon the CIC BIM Protocol, is a supplemental agreement that is incorporated into professional service appointments and construction contracts by way of a simple amendment. The protocol allows BIM adoption to take place without the need to redraft contracts, by making the minimum changes necessary to the pre-existing contractual arrangements on construction projects. It works by using an 'enabling clause' which is added into the relevant contract terms and conditions to allow the protocol to become part of the contract. The objective of the protocol is to enable the production of information models at defined stages of a project. As well as setting out licensing terms for use of any models, it also defines the 'permitted purpose' for uses of any model.

The protocol would typically be completed by the Capital Projects officer for the Board with support from CLO, potentially via the FS2 team.

2.5.2   Common Language (Uniclass 2015)

Data classification systems are essential for co-ordinated construction project information, as they allow information to be recognised, differentiated and understood. They enable data to be indexed and structured, so everyone can find the information they are looking for. One such classification system is Uniclass 2015, described as a unified classification system for the construction industry. It is unified in the sense that it covers all construction sectors including buildings, landscape and infrastructure. Uniclass 2015 works by way of a hierarchical suite of tables allowing information about a project to be defined from the broadest view of it to the most detailed, from a hospital complex, to a Ward, to a hospital bed screen. There are tables within the classification that cover different classes of information and deal with different scale of information. Section 3 looks at classification in more detail.

2.5.3   What information is required and when (A Digital plan of Work)

A Digital Plan of Work or dPoW is a generic schedules of phases, roles, responsibilities, assets and attributes, made available in a computable form. It helps supply information that will help support the creation of a Master Information Delivery Plan (MIDP) by helping NHS Boards define their deliverables at each stage of a construction project, from developing the strategy through to managing the asset. Section 6 explores the MIDP in more detail, but in short it is essentially a primary plan that defines when project information is to be prepared, by whom and using what protocols and procedures, and is made up by incorporating the supply chains task information delivery plans (TIDP).

There are a number of Digital Plan of Works tools available, the NBS BIM Toolkit being an example. The BIM Task Group worked with Innovate UK and NBS to develop a free-to-use NBS BIM Toolkit that provides step-by-step help to define, manage and verify responsibility for information development and delivery at each stage of the asset lifecycle.

The toolkit allows management of tasks and deliverables and contains online functionality that allows data to be prepared for inclusion in project documents such as your EIR. The tool allows you to select a number of plans of work as a basis of defining your requirements, in particular the RIBA Plan of Work 2013, which is mapped to the NHSScotland all-encompassing process map. We consider Plans of Work in more detail in section 6.

2.6   The Scottish Futures Trust (SFT) BIM Portal

BIM is no longer seen as 'Nice to have'. The Scottish Government reconfirmed their commitment to BIM by embedding it within procurement policy through a policy note issued note (SPPN01/2017) setting out how BIM should be adopted within public sector procurement. The policy states that 'The introduction of BIM is a key catalyst to improve efficiencies in public sector infrastructure expenditure and support wider productivity within the construction industry.'

In support of the policy the BIM Delivery Group for Scotland have produced a free to use online portal. The portal seeks to answer three questions for the procurer, when, why and how they should adopt and implement BIM.

The portal can be accessed from https://bimportal.scottishfuturestrust.org.uk
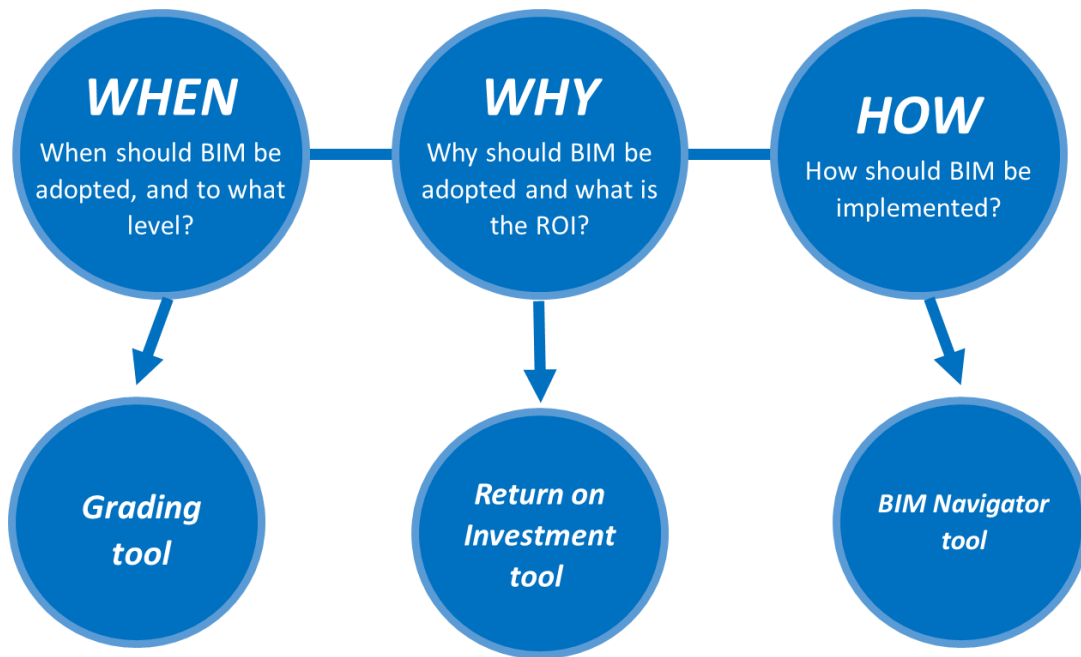
Figure 2-4 SFT BIM Portal questions
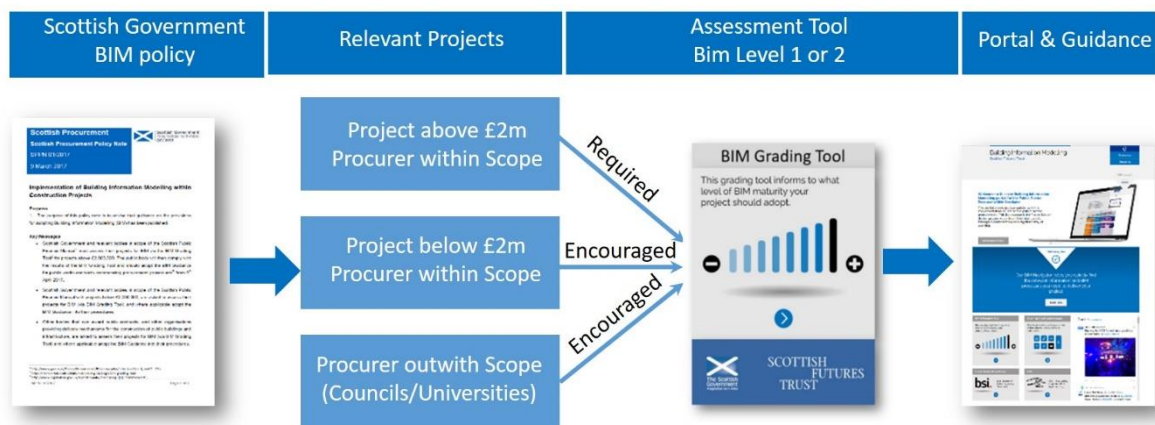
2.6.1   As a client when should I adopt BIM? (Grading Tool)

The policy note relates to bodies within the scope of the public Finance Manual, including NHSScotland Bodies who must assess projects above £2,000,000 for BIM using the SFT BIM Grading tool and comply with the results. The tool provides a method to assess when a public sector project should adopt BIM and too what level. The grading tool is an easy to use online questionnaire that seeks key data for a new project. Through this information the tool assesses to what level BIM should be implemented for that project.

The earlier sections in this guide give an overview of the different levels of BIM and the supporting standards and tools. It worth noting that in every case a minimum of BIM Level 1 is required. The grading tool can be accessed from:

https://bimportal.scottishfuturestrust.org.uk/page/bim-grading-tool

The assessment works by asking a series of weighted questions such as anticipated digital data deliverables (digital BIM files, CAD or Hard copies), provision of a CDE? Templated EIR for information coordination and definition? Typically you should allow for around 20 to 30 minutes to complete this.

Where a project is under £2,000,000, Scottish Government and NHSScotland encourage the use of BIM on all of its projects however the approach is one of proportionality. There is an awareness that procurers as well as industry need to get the basics right and develop a robust information management platform to allow industry to progress. Therefore in some instances it may be better to implement BIM Level 1 in lieu of BIM Level 2 to meet the needs of the project and embed better data management and sharing.

2.6.2 Why should I adopt BIM? (Return on Investment Tool)

Calculating the return on investment will be a key business driver within the business case. Industry reports and case studies indicate that there are many benefits to implementing BIM however there is not always a formal common agreement on how savings and ROI for BIM are calculated.

The SFT BIM portal includes a helpful return on investment (ROI) BIM tool that assesses the benefits and level of return that the adoption of BIM level 2 will have on a new project. The tool supports the user to assess the benefits of adopting BIM Level 2 against a predefined list of benefits. The tool provides both a quantative and qualitative assessment and this is reported within an easy to understand dashboard.

While the default settings within the tool considers level 2 and new projects, it offers the ability to input your own data fields. Typically you should allow for a morning or afternoon to complete this task. The Return on Investment Tool can be accessed from:

https://bimportal.scottishfuturestrust.org.uk/page/roi-calculator

It is important to remember that the principal supply chain partner as part of Framework Scotland 2, have already allowed for provisions for working at BIM Level 2 and for working within a Common Data Environment (CDE). Therefore, these services should not cost any more to procure as they have already been factored and should be considered as part of your ROI calculations.

It is important to remember that ROI is just one way in which to give a score to the cost benefits. You should consider the wider question of 'why should we implement BIM?' The Scottish BIM policy and NHSScotland's commitment to BIM makes the use of BIM mandatory, however there are other aspects which also help justify its implementation.

Inevitably there will be a period where everybody is on a learning curve. During this time productivity and efficiency may dip while people get accustomed to new processes technologies and ways of working. There will also be a degree of investment required not only into software and the supporting infrastructure, but also in people. Staff may require new skill sets to adopt BIM enabled ways of working. From a technical point of view not all staff will be required to produce model information. Most however will need to interact with model information and therefore understand how to read, interrogate and extract data.

New plans of work to support BIM and collaborative ways of working may require more upfront consultant time at the beginning of the project. This is something to consider. Also other aspects such as integrated project insurance and soft landings (SL) may be an additional charge service to what is currently offered. However the cost to procure this will be far outweighed by the reduced operating and maintenance costs that a SL approach will bring about.

2.6.3 How do I implement BIM on projects? (Navigator Tool)

The SFT portal features a BIM Navigator tool that directs users to organisation-specific guidance to support their BIM adoption. Figure 2-5. Key to the guidance is to support public sector clients in developing considered and well-defined information requirements to set the conditions for success.

The BIM Guidance Portal includes a specific NHSScotland landing page and dashboard. The dashboard aligns the project data lifecycle with NHSScotland plans of work and the key BIM tasks for each stage. Figure 2-6. You should consider the 'resources tab' which features good general information regarding what and why of BIM.

The BIM Navigator can be accessed from the main portal landing page:

https://bimportal.scottishfuturestrust.org.uk

Figure 2-5 SFT Navigator tool
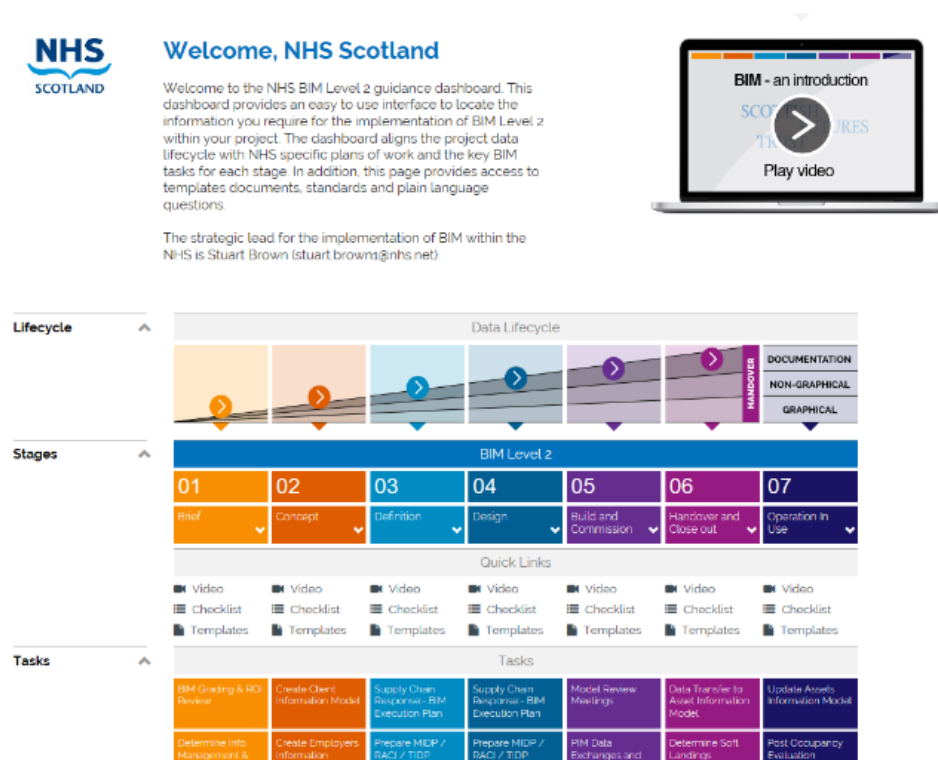
Figure 2-6 SFT NHSScotland landing page

2.7   Section Summary

You should now have an understanding of the different levels of BIM maturity and the supporting standards and tools to help implementation. Information management is applicable on all projects regardless of level of BIM maturity. The Scottish Government have bedded the use of BIM within a policy note and an NHSScotland BIM roadmap, strategy and support framework have been established to help regional boards plan and implement the requirements of the BIM policy and deliver BIM on applicable projects. This support includes BIM template documentation and tools developed to offer all NHSScotland boards a methodology and consistent approach to BIM delivery and management.

To get you on the right track it is important that as an industry we get the basics right. This may mean that it is appropriate that you successfully achieve and implement BIM level 1 as the foundation to progress to Level 2 at a later date. Level 1 is an important repository for current existing data sets, especially on retrofit or refurbishment projects.

It is important to remember that both level 1 and level 2 require Boards to define their information requirements within an EIR and manage information within a Common Data Environment.

3 Information management and CDE strategy

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Now that you understand the BIM Proposition and assessed your project via the SFT grading tool (refer to 2.1) to determine the appropriate level of BIM maturity for a proposed project, you now need to consider your Information Management strategy. You need to think about how you are going to share, produce and deliver information.

3.1 Sharing Information (CDE)

BIM is a collaborative process that is enabled by technology and supported by people. Collaborative working involves tasks being carried out in a particular order for the mutual benefit of all. It is within a collaborative working environment that teams produce information using standard processes and agreed standards and methods. This ensures data can be communicated, reused and shared efficiently, without loss, change or interpretation. (Figure 3-1)
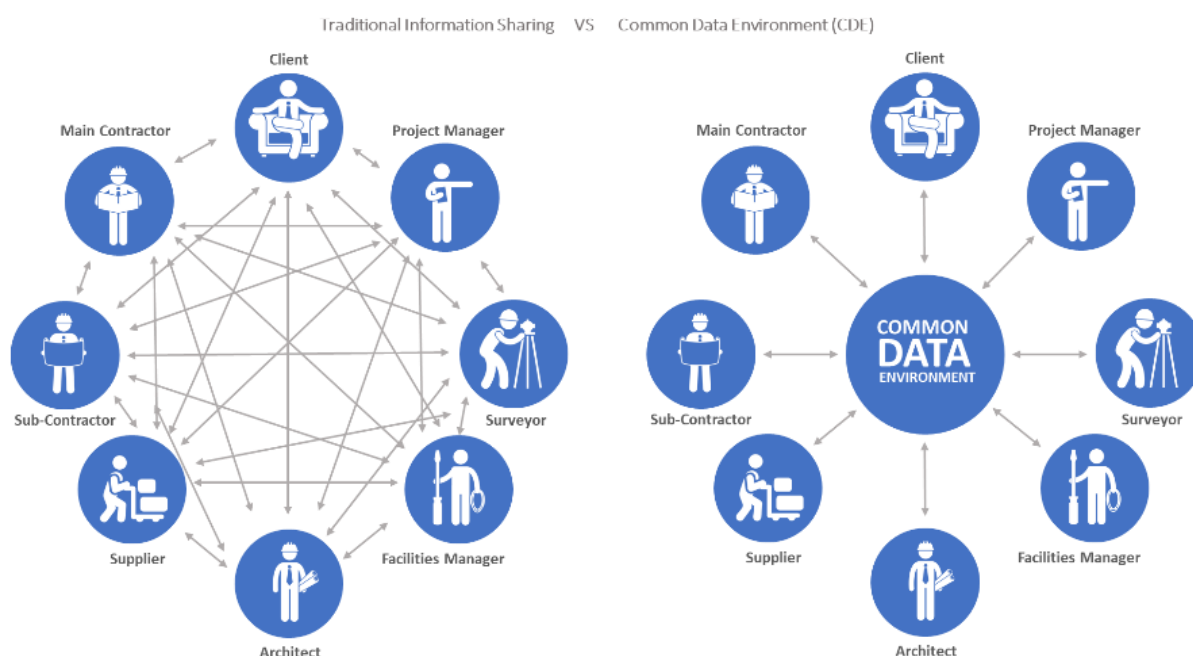
Figure 3-1 Common Data Environment (CDE)

A Common Data Environment or CDE is a technology solution and process to enable this collaborative way of working. It is a place to store a variety of information. This does not just include graphical (such as Drawings and models), but also Non graphical information (such as Schedules and specifications), and Associated documents (such as manuals and warranties) as illustrated in the figure 3-2.
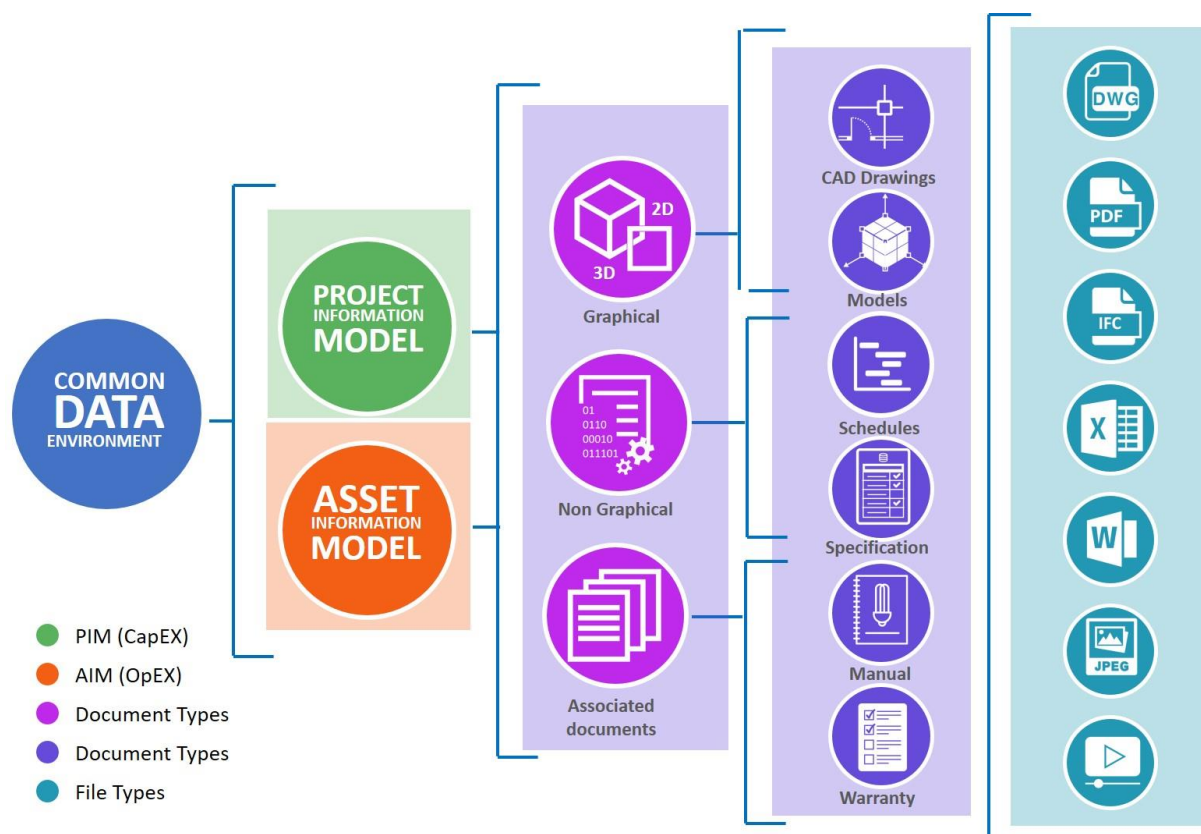
Figure 3-2 CDE repository

Regardless of working with CAD data or Models, before sharing information it is important that information is verified and validated. In this context verified means making sure that the information is technically correct and has been through an approval and sign off process. Validation on the other hand means making sure that the information that is to be shared is suitable for its intended purpose. To help with this, BS 1192 offers a Status code, Suitability code and a Revision sequence.

Q&A

What are my CDE considerations?

When managing information in a CDE or centralised location you need to consider the following:

- ✓ Access controls and permissions (Such as locking down a folder and apply certain access rights)
- ✓ Follow a consistent naming convention and file structure (this will help manage data and protect file contents)
- ✓ Transfer of project information (consider how and what information will be transferred and shared. Think about sensitive items such as locks and CCTV)
- ✓ Disposal of working progress information from supply chain (How will this be protected at the end of the job?)

3.1.1 Defining your Information hierarchy

There are multiple ways in which a CDE can be achieved, but the important thing is that it follows a defined process as set out in BS 1192. The CDE is broken down into four phases, as illustrated in table 3-1 and figure 3-3.

It is important that the CDE follows an agreed information hierarchy BS 1192 also outlines how Directories and folders should be structured.

Table 3-1 CDE Phases

| Section	Description
Work in progress	Area of the CDE where team carries out their own work using their organization's software systems. Non-verified design data used by in-house design team only.
Shared	Area of the CDE where the team shares verified design data with other members of the project team.
Published	Area of the CDE for coordination and validated design output for use by the total project team.
Archive	Area of the CDE for project history maintained for knowledge and regulatory and legal requirements. It is also a repository of the project information for non-asset portfolio employers.
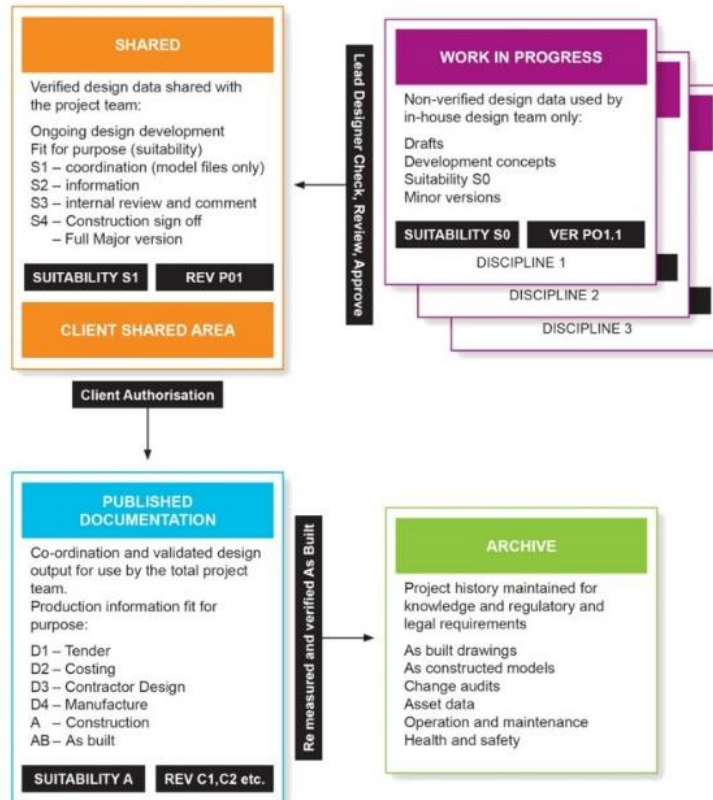
Figure 3-3 CDE workflow

If a CDE is not in place, there are still a number of interim steps that you can take to work towards the future. This may include following the coding, naming and status conventions so that everyone is clear what the information contains and what it can be used for.

Establishing and using a common approach such as this will put you in good stead for when you do implement a CDE. Thinking about how you centralise and manage your information should be your main goal here.

While online storage solutions such as Dropbox, Google Drive or Microsoft OneDrive (to name but a few) enable file storage and sharing, there are not considered a CDE as they do not comply with BS 1192 such as naming conventions and file approval processes.

3.1.2 Appointment of the Information Manager

Information Management is such an important element of the BIM process, that the NHSScotland BIM Protocol (See section 2.5.1) mandates role of the Information Manager. The Information Manager has no design responsibilities and may be a standalone role or undertaken by different disciplines, the design lead project lead consultant or PSCP at different stages during the project, however the important thing to remember however that is it is the NHS board's responsibility to appoint this role.

NHS Boards must ensure that there is an Information Manager appointed (whether by the Board or another party) at all times until completion of the Project, save to the extent that this is the responsibility of the relevant Project Team Member. The responsibilities of the IM will be likely to be outside of the design or project leads normal scope of work and therefore will likely to carry an additional fee, however NHS Boards should make clear any responsibilities and requirements as part of their EIR.

The Scope of Services for the Role of Information Management will need to be defined in the Appointment of the party undertaking the Information Management Role. It is recommended that the scope of the Information Manager is based on the scope of services that have been prepared by the CIC. This is free to download from the CIC website. http://cic.org.uk/publications/

The principal responsibilities of the Information Manager can be summarised as:

- Managing the processes and procedures for information exchange on projects;
- Initiating and implementing the Project Information Plan and Asset Information Plan;
- Assisting in the preparation of Project Outputs, such as data drops; and
- Implementation of the NHSScotland BIM Protocol, including the updating of the Model Production & Delivery Table (MPDT.)

3.2 Producing and delivering information

Now you have considered the environment in which information is to be shared, next you need to draw your attention to how information is produced and delivered in order to meet your information requirements. The production of information is supported by a standard, BS 1192 (See section 2.3.2). This standards provides a common way to approach collaborative working as well as providing common naming conventions. Its focuses on CAD information (as well as BIM) and its aim is to make sure that everyone can share, communicate and re-use data by all parties using the conventions and procedures the document sets out.

3.2.1 Standard method and procedure

The effective sharing, communication and re-use of data is achieved by all the relevant parties involved in the project, such as client, designers, supply chain etc. agreeing on a Standard way to do

things or 'Standard method and procedure (SMP). Essentially the SMP means adopting a project-specific set of modelling, drawing, naming and classification criteria that is used by the whole project team. As part of your SMP, you need to consider the following:

3.2.1.1 Who is doing what? Determine roles and responsibilities

It is important that you agree the roles and responsibilities for the design Coordination of various disciplines, and that these are clearly set out in the EIR. This includes the roles NHS will undertake as well as the supply chain.

At BIM Level 1, as a minimum you should determine the following:

- Employers representative / Project Manager
- Soft Landings Champion (NHSScotland Role)
- Built Asset Security Manager (NHSScotland Role)
- Information Manager (Lead Designer / PSCP – depending on project stage)

At BIM Level 2, you should also further determine the following:

- Technical Advisor (NHSScotland)
- Project Delivery Manager
- Lead Designer (PSCP)
- Task Team Manager(s) (PSCP)
- Task Information Manager(s) (PSCP)
- Interface Manager(s) (PSCP)
- Information Originators (PSCP)

PAS 1192-2 table 2 gives typical duties. The supply chains BEP should include a RACI (Responsible, Accountable, Consulted, and Informed) 'matrix-type' table outlining the roles, tasks and authorities. It is important that the roles, tasks and authorities to parties should be outlined and maintained in the BEP. The responding party is encouraged to develop a RACI (to outline project specific requirements), while roles and responsibilities should also be embedded with contract appointments and align with contract terminology.

3.2.1.2 Establish naming conventions (What are things called?)

You should use an agreed naming convention and create and maintain project codes. This is becoming more vital as more and more information is shared digitally, requiring the need for structured, consistent and understandable naming conventions. BS 1192 sets out how construction project documents are to be named. The set of project documents and each document within it are viewed as a hierarchy of named containers. The standard recommends how to structure names to convey information about the containers required for effective information management.

3.2.1.3 Classification systems (Where can I find things)

All documents, including project information such as drawings and specification, cost information, and models, should be classified using a classification system in accordance with BS ISO 12006-2. In order to establish a consistent approach to enable collaboration and information management, NHS Boards requires the PSCP (or main contractor) and its associated supply chain to adopt the latest format of Uniclass as the core classification. (See 2.5.2)

The Uniclass 2015 classification can be accessed via the NBS Website, where tables can be viewed or downloaded to a spreadsheet format.

Further information on Uniclass 2015 is available via the NBS website (www.thenbs.com/uniclass2015)

Uniclass 2015 Example - The Complexes table is the highest level and describes facilities in overall terms. Complexes can be broken down as groupings of Entities, Activities and Spaces depending on the particular use. Using the Queen Elizabeth Hospital Campus, Glasgow as an example, the whole site is a Complex, which is made up of a number of Entities and Spaces. Within Uniclass 2015 this is classified as Co_35_10_37 Hospital Complex

A complex will be made up of a number of Entities, these are the main starting point for detailed design and construction, and include major objects such as buildings, tunnels and roads. The Queen Elizabeth Hospital is made up of a number of Medical Building entities, which in turn are made up of a number of Elements and Functions and systems. An example EF_20 Structural elements, EF_25 Wall and barrier elements EF_25 Wall and Barrier elements.

A complex can also be described in terms of the spaces it provides for different Activities. For example, Offices, Kitchens, car parking and even Helicopter take-off and landing. Figure 3-4.
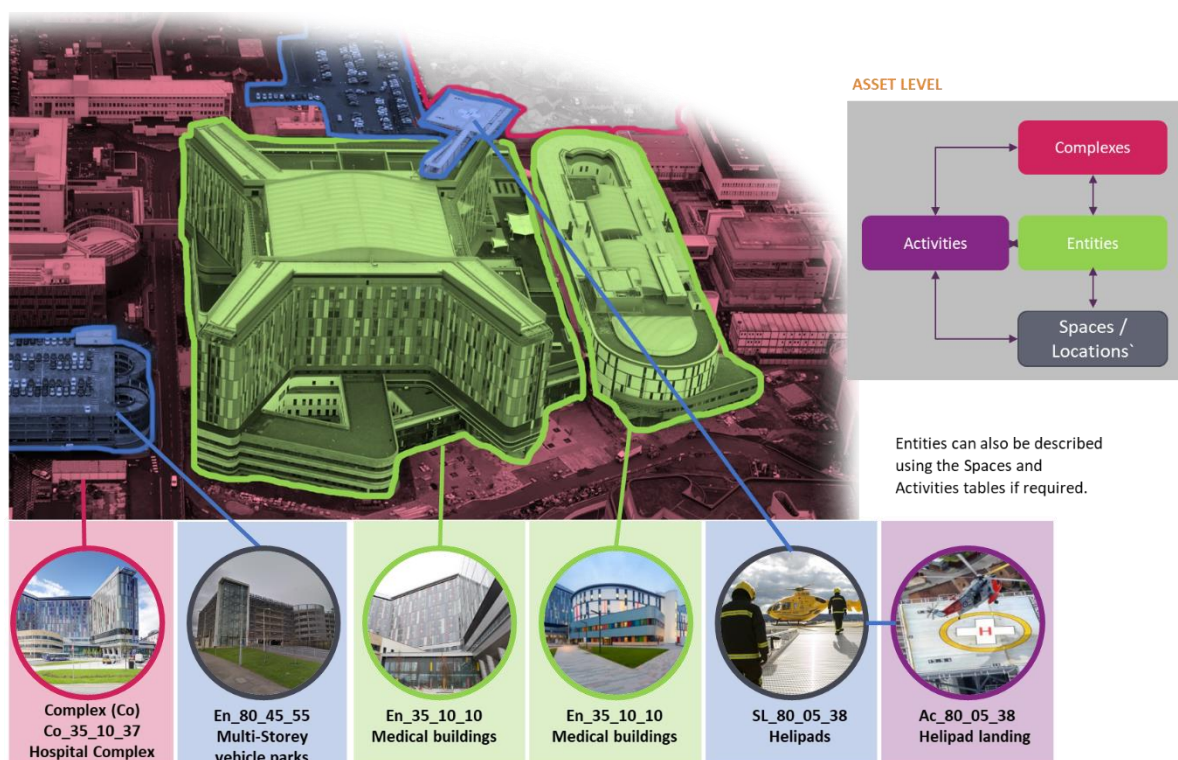
Figure 3-4 Classification at Asset Level

The main architectural components of an entity are elements, for other requirements in an entity such as drainage, heating or ventilation, the activities table sets out these functions. These Elements and Activities are fully described in the Systems which in turn contain products. For example, Hospital Ward Fixture, Fittings and Equipment (FF&E) systems, are made up of a number of products such as Hospital beds and hospital bedheads.

3.3   Section Summary

Regardless of BIM level 1 or 2, the CDE becomes the fundamental component within a collaborative environment. This in conjunction with clearly defined Standard Methods and Procedures allow for the

effective collaboration to take place, to reap the rewards BIM brings. In the next section we consider your strategy for Built Asset Security and the appointment of the Built Asset Security Manager.

4 Determine your strategy for Built Asset Security

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Security within the construction industry will only become more important, as the use of collaborative technologies and processes increase. The sharing of digital information requires the management of risk that can come about from unauthorised access, manipulation and sharing of sensitive data. Appropriate governance and accountability in the collaborative use of information is fundamental to any project, regardless of BIM maturity level, and hence why SFT are advocating the adoption of PAS 1192-5:2015 specification for security-minded building information modelling, digital built environments and smart asset management (See section 2.3.3). At the time of writing the standards along with PAS 1192-5 are available for free. www.bim-level2.org/en/standards

PAS 1192-5 is intended for use by asset owners or, within a project, the Employer. It will also be of interest and relevance to other organizations and individuals involved in the design, construction, maintenance and management of built assets, including those who wish to protect their commercial information and/or intellectual property.

A key term referred to throughout the document you should know is 'Security Minded' This means the understanding and routine application of appropriate and proportionate security measures in any business situation so as to deter and/or disrupt hostile, malicious, fraudulent and criminal behaviours or activities.

The PAS adopts a risk management based approach to the identification of security issues, leading to the production of a built asset security strategy and security management plans. It is important that where appropriate, the Built Asset Security Management Plan cross references any other security policies or plans that NHS Boards have in relation to cyber security and cyber resilience.

You will need to apply a holistic assessment of the risks that could impact on the safety and security of:

- NHSScotland personnel and occupants and patients of a built asset and its services;
- a built asset itself;
- asset data and information; and/or
- the benefits a built asset exists to deliver; and
- the implementation of appropriate and proportionate measures to mitigate those risks that exceed the risk appetite of the affected parties.

When determining your strategy you should consider the following:

- What are the National security issues regarding the protection of NHS Boards critical assets, including data and information?
- How do we preserve the values, longevity and ongoing use of an asset?
- How do we prevent the loss or unauthorised disclosure of commercially sensitive and personal data?

4.1 Appoint Built Asset Security Manager

As a client NHS Boards have an obligation to appoint a Built Asset Security Manager. It is important that the role is carried out by someone suitably qualified and experienced. This is likely to be a role that has not been carried out before with a NHS Board, however the role may be carried out by someone that is currently responsible for security, and on smaller projects is likely to be a part time

function. While the built asset security manager has overall responsibility for security, they can delegate specific security tasks or duties to others, for example, personal security to NHSScotland HR, cyber security to NHSScotland Chief Information Officer and asset management functions to asset manager or facilities manager.

Typical duties include:

- Provide a holistic view of security issues and threats to be addressed;
- Offer guidance and direction of handling risks;
- Take ownership, manage and assist in the development of the built asset security strategy
- Assist in the development of plain language questions and employer's information requirements (EIR) in projects
- Be responsible for promoting a security-minded culture;
- Where appropriate and necessary, seek appropriate professional security advice to provide additional guidance throughout the lifecycle of the project and/or asset.

4.2 Section Summary

It is important to remember that your data and information are also 'assets' as well as the more traditionally associated 'Physical' assets such as buildings. Boards need to consider the appointment of the Built Asset Security Manager.

5 Determine your Soft landings approach

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Soft Landings (SL) is a key element of the design and construction process maintaining the "golden thread" of the building purpose through to delivery and operation, with early engagement of the end user(s) and inclusion of a SL champion on the project team, and commitment to aftercare post construction. The SL approach is intended to improve performance of buildings by "aligning the interests of those who design and construct an asset with those who subsequently use it". A Soft Landings approach is supported by BS 8536-1:2015 (Refer to 3.1.1 & 3.1.5)

The NHS Scotland Soft Landings Guidance document outlines the NHSScotland SL approach and gives supplementary templates to allow a Board to create a project SL strategy and implementation plan. It is important to recognise that many of the principles and processes of soft landings are already being implemented by NHS Boards and should therefore not carry much additional cost but codify best practice.

5.1 Benefits of Soft landings

The following benefits have been identified in the adoption of SL:

- Provides an asset that meets the end users' needs and required operational outcomes;
- Enables end user involvement at an early stage and throughout the project;
- Enables early challenge of design decisions that may impact upon on-going maintenance and operational cost of the asset, which form the majority of the expenditure during the asset's lifecycle;
- Provides fully populated asset data from the BIM model, reducing the cost of data input to FM asset management systems;
- Ensures that full training, commissioning and handover is provided at an early stage, which reduces the cost of protracted handover and means the building will reach optimal performance sooner;
- Post occupancy evaluation, which monitors the project outcomes [usually through an extended after-care period] post completion against performance and cost criteria, with lessons learnt captured for future projects.

5.2 Contracts and Procurement

Soft Landings does not significantly affect standard NHS procurement processes and contract conditions. As with all contracts, specific Board or project requirements are built into the contracts. Soft Landings is just part of this procurement process. It is a simple concept, based around defining the needs prior to procurement, embedding targets and support requirements into the scope of works, specifications and plan of works.

Typical examples are:

- Aftercare: Specific requirements for attendance and support for the Aftercare period are to be designed by the Project Manager and then embedded into procurement documents. This is likely to seek engagement beyond Practical Completion and standard Defects Liability Periods.
- Asset Registers: The requirement for supply of Asset Register information, issued directly into the project database, should be built into the scope of works and specifications for all suppliers.
- Environmental: Evaluation and monitoring against the design targets should be identified as a contract requirement for relevant consultants and suppliers. Probably the most important

requirement is to engage in collaborative behaviour. This can be set as a performance objective; it can be measured and evaluated.

In summary, the procurement of Soft Landings is inherent and built in through working with the framework in figure 5-1. Defects liability periods and Warranty provisions can be extended to support the principles if required, possibly focussed on critical areas. Any such decision needs to be made in conjunction with a review of retention provision. The SFT website provides a free to use template that can be developed. This can be accessed from the SFT BIM Portal.

5.3   TASK Create your Soft landings process

The diagram below highlights 12 stages you should consider as part of your soft landings process.
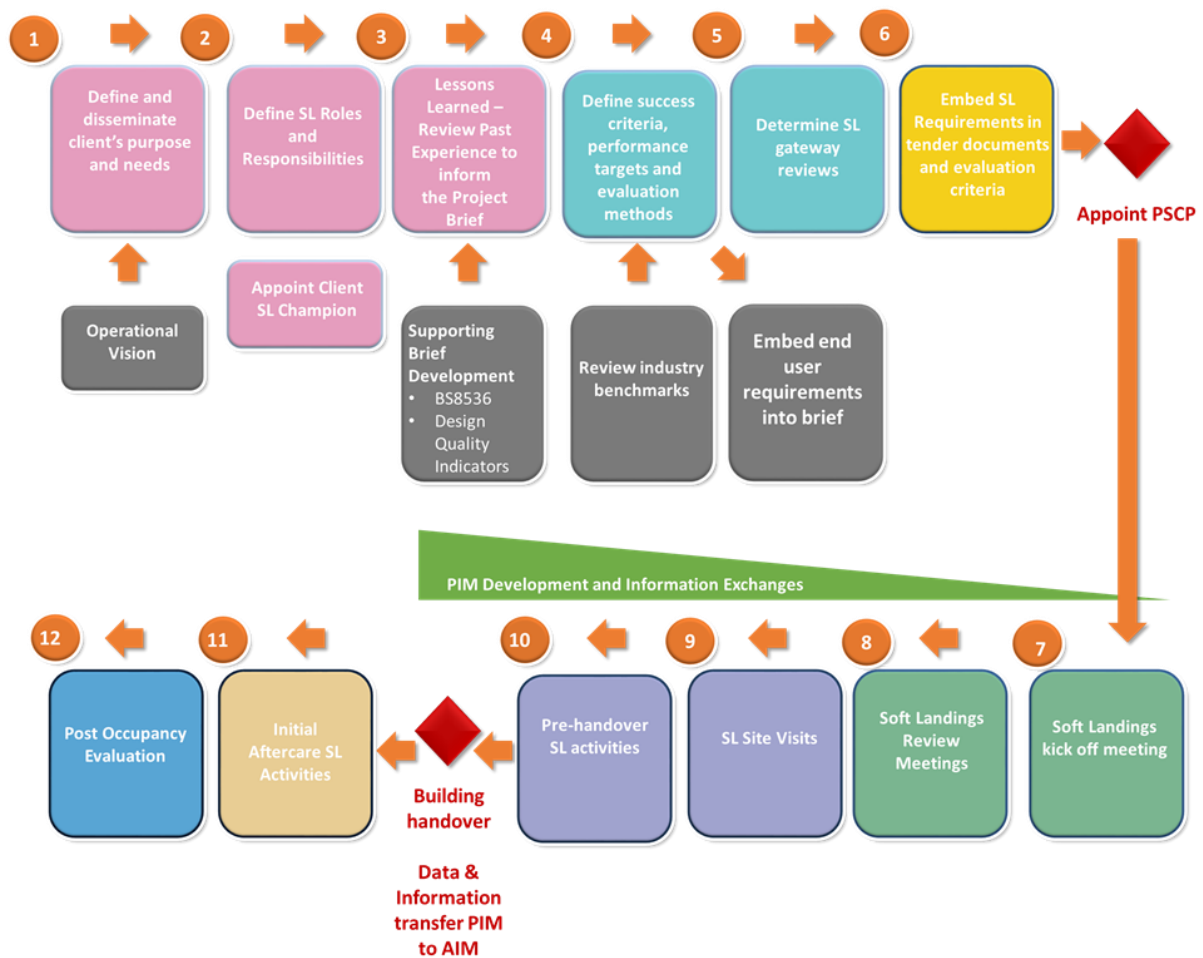
Figure 5-1 Soft landings process

Step 1: Define and disseminate client's purpose and needs

The Soft Landings [SL] process is founded on the client having defined clearly purpose and need. It is vital that the purpose and success criteria is defined to ensure that SL activities can help measure development and test these as the project develops and ultimately becomes operational. It is important that all project stakeholders understand the purpose of the project.

Step 2: Define SL Roles and Responsibilities

Determine key project stakeholder groups and allocate roles and responsibilities relative to soft landings based upon this framework. It is vital that each group has consistent appointed representation during the SL process who have sufficient seniority to make decisions.

Appoint Client SL Champion

A Soft Landings Champion (SLC) allocated from the Board shall lead the SL process on behalf of the client. The SLC may already be part of the project team. It is the essential that the SLC has the right skills and knowledge. It may be necessary that the SLC will require training or upskilling.

Step 3: Lessons Learned – Review Past Experience to inform the Project Brief

The Soft Landings Champion (SLC) shall undertake a desktop assessment of lessons learned from previous projects [especially operational issues] and communicate these to those preparing the project Brief. It is also recommended that a stakeholder workshop takes place to gather relevant experience both good, bad plus potential areas for improvement that maybe useful for informing the brief and target setting. Visiting similar projects and interviewing users and the facilities management team is also encouraged.

Step 4: Define success criteria, performance targets and evaluation methods

The SLC shall with input from key stakeholders determine appropriate and measurable targets in relation to operational performance and other relevant goals such as maintainability.

Measures may include:

- Financial performance
- Functionality and effectiveness
- Environment
- Asset operation related at asset and facilities management

Early development of Post Occupancy Evaluation [POE] plan in context of functionality and effectiveness.

Step 5: Determine SL gateway reviews

The SLC shall establish structured gateway reviews for SL during the currency of the programme to support decision making and review progress of the design in relation to project goals and targets. The SLC shall prepare a summary programme of milestones and SL review meetings and where practical these SL meetings will piggy back other key design meetings.

Step 6: Embed SL Requirements in tender documents and evaluation criteria

It is important the SL process is included as explicit requirements in the tender documentation to allow the PSCPs to make appropriate allowances for same.

SL meetings should be clearly defined along with any post occupancy evaluation requirements, surveys and or extended aftercare.

The PSCP should be requested to include proposed methodologies for SL delivery within their proposals. Tender evaluation should include criteria for soft landings.

Appoint PSCP

Step 7: Soft Landings kick off meeting

Shall chair a SL Kick off meeting to ensure that a detailed SL plan is in place by those delivering the project and that project Purpose, Targets, Milestones and Review Meetings are in place.

All information requirements for handover and operational delivery should be established in the MIDP.

The SLC shall ensure that all lessons learned have been disseminated to the PSCP especially those that might influence design.

Step 8: Soft Landing Review Meetings

During the design and construct period and aligned with the SL gateway milestones where possible reality check meetings should be undertaken using BIM and other virtual design and construct processes such as virtual reality. Virtualisation of key spaces are particularly important.

It is important that key stakeholders are in attendance to virtually test the developing proposals against the project targets.

Development of MIDP to be reviewed.

All issues should be logged for amelioration prior to the next meeting or gateway.

It is important that the PSCP be well prepared for the workshops with all relevant project information at hand.

Step 9: SL Site Visits

During the construction period SL site visits should be undertaken to allow users to get early understanding of the facility and raise early any issues not established during the regular SL reality checks.

Key spaces and areas should be formally visited, reviewed and signed off from an SL perspective.

Accessibility reviews and plant room walk rounds by the FM team are also recommended.

Step 10: Pre-handover SL Activities

Review the logging of measurable performance targets.

PSCP to prepare a building readiness programme in advance of commissioning works.

Check commissioning records.

Early training of building operators.

Detailed plan for aftercare team mobilisation.

End user migration plan created.

User and Operator guides created to compliment digital O&Ms.

Building Handover and Data and information transfer to PIM to AIM

Step 11: Initial Aftercare SL Activities

After care team in place with delivery plan.

Aftercare team meeting with FM team post-handover to ensure operational understanding.

Clear communication of contacts established telephone numbers etc.

Regular walk arounds and meetings with users by SLC and Aftercare Team to identify any initial operational issues.

Issues resolution plan established.

Update users on resolving any initial operational issues.

Capture any lessons learned.

Step 12: Post Occupancy Evaluation

The POE should include:

- Regular meetings and workarounds with after care team.
- Logging of performance data.
- Fine tuning of systems.
- Surveys with end users.
- Measure and evaluate performance.
- Formal Post Occupancy Evaluation (POE) review against targets and success criteria [this may be undertaken by an independent reviewer]. Usually yearly [Y1,2 and 3]
- Communicate and feedback to end users.
- Record lessons learned.

5.4   Section Summary

In order for fully achieve the full benefits of BIM requires it to be used in conjunction with other initiatives. Soft Landings is a core component of successful BIM implementation and requires NHS Boards to consider the end in mind.

6 Creating the Client Information Model

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Now you have determined the collaborative environment in which information is to be shared, and how information is to be produced and delivered, you need to consider and define your project information strategy.

This will include the information you require as an NHSScotland Board and when you need this information in order to answer a business decision.

6.1 Client Information Model

The Client Information Model or CIM, defines the strategy for how data will support the operational and capital expenditure strategy, inform decision making through the project lifecycle and also defines the MIDP. This will look different depending upon if your project is a new build or a refurbishment, however regardless of this, they have common themes that run through them.

Clearly defined data and information requirements will make sure that NHSScotland procure and receive verified data and information to the right level of definition. It is important to remember that all data produced, regardless of project size, will feed into the overall jigsaw of the NHSScotland digital estate, building up a clearer picture. This data and information has a wide range of possible uses and therefore as a client, NHSScotland Boards need to assess and understand their specific needs. We refer to these your Clients Strategic Purpose which we discuss in section 7.

In preparation of the MIDP, NHSScotland Boards need to consider information requirements in the context of NHSScotland Board requirements and contractual requirements in order to inform the required outputted deliverables. These requirements consist of:

- Organisation Information Requirements (OIRs),
- Asset Information Requirements (AIRs)
- Built Asset Security Information Requirements (BASIRs).

The CIM and its relationship with elements of information is illustrated in figure 6-1. It shows how the Employer's Information Requirements (EIR) document combines the requirements of the OIR's and AIR's together with further inputs and acts as a vehicle to articulate the NHSScotland Boards information requirements to the supply chain.

A BIM Level 1 Project will still require an MIDP as part of a 'lighter' EIR. We look at EIRs in details in Section 7.
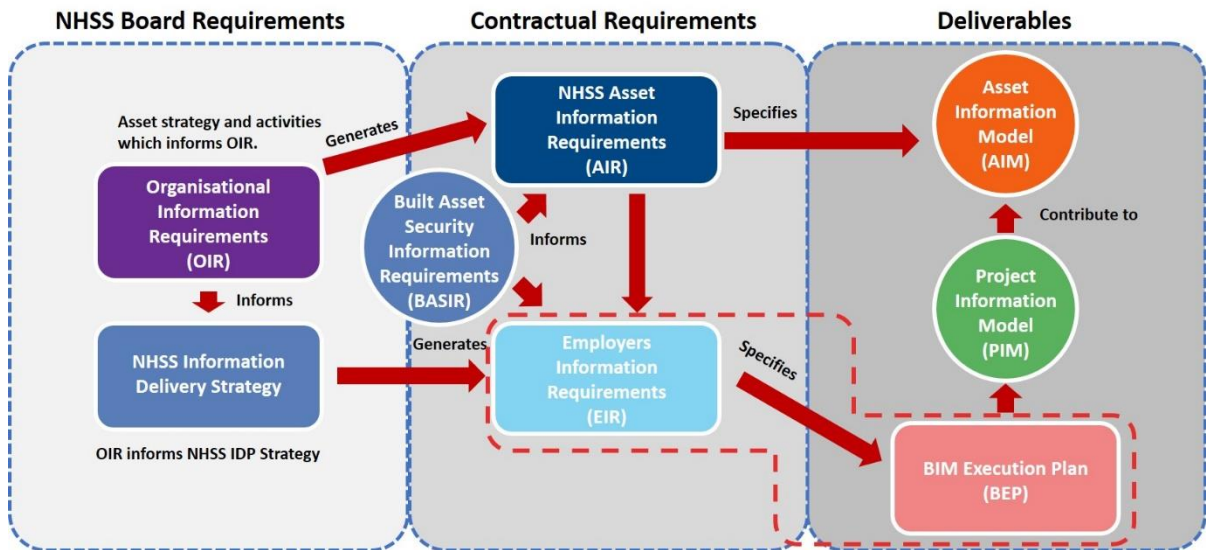
Figure 6-1 Overview of Client Information Model

As part of your strategy you should develop the 'Why' questions and what it is you need to deliver. This will require a number of teams coming together to establish this and therefore it is important to get asset managers input to the design process. We refer to these as Plain Language Questions or PLQs. Figure 6-1 shows how the Information requirements inform the EIR, all of which are supported by PLQs.
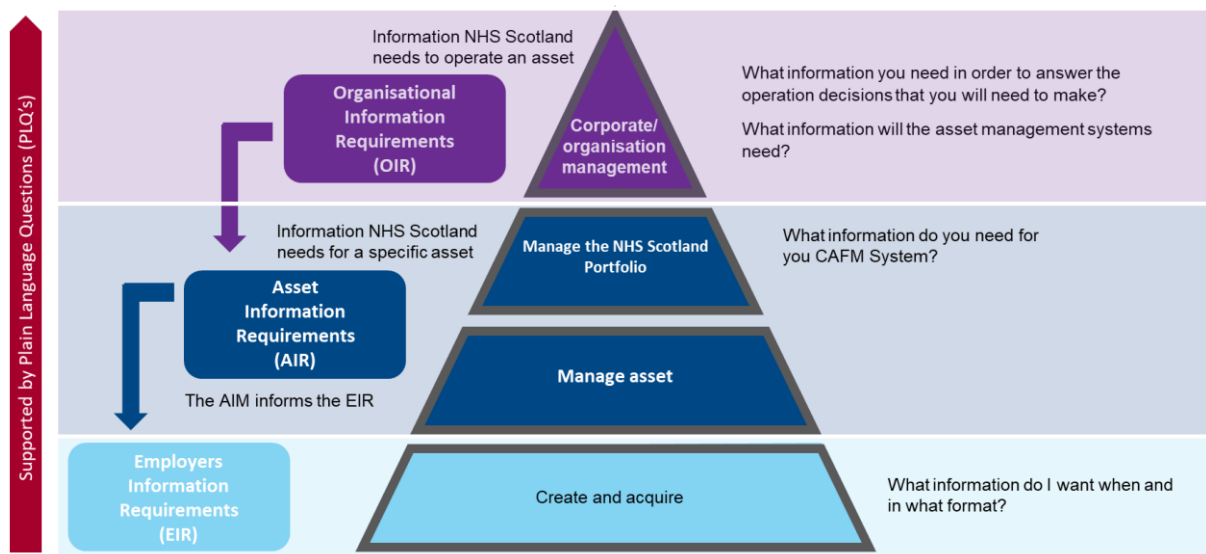
Figure 6-2 Information requirements

6.2 Exchange Plan – Master Information Delivery Plan (MIDP)

Irrespective of if the project has been graded at BIM Level 1 or level 2, there is still a need for baseline production and exchange of structured data and information. This will support key project decisions and also populate the asset information model and other related systems as Computer Assisted Facilities Management (CAFM) and Asset Register tools. This is likely to be more of a manual and less automated process at BIM level one, however is still a key strategic need for almost any project.

Building up a picture of what your information requirements looks like, helps inform a Master Information Delivery Plan or MIDP for the project. The MIDP is a primary plan that communicates when project information is to be prepared and by whom during the project lifecycle. In essence it is a collation of Individual Task Information Delivery Plans or TIDPs that are prepared by other team members. It lists out the information deliverables such as drawings, information models, specification and reports and is typically developed by the project delivery manager in collaboration with the task team managers. It is then used by the PSCP to assist in the delivery of project information during the project. At BIM level 1, the MIDP is likely to be more focused on CAD and project document deliverables.

6.3 Plain Language Questions (PLQ) important at all stages

Plain Language Questions (PLQs) are in essence the questions that an NHS Board needs answering at a project approval gateway in order to approve that the project progresses to the next stage. Think of a PLQ as a broad information requirement against which a supplier will respond with data taken from models and other sources. Although not a requirement of BIM Level 1, it is good practice to include them. Any more information and waste is incurred, any less and the question cannot be effectively answered.

Information matures during the project stages that will help you make key stage decisions. For example at a design stage you will need to know the heating strategy for the asset, while at handover you will need to know what actual heating systems are installed to help with maintenance and future investment decisions.

PLQ'S, help inform NHSScotland Board business decisions by requesting information in simple and easy to understand terms. They help inform what data is required, and when by mapping each PLQ against an adopted plan of works, project life-cycle process and key gateway decision points. Each stage in the plan of work is supported by a sequence of high level questions in a clear and non-technical language what data or information the client needs to inform if the project can progress to the next work stage.

The RIBA Plan of Work has been the definitive UK model for construction for almost 60 years and the RIBA 2013 Plan of work received its biggest overhaul since its inception to reflect evolving processes within the industry and the CIC Plan of works 8 stages. This has been mapped to the NHSScotland process map.

Q&A

What is the CIC Plan of Work?

There are many Plans of Work all with a different focus and approach depending upon a specific sector. To help different construction sectors to work together and to acknowledge the way in which information flows through a BIM enabled process, the Construction Industry Council (CIC) produced a new, coordinated UK Plan of Work.

The Plan of Work comprises of 8 stages (0-7) to take into consideration the whole asset life cycle from strategy to operations and end of life. This new Plan of Work provided the basis for institutions and organisations to align their processes to 8 common stages.

You can find out more about the RIBA Plan of Work 2013 from www.ribaplanofwork.com

NHSScotland have their own business process along with using the Scottish Capital Investment Manual (SCIM) and Office of Government (OGC) Gateways. As part of the NHSScotland BIM Strategy these processes have been mapped together. The NHSScotland BIM Strategy Asset Lifecycle process map (V 2.0) provides an overview of the SCIM process, (*i.e. project inception to post project evaluation of services*) aligned with the RIBA Plan of Works, OGC Gateways, and key information exchange points. The map offers an insight into the correlation and parallel nature of the variant project delivery

processes, and helps determine the inter dependencies of information development and flow relevant to each decision-making gateway/ stage.

The prescribed project deliverables (3D models, drawings, reports, schedules etc.) for each information exchange point have been carefully collated to ensure all relevant information is available at the right time for appropriate decision making and client approval. The information exchanges are timeously related to project SCIM activities, decision making and approvals process. This can include design assessments, stakeholder engagement, case stage approvals (e.g. strategic, economic, commercial, financial, management), Benefits Realisation, Risk Management, or pre/ handover stage commissioning etc.

Key decision points, data drops and supporting PLQs are added together with the data and information needed to support these activities.

The NHSScotland BIM Strategy Asset Lifecycle Process map is available from the member's area of: https://www.frameworks-scotland2.scot.nhs.uk/

6.3.1   TASK Defining your PLQs

Setting your PLQs are a key part of the information requirements process ensuring data is only produced when needed and ensures that digital data has clear purpose and aligned with the NHSScotland Board's organisational and project needs such as SCIM. They help NHSScotland boards to identify their minimum information requirements for each stage and helps ensure that it is mapped to their business process. These PLQS and associated information requirements will be set out in the project Employer's Information Requirements (EIRs) and shall provide enough information to answer the" Plain Language Questions" required at a particular stage, at an appropriate level of definition.

Step 1: Agree Key decision points

Once the project's plan of work has been defined such as RIBA 2013 the key decision points should be agreed, essentially "when do I need information to support my decision gateways"? Normally these exchanges occur in advance of the end of a stage to allow the client decision making to occur and any necessary re-work such as refining design to meet area targets if the decision that the current target has not been made. It also important to articulate the purpose of these gateways for example, to agree at target price.

Step 2: Articulate the PLQ

Having defined the employer's decision points it is now necessary to articulate the PLQs themselves, this is often best done in a workshop environment and should also include those from a facilities management perspective who may want related PLQs such as "can I effectively and safely maintain this facility based in the current design solution?"

The NHSScotland Plain Language Questions template (EIR Appendix A) should be used as a starting point as this already embraces the PLQs that support the SCIM process and align with RIBA Plan of Work 2013 and project information exchange points however the project unique questions should also be articulated. It is important that you only develop one master version per project and store in a central server location or resource section of the NHSScotland Board CDE.

Step 3: Format requirements

Once the PLQs have been expressed it is then necessary to set-out the information requirements and format that will support the decision making. This maybe one piece of information or several

depending on the complexity of the question from a model, a report or Construction Operations Building information exchange (COBie) data. (See data exchange format section 7.1.1.4)

Step 4: Define responsibilities

Next it is important to define who will be responsible for the creation and management of the information deliverables e.g. lead-designer, main-contractor etc.

Step 5: Consider Level of Definition

It is important to consider the amount of graphical detail and information that will be required to support the decision. How much information must be driven by the amount of information needed to answer each PLQ. More information will be produced as the design is developed, but the level of detail required may vary based on whether a separate design team or a contractor is responsible for detailed design. This is referred to as Level of Definition, which is the collective term for Level of detail (Graphical) and Level of Information (Non graphical). A benefit of using an agreed Level of Definition is that Design information is produced to a consistent level of detail that is no less or no greater than is required at the stage of a project. Figure 6-3 illustrates an example of non-graphical and graphical information for a cavity wall.
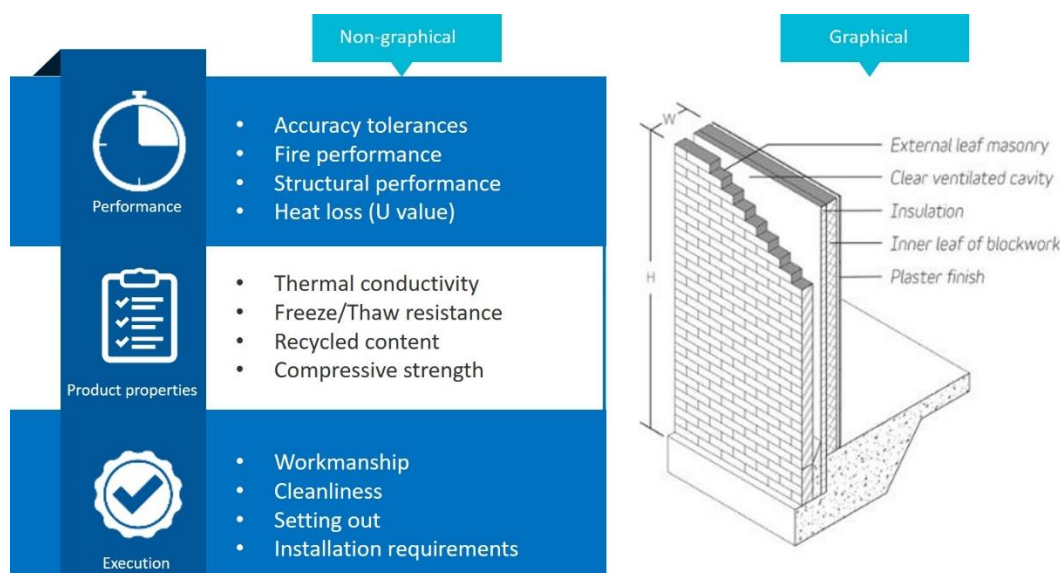

Figure 6-3 Non- graphical vs Graphical information

Typically information will grow throughout the project stages. At an early stage details of the heating strategy and high level volume strategy may be required for space allocation, while at handover, details of the installed heating systems including performance data and warranty information will be required to understand and answer operational questions. Figures 6-4 and 6-5 illustrate the concept of information progression.
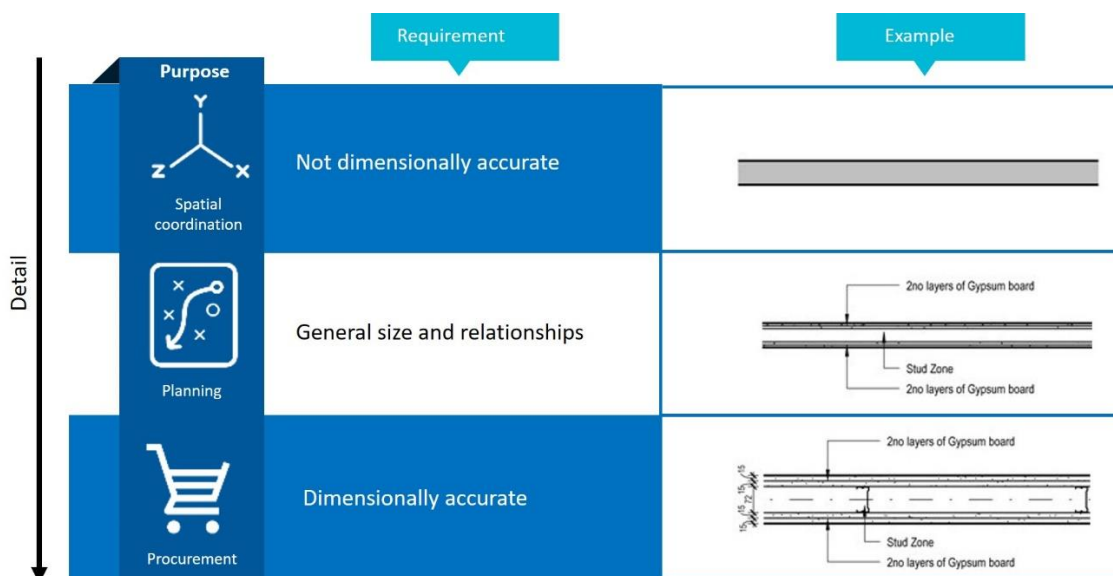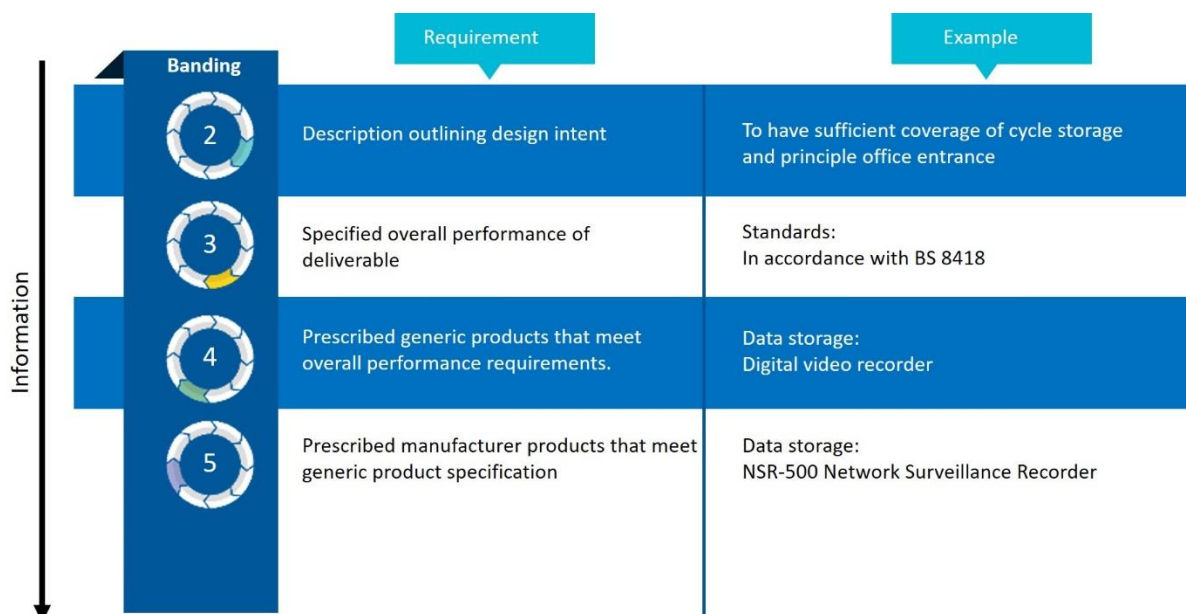
Figure 6-4 Level of Detail progression

Figure 6-5 Level of Information progression

The Level of Definition concept moves away from the idea of having a single code applied to a model at a certain stage. It is only when we combine both Graphical and non-graphical information do we get a clear picture. For example, while geometrical or graphical data can communicate the width of the brickwork leaf and the height of the wall, it is the written word that takes us to a deeper level of understanding. Information such as the bricks density, strength and source are not modelled graphical.

Having the ability to use Level of Detail (LOD) and Level of Information (LOI) together provides for greater flexibility and allows for different procurement routes. It is also important to understand that LOD and LOI codes are not mutually exclusive to a project stage and may be higher or lower than the project stage number. For example at stage 2 Concept design stage client may ask for an LOD 2 (just

enough to show spatial coordination, and door swing) and LOI 3 in order to understand Fire or security performance.

The amount of graphical information needed for each object at each stage will also differ depending upon what it is. For example a light switch may only ever require symbolic information showing its location, while other items may require more geometry and volumetric information to help resolve spatial requirements and clashes.

Supporting tools such as the free to use NBS BIM Toolkit are useful as it provides a reference definitions library for over 5,700 construction definitions for level of detail. The definitions are arranged by Uniclass 2015 classifications which are split into tables to help group similar items together. The tables are hierarchal support the clarification of big to small, such as from a Hospital campus, road network, to a floor tile or kerb unit. These can be obtained from the NBS BIM Toolkit website https://toolkit.thenbs.com

Step 6: Articulate PLQs through the EIR

Once this has all been completed the information requirements associated with the PLQs can be articulated in the EIR.

Finally once the information exchange occurs and the information has been validated and verified the project team should have a mechanism in place to review the data and interpret same to support the decision making.

6.4 Organisational Information Requirements (OIR)

Your Board's Asset strategy will inform your high level strategic information needs that you need to consider at an organisational level and how this information can support operational decision making. These are known as Organisational Information Requirements or OIRs and help support NHSScotland's long term strategic goals. They define what data you need across the NHS Board and the reasons for collecting this data.

Defining your OIRs is focused on organisational information requirements and not just at a project level. You should be asking what information you need in order to support and answer the operation decisions that you will need to make such as:

- Optimising your Board's asset management strategy and optimising/prioritizing its asset management plan(s).
- Assessing the financial benefits of planned improvement activities.
- Modelling the asset to support operational decision making. Information required for asset management systems, such as asbestos surveys and health and safety files.
- Determining the operational and financial impact of asset unavailability or failure.
- Making life cycle cost comparisons of alternative capital investments.
- Identifying expiry of warranty periods.
- Determining the end of an asset's economic life, e.g. when the asset related expenditure exceeds the associated income.

6.4.1 TASK Defining your OIRs

The NHSScotland estate is made up of many different assets, facilities and departments, all with their own data needs. Collating the OIR will involve discussions with other departments (and Boards) usually through a workshop to understand the requirements. This information gathering is likely to need the input of various teams and departments. It will require input from strategic decision makers and those responsible for the asset portfolio or estate. The information is underpinned by the Estate Asset

Information System (EAMS) provided by 3i Studio. EAMS is a property asset management system used for capturing backlog maintenance and asset lifecycle information via condition surveys. It is also used to capture information such as space utilisation, functional suitability, quality and condition across the NHSScotland estate and can be used for forward investment and planning. 3i studio centralises core estate information, in one place for easy access and management allowing the ability to report on the entire estate.

Step 1: Site and Building Details

Consider what information you need as a minimum baseline for the general site and buildings that will meet the needs of your asset management systems and other organisational asset management functions. This may include information such as site name, site type, site address, year of construction etc. You should consider the form you need the information in, such as a .csv file and also identify how will be delivering the information and date the information is required.

Step 2: Baseline requirements

Next consider the organisation information you need to meet the needs of your asset management strategy and duty holder requirements. These may be demonstrate compliance with statutory regulations for example such as asbestos registers, medical gas certificates or emergency lighting certificates. Other information requirements may be needed to demonstrate your board's compliance with internal compliance for example As-built drawing, BREEAM Certificates and warranty information for maintainable systems and products.

## Step 3: Block, floor and room information

Now consider information needed for asset management systems and other organizational asset management functions. For example Room information may require a Site code, block no, floor level, room number, zone name, room description, functional suitability, Gross Internal Area (gia) m^2 and room height.

Step 4: Whole Life Cost Information

Finally consider both the actual and projected cost information that boards need to meet their asset management strategy and related systems. This may include aspects such as Purchase Costs, construction costs, projected rents and rates, projected operation & occupancy costs, projected energy and utilities costs, projected maintained costs, replacement costs, projected disposal costs and projected project income.

6.5   Asset Information Requirements AIR

Once you have established your NHSScotland Boards requirements and how the information is to be produced and delivered, next you need to consider the contractual requirements and the information that the supply chain is to deliver. To prepare the content required to answer the established OIRs will often require the collection, aggregation and manipulation of multiple pieces of asset information. These are known as Asset Information Requirements or AIRs. As part of this you should consider your Statutory Requirements, such as Building Regulation Approval Certificates as well as Health and Safety regulations information for inclusion in Health and safety and O&M Manuals. As an example, figure 6-6 considers pieces of information you may require answer to in order to run and maintain a boiler.
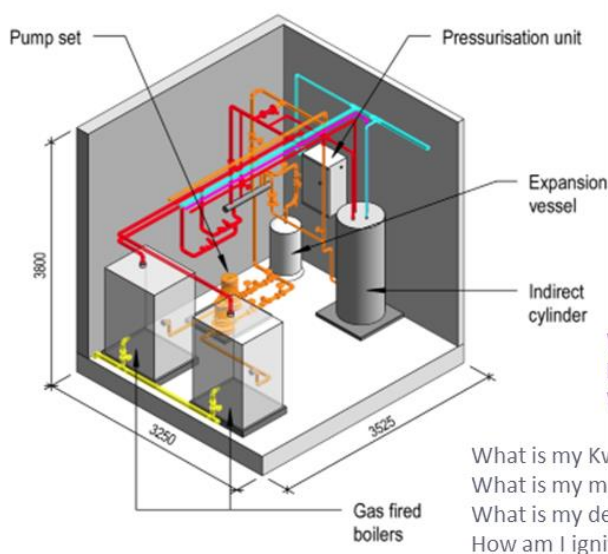
Who supplied me?
What's my serial number?
When should I be tested?
How long does my warranty run for?
How much do I cost to replace?

How should I be maintained?
How do you diagnose fault if I'm not working properly?
What is my planned power consumption?
What's my embodied carbon?

Where am I located?
How much do I weigh?
What is my storage volume?

What is my Kw capacity?
What is my max flow temperature?
What is my design safety overpressure?
How am I ignited?

Figure 6-6 AIR considerations for a Gas fired boiler

You also need to consider what information you need for you CAFM system. At present there is no one CAFM solution across NHSScotland however, regardless of CAFM system you use, information must be to a sufficient level of detail in order to answer key questions at each stage of the asset lifecycle.

You need to consider the trigger events that might require the retrieval of this data include:

- Receiving information during major works project
- Deciding to manage asset information according to the PAS
- Evaluating performance of an asset
- Planned or reactive maintenance work
- Minor works (repairs, component replacements)
- End-of-life works (decommissioning, mothballing)
- Change in regulations relating to the asset
- Change in organizational requirements for the asset
- Change in owner, operator or maintainer

It is important to understand that AIRs grow from the very beginning of a project. Typically information required at handover includes aspects such as Space Data Requirements and Data attributes, Fixture, fittings and Equipment Requirement Data Attributes, Building Services Required Data Attributes and Building Element Requirements and Data Attributes.

6.5.1   TASK defining your AIRs

To help you communicate your AIRs for a project, you should use the following NHSScotland templates to prescribe your project asset data deliverables.

- The NHSScotland Asset List (Appendix D)
- The NHSScotland Facility/Estate Asset Management System requirements (Appendix E)
- NHSScotland COBie Data Requirements (Appendix F)

Step 1: Asset list

Considering asset and operation information requirements from the outset is essential for the smooth running of the asset in the future. Your starting point should by The NHSScotland Asset List template (Refer to EIR Appendix D) lists all project assets that require periodical physical condition, statutory and manufacture/ warranty related maintenance assessments throughout the new facility / asset lifecycle. Figure 6-7. The standard, default list has been referenced from the NHSScotland Estates Asset Management: Property Appraisal Manual (PAM) Version 3.0_August 2016 It provides a way to record assets and any requirements for tagging. Additional fields allow for the specification of O&M manual information as well as providing further comments. For example, when considering Windows and in particular Window restrictors mechanical / automated control systems, the NHSScotland Board may have a particular requirement for the automated façade controls to be included in the model as they will be linked to weather stations and the BMS system.

This appendix informs the development of the MPDT appendix (see section 6.6) and defines the Asset Information Model (AIM) deliverable at RIBA Stage 6, handover. It is important that the list is reviewed during the EIR and SCIM Commissioning Master Plan development stages and refined (added/ removed as applicable) to reflect the project specific maintainable assets.

Figure 6-7 Extract of NHSScotland Asset List (Appendix D)

Step 2: Define NHSScotland Facility/ Estate Asset Management System (EAMS) requirements

The NHSScotland Facility/ Estate Asset Management System (EAMS) requirements template (Refer to EIR Appendix E) helps you consider what data and information you need the supply chain to deliver for mapping and import into the national NHSScotland EAMS, 3i Studio. Figure 6-8. The template identifies all the required data entry fields for system population through 3i manual / picklist or importing COBie data, helping standardise the methodology for 3i project setup and enabling quicker data population onto the system pre- project handover.

It is important that the Facilities Management provider provides input into this process and that the deliverables should form part of the SCIM Commissioning process.

NHSS Estates PAM Facet Reference	Attribute Field	Description	EAMS (3i Studio) Manual Input / Picklist	COBie Data (models & excel export)	Model element tagging for CAFM (Non COBie)	O&M Info	Comment
EMPLOYERS INFORMATION REQUIREMENTS - Appendix E - NHSS Facility/ Estate Asset Management System (EAMS) Requirements							NHS SCOTLAND
Local Sheet Status: Revision [Pxx] Amended By [XX]							
EAMS top section reflects standard data delivery requirements for all NHSS projects. O&M lower section to be reviewed at project EIR production stage and updated to reflect specific information delivery requirements.							
EAMS PROJECT SETUP / LIFE CYCLE SURVEY DATA							
Site Information							
Required data	Site Code	A unique SRN that identifies a site owned, leased or occupied by an NHS organisation. Code available from NHS Boards		YES			Up to 10 Characters. COBie.Facility.LandTitleNumber
	Site Name	A name by which a site is known. Site names to be provided by NHSScotland		YES			Up to 10 Characters. COBie.Facility.SiteName
	Site Status	The Site Status (Land) should be selected from the EDMS picklist	YES				EAMS picklist
	Essential	If the Site is an Essential Site select 'Yes' from the picklist, otherwise select 'No'	YES				EAMS picklist
	Site Future Plan	The Future Plan for the Site (Land), in relation to disposals	YES				EAMS picklist
	Land/ Site Area (Ha)	Land Area entered in Hectares	YES				Up to 2 decimal places. Manual EAMS entry.
	Site Grouping	The NHS Organisation responsible for maintaining the information on this Site	YES				Selected from the EAMS picklist for the Site Grouping.
Ideal data	Site Address	The first line of the address for the Site		YES			COBie.Facility.SiteDescription
	Town		YES				Manual EAMS entry
	Postcode		YES				Manual EAMS entry
	County		YES				EAMS picklist
Optional data	GIA (m2)	Enter the Site Gross Internal Area (GIA) in square metres		YES			Rounded to the nearest (m2). COBie.Facility.GrossArea
	Site Cross Reference		YES				If the Site is known by a different code or other reference then

Figure 6-8 Extract of NHSScotland Facility/Estate Asset Management System (EAMS) Requirements (Appendix E)

Step 3 Define COBie data requirements

The NHSScotland COBie Data Requirements template (Refer to EIR Appendix F) helps you consider what information you need for Facilities Management (FM). Figure 6-9. Construction Operation Building information exchange or COBie, is an open standard to enable the transfer of FM information, capturing critical information for building owners and operators to assist with the management of their assets within a facility. It is supported by a standard BS 1192:4 (Refer to section 1) and is focused on "managed assets" – that is, assets which will require maintenance, regular inspection and checks and in some cases, replacement parts for example, details of equipment, such as a boiler would include information describing what type of boiler it is, when it was commissioned, but also where that boiler is located within the asset. This information is produced throughout the design, construction and commissioning stages, by a number of different parties and exchanged at defined "information exchange" points. While designers provide general information such as spaces and equipment, contactors will refine this to include make and model numbers.

The template lists out the full COBie deliverables which should be reviewed and finalised during the development of the EIR. The template also captures additional COBie parameters to generate data for import into the NHSScotland EAMS, 3i Studio. A detailed project specific COBie Responsibility & Delivery Matrix should be developed by the PSCP as part of the Post- Contract BEP production.

Figure 6-9 Extract of NHSScotland COBie Data Requirements (Appendix F)

6.6 NHSScotland Information Delivery Plan

With your information requirements now defined, you need to turn your attention to how you will communicate how and when the information is to be delivered. Figure 6-10.

Using the NHSScotland Model Production and Delivery Table (MPDT) template, you need to map out the required Level of definition for each system, or element against project stages, milestones dates together with who is responsible for the production and delivery of the information. (Refer to EIR Appendix) See section 7 for more detail.

Figure 6-10 Extract of NHSScotland Model Production & Delivery Table (Appendix C)

While the Model Production and Delivery Table or MPDT considers model and graphical elements, the Information Exchange Requirements template (Refer to EIR Appendix B) helps boards to articulate broader non graphical information requirements such as performance, specifications, strategies and statutory requirements. Figure 6-11. For example, at RIBA stage 02 Concept stage / SCIM OBC Outline Businesses Case, the NHS Board will want to understand the Fire Strategy, and therefore will have a requirement for an outline fire strategy summary that is relevant to the building context, function, levels, zones, target occupancy etc. Within the Information Exchange Requirements template, you

should also state the form that the information should take, such as 3D models, 2D PDF Drawings, 2D .dwg drawings, COBie, and Documentation.

These documents allow the PSCP to review the NHSScotland Boards' information requirements and confirm their ability to provide the required information, by the appropriate resources, in the appropriate formats and at the appropriate project stage or decision gateway. It is therefore important that any proposed variations, amendments or additions to the plan are brought to the NHSScotland Boards attention via bidders pre-tender BEP.

INFORMATION EXCHANGE 02										
RIBA Stage (PoW 2013)	SCIM Stage	Objective	Description	3D Models	2D pdf drawings	2D dwg drawings	COBie-UK-2012	Documentation		
		Overall Form and Content				X = REQUIRED (add/ delete as appropriate)				
		Space planning	Overall Zoning. Approximate scale of spaces and the building as a whole. Required adjacencies and circulation pattern	X	X		X	X		
		Site and Context	Relationship to adjacent buildings and external users' circulation	X	X		X	X		
		Surveys								
		External Form and Appearance	Outline approach to external appearance, materials and treatment relationships. Concept visualisation for client / external stakeholders		X			X		
		Building and Site Sections	Outline approach to overall building form, volume, levels, critical heights. Concept visualisation for client / external stakeholders / statutory authorities		X			X		
		Internal Layouts								
		Design Strategies								
		Fire	Outline fire strategy summary relative to building context, function, levels, zones, target occupancy etc.		X			X		
		Physical Security	Outline physical security strategy relative to building context, function, levels, zones, target occupancy etc.		X			X		
		Disabled access	Outline disabled access strategy relative to building context, function, levels, zones, target occupancy etc.		X			X		
		Maintenance access	Outline maintenance access strategy relative to building context, function, levels, zones, operational requirements etc.		X			X		

Figure 6-11 Extract of NHSScotland Information Exchange Requirements (Appendix B)

6.7   Section summary

Your Client Information Model defines the strategy for how data will support the operational and capital expenditure strategy, informing decision making through the project lifecycle and also defining the MIDP. In the next section we consider how your information requirements are articulated to the supply chain via your Employer's Information Requirements.

7 Creating the Employers Information Requirements (EIR)

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With your Information Requirements clearly defined, we need to consider how these are articulated to the supply chain. The Employers Information Requirements (EIR) document combines the requirements of the OIR's and AIR's together with further inputs to define what information you want, when you want it, and in what form the standards and processes that are to be adopted. The EIR forms part of the appointment and tender documents on a Project to enable suppliers to produce their initial BIM Execution Plan (BEP).

The EIR describes:

- **WHO** shares the information – Outline responsibility Matrix
- **WHAT** information is needed – Information Requirements
- **WHEN** information is required by – Project milestones
- **WHY** Board information needs shared – Information purpose
- **HOW** information is produced – Standards and processes to be followed

Regardless of if your project is level 1 or level 2 you will still need to clearly define your information requirements. A Level 1 EIR will be 'lighter' than a Level 2 EIR, however they still share the same common components. A good EIR should establish information requirements especially those from the models which will subsequently inform the MIDP and BIM Protocol.

The NHSScotland EIR template and associated appendices shall be adopted and form part of the appointment and tender documents on all NHSScotland BIM projects. The EIR template provides a minimum baseline of information and level 2 deliverables that include:

- 3D Domain Model(s) of the Buildings and infrastructure in both editable format and aggregated in formats for FM Viewing.
- 2D drawings based upon the 3D model(s) and fabrication and manufacturer drawings
- Asset data derived from the 3D model object attributes.

As the NHSScotland BIM protocol requires details of Building Information Models and Information Management processes, the EIR provides an effective platform to communicate these requirements as part of an appointment process.

Figure 7-1 shows how the various components of the appendix come together to articulate NHSScotland Boards information requirements and informs the NHSScotland Information Delivery plan. The EIR becomes the vehicle in which these requirements are communicated to the PSCP and supply chain. (Shown Blue). The Red component show the various components of the PSCPs responses which are articulated back to NHSScotland Boards by the BEP.
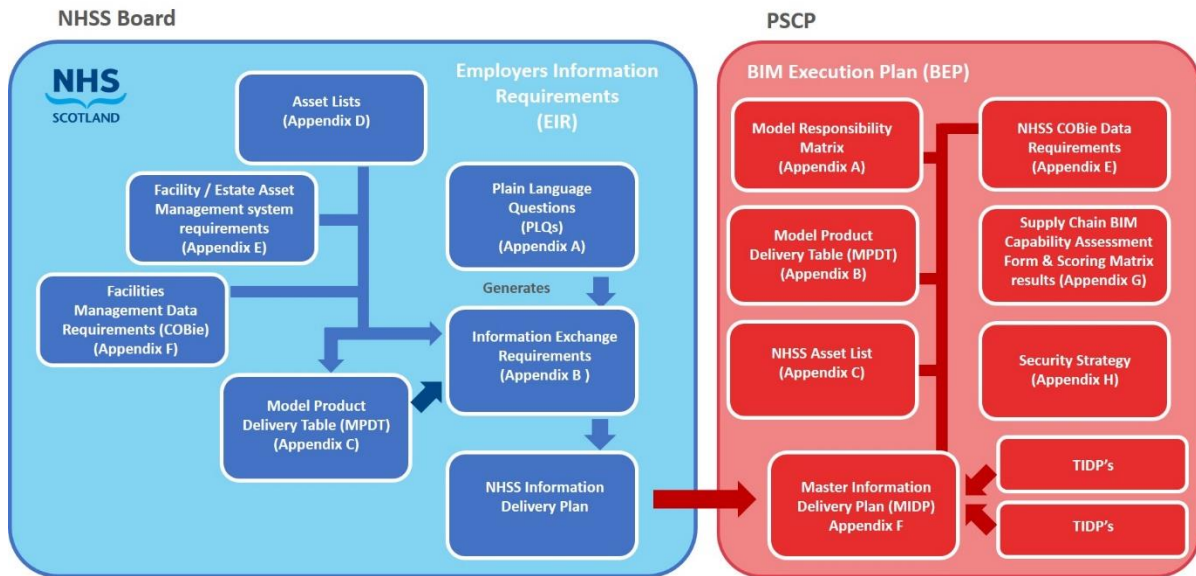
Figure 7-1 NHSSCOTLAND Boards requirements & supply chain response

7.1.1   EIR Content

The main body of the EIR document is structured into three main sections Technical, Management and Commercial, each outlining the project delivery requirements and forming the basis for development of responding pre- and post- contract BIM Execution Plans. The EIR also outlines the standards and processes to be adopted during the project delivery phases. The document structure has been adapted from an industry standard template but further developed to capture the typical NHSScotland BIM delivery requirements. (Figure 7-2)

The associated EIR appendices establish the overall project information requirements and associated deliverables. They outline the required level of definition (WHAT), described in terms of geometry (levels of detail) and information requirements (levels of information), the means of information exchange (HOW), and the key delivery stages (WHEN) aligned to SCIM and overall project programmes.

1. **Technical** – details of software platforms, CDE, CAFM Systems used by the client, definitions of levels of detail etc.

2. **Management** – details of management processes to be adopted in connection with BIM on a project.

3. **Commercial** – details of BIM deliverables, timing of information exchanges and definitions of information purposes

Figure 7-2 NHSScotland EIR contents

7.1.2 TASK Creating your Project EIR

NHSScotland Boards should develop the EIR as early as possible. (Ideally pre-appointment or pre-contract and before the appointment of design and construction suppliers). NHSScotland Boards may produce the document in house, or seek a suitable experienced professional advisor on their behalf. The points at which information exchanges are required should be specified in the EIR by reference to the applicable work stage and decision gate (or point).

Step 1: Completing the Technical section of the EIR

This section establishes the project technical delivery requirements to ensure the sequential delivery of a Project Information Model (PIM). All responses and agreed protocols shall be recorded in the BIM Execution Plan (BEP).

Software Platforms NHSScotland Boards should communicate their software platforms and versions where known and where they might influence the preparation of a bid by the supply chain. You should define your software platforms for the CDE, CAFM System, CAD Systems (and BIM Systems if Level 2). As a public body OJEU rules preclude NHSScotland specifying and making a selection based on proprietary systems. This means that you should not dictate what software solutions the supply chain must use, however you should still state the versions and platforms that are used to prepare the information exchanges that the supplier will receive. The supply chain should confirm their ability to use and integrate with these platforms within the BEP.

The supply chain should also seek agreement with the NHSScotland Board and project management team should there be any update or change in software versions during the project duration.

Data Exchange Format It is best to agree this with the project team as early as possible so everyone is clear on the expected deliverables. In order to make the exchange of data as efficient as possible, agree the version of format that is to be used.

It is also advisable to agree with the project team how you intend to acknowledge receipt of digital data. Will this be by way of a confirmation email? Completed issue sheet? Whatever method is agreed upon, you should ideally try an initial data transfer to test out your established procedure and ensure that everything is running smoothly. As such before any data exchange of project information takes place, the lead designer should facilitate a trail exchange of data and linking of models via the CDE to text quality and integrity.

At BIM Level 1 the exchange of information this is likely to be a mix of paper and CAD, however all projects still require raw data. The Data set is the same, the difference is how it is produced. You should define a matrix of exchange formats (both native format and exchange format as a minimum:

- CAD Files (.dwg)
- Document sand Reports (searchable .PDF files)
- Tabular data
- Asset Data
- Analysis
- Survey data

In addition to the above, BIM Level 2 projects will require native 3D object based model files, COBie and reviewable PDF files. It is important that the supply chain understand that this information should be generated from the same data set. You should also consider other file formats you may need to

support intermediate and final information exchange deliverables such as text files (.doc and PDF), Photos (.jpeg, .png), Videos (mp4) for example.

You need to consider any upward stream software systems that may potentially use the data such as EAMS 3i studio or a CAFM system. If data is to be exchanged using a native file format, (the file format specific to the software that produced the data) then consider any backward compatibility issues to ensure you can open and read the data.

Coordinates You need to adopt a common coordinate system for data, to ensure consistency. At level 1 this is likely to include grid reference, Intersection of grids in global coordinates Eastings and Northing, Datum information and finished floor levels (FFL) as well as establishing the units that are to be used.

In addition to the above, BIM Level 2 projects should also include 3D geo-location coordinates, origin rotation and offsets

Level of Definition The project Level of Definition requirements are scheduled in the Model Production and Delivery Table (MPDT). Essentially it is a high level list of model deliverable and key building elements and acts as a High level responsibility matrix. Thinking about information in a logical way for example from the substructure, to the superstructure through to the building envelope and internal and external finishes provides a good 'aide memoire' and way for NHSScotland Boards to check that they have received the information they need. It also serves as a way for the supply chain to understand the information they need to deliver and a way to check that they have received any expected information from others within the supply chain.

While NHS Boards may have an idea of the information they will require, they are unlikely to know everything about the project from the outset. Therefore information requirements are developed overtime with the help and input of various NHSScotland Stakeholders and the wider project team. Using the Model Production Delivery Table (MDPT) template (Refer to EIR Appendix C) NHSScotland Boards should work through the listed work packages which are listed by NRM1 (BCIS Elemental) and amend to suit and reflect the particular project. Not all the listed work packages will be applicable to your project and additional items may also be needed depending upon the project's needs.

Against each item in the list you should map the following:

- General Level of Definition (Level of Detail & Level of Information) against project stages and key milestone dates to support NHSScotland Boards PLQ.
- Identify which party is responsible for the production and delivery of the associated information.
- Add the appropriate Uniclass 2015 code from the relevant Uniclass table. To help with this task the NBS BIM Tool kit contains a searchable database, or downloadable excel spreadsheet of the Uniclass2015 table. These are helpful as Uniclass2015 has been mapped to NR1.
- Consider if an Asset Tag and/or COBie data is required. This is indicated by a simple Yes or No. COBie data generally applies to 'Managed Assets',

It is important that the models included in the MPDT are identified within the EIR and that the MPDT is updated during the contract if the required models change.

Training NHSScotland Boards need to consider any training requirements they may need the bidder to deliver as part of their appointment/contract. At BIM level 1 this will be minimal, however at BIM Level 2 you should consider any 3D viewing software training for example.

While the PSCP should provide any training to the employer for access and operation of their CDE, NHSScotland Boards should also provide any training for the use of the employers CDE systems to nominated suppliers as agreed.

Step 2: Completing the Management section of the EIR

This section establishes the management standards, protocols and processes to be implemented throughout the project delivery stages. Methodical responses to the EIR shall be recorded in the BIM Execution Plan (BEP)

Standards Outline the standards, processes and procedures that need to be followed to effectively manage information on the project. The applicable BIM Level 1 and BIM Level 2 standards are outlined in table 2 'Applicable BIM standards, supporting tools and templates' within this document and the relevant documents should be listed within the EIR.

Roles and Responsibilities This section should set out clear roles, responsibilities and authority which should be specifically addressed within the contractual documentation. You should clearly communicate the allocation of roles associated with the management of project information. BS 7000:4 Table 1 highlights functions and titles to should consider, while additional roles for BIM Level 2 are described in PAS 1192:2.

NHSScotland Boards will typically be undertaking the following roles:

- Employers representative/Project Manager
- Information Manager (Client side)
- Commissioning Manager
- Soft Landings Champion
- Built Asset Security Manager

Planning the Work and Data Segregation Information management and naming conventions set out in BS 1192 should be used. Within a BIM Level 2 project, you will also need to set out the naming for zones and also manage information in accordance with the processes described in BS 1192:2007, PAS1192:2 and part 3).

You should also consider any NHSScotland internal standards that the supply chain is to follow.

Security This section communicates NHSScotland Boards specific security measures required in order to manage sensitive data and information. Details should also be sought in terms of security in relation to the suppliers CDE.

NHSScotland Boards have an obligation to appoint a Built Asset Security Manager. Typical duties are outlined in section 5.1 and will have a key role in completing this section. Refer to Strategy to Determine the Built Asset Security. Further details can also be found in the *NHS Scotland Mindful Security Guidance* document.

Coordination and Clash Detection Define the required coordination processes, together with requirements for quality control. A BIM Level 2 project will also include 3D spatial clash detection.

Collaboration Process Define how where and when project information will be shared and also any specific requirements around the archiving of information.

Health and Safety / Construction, Design & Management (CDM) Regulations As an organisation, NHSScotland expects the utilisation of BIM to support the project Health & Safety / CDM management process as required under the Construction (Design and Management) Regulations 2015. BIM provides

greater opportunities to identify "foreseeable risk" much earlier, and continuously, throughout a project's lifecycle, and to communicate the risks more clearly for use by others. PAS 1192-6:2018 'Specification for collaborative sharing and use of structured Health and Safety Information using BIM' (Refer to section 1) aims to integrate Health and Safety information into BIM models, processes and applications. As part of the collaborative nature of BIM, all stakeholders can contribute to management and mitigation of H&S risks and improve outcomes. The opportunity also exists for the output of a health and safety file as part of the BIM information that can be transferred to the NHSScotland estate team in an electronic format.

As a client, the NHSScotland Boards should invoke the PAS via the EIR by way of a simple instruction. As such the NHSScotland EIR template makes specific reference to PAS 1192:6 and that a 5 phase H&S risk management strategy will be identified within the BEP, and that the supply chain shall adopt the 4-step Risk Information Cycle approach to 'Identify, Use, Share and Generalise' project risk information.

It is important to state within the EIR, what is expected of the supply chain. This involves explaining within the EIR, what the supply chain BEP should cover in this regard. This is then accepted and specified in the project BEP.

As a client, NHSScotland Boards have a duty under CDM to make arrangements to manage a project in order to ensure H&S and to provide H&S information. An effective EIR should focuses on the right level of H&S information, who is to provide it and at what point during the asset lifecycle, essentially specifying the information NHSScotland Boards need, including the information prescribed by the CDM regulations.

It is important that with your EIR you provide existing documentation, risk registers and risk studies to communicate risks so that identified elevated risks and associated H&S information can be recorded. There should also be a focus on the operational phase and any future health and safety considerations.

You should clearly set out, document and agree the specific requirements you need within the EIR and consider the following:

- Where or how H&S information is to be used
- What H&S information is to be provided or communicated
- The risk management tasks relating to elevated risks of critical mitigation.

System Performance This section outlines an Employer-side IT system limitations and/or hardware requirements that the supply chain need to consider when developing their BEP. It is important that the relevant NHSScotland I.T. staff are consulted early to advice on any limitations such as model file size for example.

Compliance Plan (Quality Assurance) A Quality policy should be in place to ensure that information and models are maintained over their lifetimes. At the outset of any project all facets of the organization of the project's graphical database should be formulated by the authors of the data with a view to satisfying end users.

NHSScotland Boards should seek proposals within the supply chains BEP for CAD Quality assurance/control procedures, data validation processes and details of how long the information shall be managed for. In addition to the above, BIM Level 2 projects should also seek assurance around modelling standards and BIM objects and also the governance and review process to ensure

compliance of the COBie / asset data deliverables between the Information Provider (PSCP/ Main Contractor) and the Information Receiver (Employer/ NHSScotland Board).

Delivery Strategy for Asset Information This section should define the minimum standard by which data may transferred in and out of the Asset Information Management System (AIMS) including data schema. You need to consider the format that you need assets information in and how will the information be delivered into your CAFM environments. You should describe your systems/databases and information formats you use, so that the supplier can meet compliance. In addition a BIM Level 2 project should also follow BS 1192-4 COBie).

Step 3: Completing the Commercial section of the EIR

This section establishes the information requirements, defined purposes for data, and the content of key deliverables aligned with the project work stages.

Clients Strategic Purposes The section defines the details of the expected purposes for information provided. It is expected that the primary use of the data will be for the following purposes:

Table 7-1 Clients Strategic Purposes

Required Information	Description
P01 Registration	To enable review and reporting of the registered assets
P02 Use and Utilisation	To enable evaluation of intended use pre- and post-occupancy and to provide data for any soft-landings requirements.
P03 Operations	Operational data to establish in-use requirements, costs analysis and to support soft-landings operational activities.
P04 Maintenance and Repair	To help establish maintenance task requirements, anticipated costs, required resources and spares
P05 Replacement	Information to determine asset replacement specification, supplier and expected lifecycle metrics.
P06 Assessment and re-use	To support assessment, end-of-use, re-purposing and facility capacity analysis
P07 Impacts	To enable economic and environmental (but not social) impacts and analysis of the facility.
P08 Business Case	The ability to continuously review and evaluate the business case, pre and post-handover is the main driver for the intermediate 'information exchanges'
P09 Security and surveillance	To support the assessment of the facility security and surveillance requirements and enable model/ data segregation amongst the supply chain/ FM team.
P10 Regulation and compliance	Information to support H&S and CDM activities during design and construction, and the safety of users/ operations in the facility post-handover.

Soft Landings / SCIM Commissioning Process This section communicates your SL and SCIM commissioning process to the supply chain. Refer to task 5.3 Create your Soft Landings approach.

BIM Capabilities and Experience In a BIM level 2 process the BIM execution plan (BEP) submitted on behalf of the principal supply chain partner should include a supply chain capability summary. The aim of this is to ensure that they and their supply chain have the necessary skills, capability and experience to work collaboratively.

It is important that the BEP be submitted by the PSCP on behalf of their whole supply chain and should demonstrate sufficient capabilities to demonstrate capacity and competence to meet with the boards EIR.

It is therefore particularly important that those undertaking assessment and procurement on behalf of the board pay particular attention not just to the tier 1 supply chain but also to the individual resource assessments from the lower tiers. It is important that the PSCP cascades information requirements especially those relating to BIM during their tender process. In practice this is often poorly managed and a price is still the overriding selection criteria. The PSCP should make sufficient time for proper reviews for capability and experience and more importantly resolve any issues prior to appointment.

Consideration should be given to appropriateness and that the assessment focus of key packages such as frame, envelope and building services. It is important that the PSCP makes sure that this assessment process is well documented and capable of verification by the board or their agent.

You should use the NHSScotland BIM Capability Assessment pack to help NHSScotland Boards determine the BIM competency and delivery experience of their consultancy / PSCP framework, pre-contract award. The pack is part of the EIR Appendix G and includes:

- Supply Chain BIM Capability Assessment guidance document
- Supply Chain BIM Capability Assessment Form (Questionnaire)
- BIM Capability Scoring Matrix
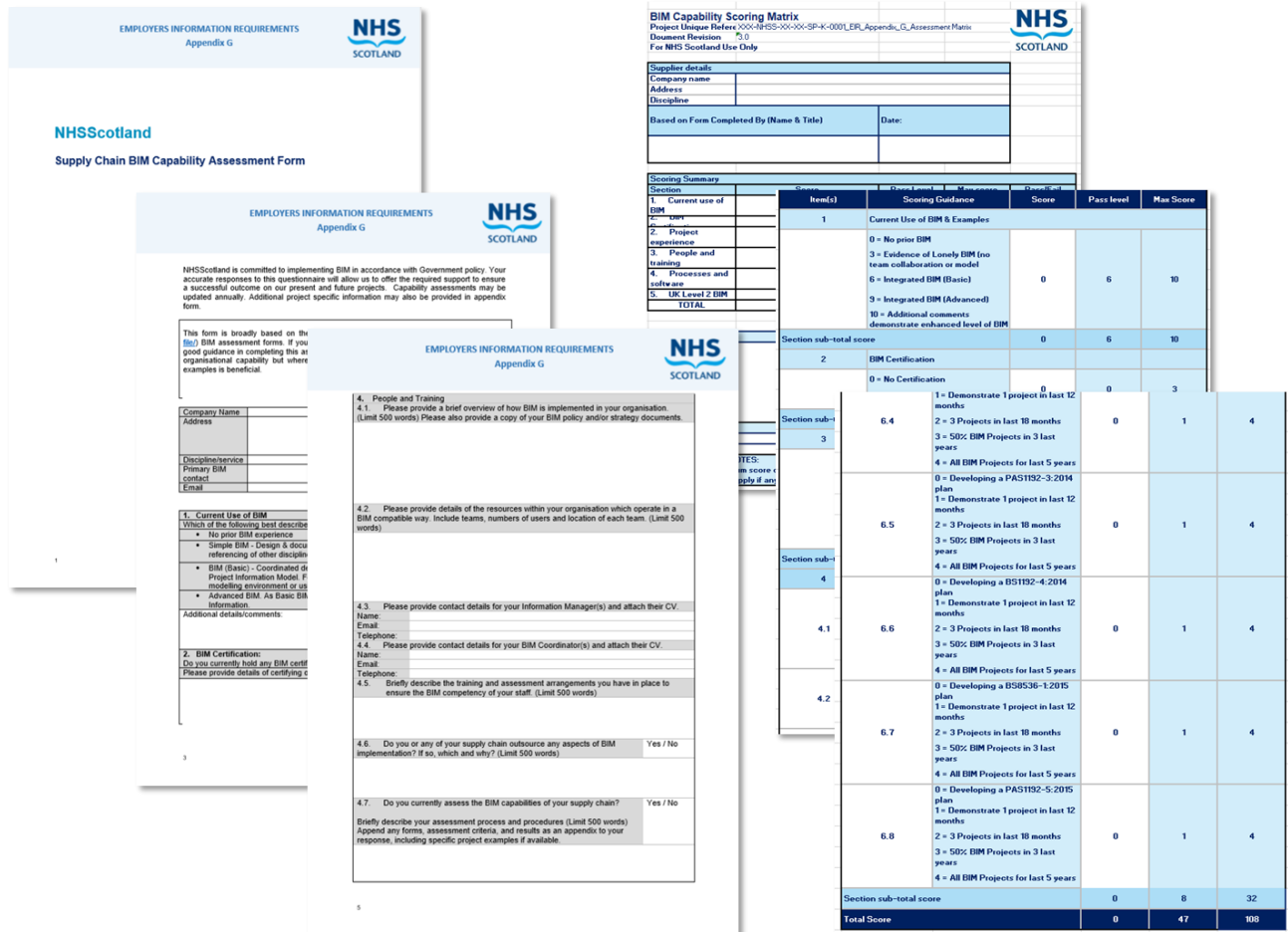
The assessment pro-forma should also be utilised by the Principal Supply Chain Partners / main contractor to re-confirm the final supply chains BIM capability and delivery experience post-contract award.

The assessment questions are based upon CPIx BIM, IT and Resource assessment forms, and augmented with questions found in PAS 91 prequalification questionnaires and the Scottish Futures Trust BIM Compass tool, located at: https://bimportal.scottishfuturestrust.org.uk/page/bim-compass

NHSScotland Boards should allow for between four to six weeks to undertake the following:

- Issue BIM Capability Assessment form with standard questions.
- Convert responses into a set of results using the associated scoring matrix
- Combine responses into a capability summary report for inclusion within the Project Implementation Plan (PIP)
- Use summary results to compare suppliers and highlight any areas requiring intervention or further investigation by the NHSScotland Board

7.2 Section summary

Your Employers Information Requirements (EIR) document combines the requirements of the OIR's and AIR's together with further inputs to define what information you want, when you want it, and in what form the standards and processes that are to be adopted.

The EIR forms part of the appointment and tender documents on a Project to enable suppliers to produce their initial BIM Execution Plan (BEP). In the next section we consider the supply chain response BEP and what Boards need to consider when assessing.

8 The supply chain response and the BIM Execution Plan (BEP)

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Your NHSScotland Board Project Employers Information Requirements (EIR) (see section 7) sets out your information requirements and expectations from the supply chain.

The supply chains response is in the form of a BIM Execution Plan or BEP, answering the questions set out in your EIR and explaining how they intend to produce the information and meet your expectations.

The BEP is delivered in two phases:

- The Pre-Contract BEP is the supplier's initial response to the EIR before an appointment has been made.
- The Post-Contract BEP is developed in more detail following contract award, and is a collaborative document that the supply chain feed into.

It is important to remember that the BEP is a live document and will change and be updated during the project lifecycle.

Suppliers will plan out the work by allocating which teams will be responsible for which sections of the project. This is set out in a responsibility matrix. The BEP will also contain what information is needed and by when in a master information delivery plan or MIDP and also describe how information is intended to be shared.

Because your EIR is very prescriptive about your information requirements it should make comparing one supply chain with another easier.

8.1 Master Information Delivery Plan (MIDP)

The supply chain will review your Boards information requirements and confirm their ability to provide the required information, by the appropriate resources, in the appropriate formats and at the appropriate project stage or decision gateway. It is important that any proposed variations, amendments or additions to the plan is brought to the NHS Boards attention via bidders pre-tender BEP.

Once the contract has been awarded, the PSCP (Main Contractor) will continue to develop part of the MPDT to ensure that all parties feed into the overall Project Information Model (PIM) and final Asset Information Model (AIM) and that all parties are aware of their responsibilities for each respective project stage and information exchange(s). The MPDT informs and helps develop the supplier's post-contract information delivery plan, known as the Master Information Delivery Plan (MIDP) which forms part of the post contract BEP.

The plan lists all the required models, as well as a list of outputted deliverables from the model, such as Models, drawings, Specifications, equipment's schedules, room data sheets together with associated documentation. The LOI delivered at each information exchange helps NHS Boards to sufficiently review and approve against the project requirements, and allow subsequent progression to the next stage.

When reviewing the BEP, you should refer back to your Plain Language Questions (PLQ) to ensure that the response will provide you with the information you need in order to make a key decision at a particular stage.

The MIDP is formed by collating individual Task Information Plans (TIDP), which are prepared by other team members of the supply chain, such as designers, sub-contractors and product manufacture and suppliers. Each TIDP documents team member responsible for the delivery of each suppliers information. The collating of TIDPs into an overall MIDP takes into consideration any required sequencing of work packages.

8.2   TASK Receiving and reviewing supply chain information

The MPDT is developed following contract award by the PSCP (Main Contractor) enabling all parties to contribute and feed into the overall Project Information Model and final Asset Information Model.

NHS Boards and suppliers will need to agree what data and other deliverables are required to answer the PLQs. These are documented in the post-appointment BEP using Task Information Delivery Plans (TIDP).

You will need to determine how information is to be received and reviewed as part of your decision making process. Information required to respond to the PLQs will be developed by the project team, using the CDE to exchange information within the team.

Once the contract has been awarded, the PSCP will continue to develop the MPDT to ensure that all parties feed into the overall Project Information Model (PIM) and final Asset Information Model (AIM) and that all parties are aware of their responsibilities for each respective project stage and information exchange(s). The MPDT informs and helps develop the supplier's post-contract information delivery plan, known as the Master Information Delivery Plan (MIDP) which forms part of the post contract BEP.

The plan lists all the required models, as well as a list of outputted deliverables from the model, such as Models, drawings, Specifications, equipment's schedules, room data sheets together with associated documentation. The LOI delivered at each information exchange helps NHS Boards to sufficiently review and approve against the project requirements, and allow subsequent progression to the next stage. Validation of the Plain Language Questions (PLQ) in Appendix A should form part of the NHS Boards stage review process.

9   Considering enabling technology
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Information Technology [IT] plays a fundamental role in facilitating the effective, accurate exchange and reuse of data and information. It is an enabler for BIM and collaborative working and should therefore play an important part within your BIM strategy. Scotland's Digital Future: High Level Operating Framework (2017) provides a collection of I.T. architecture principles. A key principle is the encouragement of the reuse and sharing of existing assets before buying and building new ones. With this philosophy in mind it is worth considering your current technology stack and software capabilities and understand if any current technology solutions functionalities could be further exploited or adapted to suit.

9.1   Understand your current network infrastructure & equipment

Before we consider specific software applications, it is important to understand your current underlying network infrastructure and staff computing equipment as this will form the firm foundation from which to implement and run the necessary applications and management systems. During this assessment, you should consider existing networks, connections, software systems and hardware to ensure that they will achieve the right level of performance needed to implement technology solutions. You should also map your current processes, to help identify any gaps in your existing processes, technology and skill base.

With many software solutions now being offered as a Software as a Service (SaaS), you need to ensure that you have sufficient secure and stable internet connections upon which to operate them.

Having an early dialogue with internal IT resources will help you establish your current capability and capacity for managing and implementing a new technology stack. Implementation will likely to be phased, replacing legacy systems over a defined period of time. This is to ensure that new ways of working and the skill sets required are embedded as far as practically possible. When assessing existing software systems it is important to understand and communicate with your organisation any retention or future replacement plans.

Items you should consider as part of your assessment include:

- What key decisions do you need to make?
- Do all computers have access to a local server?
- What key software is currently installed?
- Do your current systems support open data formats?
- Any capacity functionally or performance issues that need to be addressed?
- Is remote access required?
- What is the required or recommended internet speed?
- Reliable Internet Service Provider (ISP)?
- Adequate line size for internet?
- Adequate internal network?
- Adequate internet connection for remote workers?
- Correct browser support?
- Applications to install?

9.1.1   Software

With an assessment of your current infrastructure situation complete, you can now turn your attention to any software requirements. Your department or team members may have particular

views and prior experiences of supporting software, however it is also wise to consult with other boards and find out about their success stories and challenges.

Software vendors themselves will be promoting and pushing their own solutions, but it is important to understand that there will not be a 'one size fits all' approach, or a particular prices of software which will fulfil all of your requirements. Many software vendors will attend trade shows and conferences where you can learn more about the different market offerings available. You should also consider over digital methods of research and fact finding, such as through social media, webinars and online forums to help you make a considered choice.

Many vendors will offer a free limited trial period in which to try the software. If you do consider this, it is important to ensure that this will not have any effect or bias on any procurement selection tender processes in the future. If a free trial period isn't an option, you should consider asking shortlisted vendors to demonstrate their solution against a set of pre-determined questions

Before making a decision on any solution you should ask some fundamental questions. What do we want at the end of the journey? And 'what will the benefits be?' You should document this along with your detailed information requirements. This will help inform conversations with potential vendors and assist any tenders.

Successful implementation of technology and software will require a trusting and collaborative working relationship between NHSScotland and the vendor. When considering a vendor to work with you should consider the following as part of your assessment. Make sure the Right people involved in the implementation. This includes executive sponsor/ senior leader, IT. Project administrator – setting users up. Consider a phased roll out to allow adequate time to embed new technology, skill sets and ways of working. This may require using the solution on a pilot project or only using limited software functionality until a common baseline competency level is reached across the organisation.

Key vendor considers include:

- What key decisions do you need to make?
- Financial stability of vendor (and related risk)
- How well the products might integrate with each other (where multiple products were proposed as a single offering)
- Vendor development team size
- Year-on-year growth trends
- Key clients and referees/references
- Development roadmap
- Impact of system use on project teams (and their existing information management systems)
- Implementation services scope and/or methodology

10 Checklists

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10.1 BIM Grading and Return on Investment Checklist

Section 2 Pages 14 – 27

Section 2 BIM Grading and Return on Investment

Stage	Task	Responsibility
Stage 1 Preparation & Brief	Understand BIM Level 1 and 2 in the context of BIM Maturity	
	Understand at a high level the supporting BIM standards and tools	
	Use the SFT BIM grading tool to understand if BIM should be adopted and to what level	
	Use the SFT Return on Investment tool and other criteria to understand the Return on investment	
	Understand how to implement BIM, using this guide and the SFT BIM navigator NHSScotland landing page	

10.2 Information management and CDE strategy Checklist

Section 3 Pages 28 - 34

Section 3 Checklist Determine the Information Management and CDE Strategy

Stage	Task	Responsibility
Stage 1 Preparation & Brief	Determine the project's information strategy and how information will be shared in the context of the Common Data Environment	
	Define information hierarchy following principles set out in BS 1192	
	Appoint a party to undertake the role of Information manager as per Construction Industry Council - Information Management Guidance	
	Determine how information will be shared using a Standard method and procedure (SMP)	

10.3 Determine your strategy for Built Asset Security Checklist

Section 4 Pages 35 – 36

Section 4 Determine your strategy for Built Asset Security

Stage	Task	L1	L2	Responsibility
Stage 1 Preparation & Brief	Assess extent of security-minded approach required	•	•	
	Assess security risk to the built asset, in whole or in part (assess value, impact of loss, threats, vulnerabilities)	•	•	
	Decide on appropriate and proportionate mitigation measures commensurate with risk appetite	•	•	
	Formally record the organisations security strategy and management plan for the built asset	•	•	
	Implement appropriate and proportionate policies, processes and procedures	•	•	
	Determine the asset security requirements and develop a strategy to ensure capacity for ongoing evaluation during operational phases	•	•	
	Evaluate the requirement to appoint a build asset security manager at the project outset	•	•	

10.4 Determine your Soft Landings approach Checklist

Section 5 Pages 37 – 41

Section 5 Determine your Soft landings approach

Stage	Task	Responsibility
Stage 1 Preparation & Brief	Establish the operational vision and strategy , including the required performance targets of the proposed asset/ facility	
	Identify all stakeholders requirements for functionality, operational and facilities management of the project asset (AIR)	
	Conduct stakeholder engagement, assimilate lessons learnt from existing AIM's, asset stock and industry case studies	
	Appoint an owners representative to establish, oversee and manage the soft landings process for delivery of the AIM	
	Determine the requirements, training, systems and process for project and asset information delivery	
	Establish exchange points at project work stages for information/ data delivery (KPI's, asset data, PLQ validation)	
	Identify performance metrics, benchmarks and methodology for asset performance measurement during the operational phase	
	Assess requirements for project information transfer into the AIM and integration into any EDMS/ CAFM system	
	Establish initial target costs for both capital and revenue/ operational expenditures	
	Prepare capital and operational cost estimates including a methodology for whole lifecycle cost assessment	

10.5 Creating the Client Information Model Checklist

Section 6 Pages 42 – 54

Section 6 Creating the Client Information Model

Stage	Task	Responsibility
2 – Concept Design	Establish governance processes to effectively manage information, referencing Asset Management Strategies and Plans	
	Establish Organisational Information Requirements to meet the needs of an asset management system or organisational functions	
	Envision 'triggers' regarding information management to inform the Asset Information Requirements	
	Define asset management activities to be carried out	
	Define the specific Asset Information Requirements to satisfy the Organisational Information Requirements	
	Define data structure and classification of information to be included inside of the AIM	
	Define the information exchange points to transfer information to and from the Asset Information Model	
	Define mechanisms to create, verify/validate, store, share, archive, analyse and report on the information contained within the AIM	
	Define the interfaces for exchange of data and information between the AIM and other organisational information systems	
	Define the mechanisms for maintaining the quality and integrity of the data/information contained in the AIM through use of a CDE	
	Ensure the roles and responsibilities for information management have been considered and defined	
	Processes and Procedures for information management have been considered and specified	
	Risks relating to information management have been considered	
	Information exchange with other stakeholders has been considered	

10.6 Creating the Employers Information Requirements Checklist

Section 7 Pages 55 – 63

Section 7 Creating the Employers Information Requirements

Stage	Task	Responsibility
2 – Concept Design	Define the client/employer key strategic decision points	
	Define the 'Plain Language Questions' required to be answered using the information exchanged at the key decision points	
	Assign role of Project Delivery Manager to manage the authoring of the Employer Information Requirements	
	Ensure that the Employer Information Requirements are included in project contracts to avoid duplication of responsibilities, contents should be inclusive of Information Management, Commercial Management and Competence Assessment	
	Ensure that bidders submit details of their approach to project information management in a pre-contract BEP to support answering the Plain Language Questions	
	Ensure bidders have the capability, competence and experience to deliver the project through review of the Project Implementation Plan (PIP) received as part of the pre-contract BEP	
	Outline the specific ownership and operational purposes of the proposed facility within the EIR	
	Collate a register of required facility assets (spatially and physical) for inclusion within the EIR	
	Within the EIR specify COBie as the required information delivery format from the lead consultant and/or the lead contractor	
	Outline the security requirements for any sensitive or confidential information within the EIR, including security strategy, policy, process and procedures	
	Determine the timing and content of interim and final handover information requirements from the supply chain	
	Specify the project information deliverables at each work stage for monitoring, assessment, performance, validation and project lifecycle decision making	
	Establish a suitable CDE for storage, maintenance and archiving of facility information, asset portfolio and operational applications.	
	Ensure internal procedural and quality systems are established for the receiving and auditing of the supply chain information transfers	

10.7 Creating the Employers Information Requirements Checklist

Section 8 Pages 64 – 65

Section 8 The supply chain response and the BIM Execution Plan (BEP)

Stage	Task	Responsibility
3 Developed Design	Review Supply Chain response to BEP	
	Implement BIM Protocol where appropriate	
	PIM: Review data Exchanges and validation against PLQ	
	Ensure that the MIDP has been produced by the PDM and a project induction meeting has been undertaken	
	Ensure that Project Delivery team roles and responsibilities have been embedded into contracts and appointments	
	Ensure information management roles are defined and confirmed	
	Check or appoint a representative to check information received complies with the EIR and authorise information to pass through the shared area of the project common data environment to the published documentation area	
	Ensure that processes are in place for sign-off information and request publication.	
	Review security strategy regularly, and in response to incidents and breaches significant internal or external changes	
	Undertake regular model review meetings	

Section 8 The supply chain response and the BIM Execution Plan (BEP)

Stage	Task	Responsibility
4 Technical Design	PIM: Review Data Exchanges and validation against PLQs	
	Review security strategy regularly, and in response to incidents and breaches significant internal or external changes	
	Undertake regular model review meetings	

Stage 5 Construction

Stage	Task	Responsibility
5 Construction	PIM: Review Data Exchanges and validation against PLQs	
	Review security strategy regularly, and in response to incidents and breaches significant internal or external changes	
	Undertake regular model review meetings	

Stage 6 Handover and Close Out

Stage	Task	Responsibility
6 Handover and Close Out	Data Transfer to Asset Information Model	

Stage 7 In Use

Stage	Task	Responsibility
7 In Use	Data Transfer to Asset Information Model	

NHSScotland Building Information Modelling (BIM) Guidance v02

11 Useful links and resources

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SFT BIM Portal https://bimportal.scottishfuturestrust.org.uk

Free portal providing clear guidance in the implementation of BIM within public sector procurement. This is to support the Public Sector derive greater value from their built assets through a collaborative and digitised way of working.

BSI BIM Level 2 Website https://bim-level2.org

A resource created a as a point of reference for clients, designers, contractors, trade suppliers, manufacturers, maintainers, operators and users to understand how to use BI\FM and data to improve productivity and reduce waste. Includes links to the Level 1 and Level 2 standards.

Construction Scotland Innovation Centre - www.cs-ic.org

The construction Scotland Innovation Centre (CSIC) connects industry to world leading academic expertise. Developed with industry our support streams include: product, process, business and service. Their aim is to support and link expertise around the country to find solutions to your innovation challenges

The B1M - www.theb1m.com

Free educational videos on the subject of building information modelling. Also distribute a worldwide print and digital newspaper with the latest stories and need-to-know information.

Cambridge Digital Built Britain (CDBB) - www.cdbb.cam.ac.uk

Partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge to deliver a smart digital economy for infrastructure and construction for the future and transform the UK construction industry's approach to the way we plan, build, maintain and use our social and economic infrastructure.

NBS BIM Toolkit - https://toolkit.thenbs.com

The NBS BIM Toolkit is a free-to-use BIM project management tool that provides step-by-step help to define, manage and validate responsibility for information development and delivery at each stage of the asset lifecycle in Level 2 BIM projects.

RIBA Plan of Work 2013 - www.ribaplanofwork.com

The RIBA Plan of Work comprises eight work stages each with clear boundaries and details the tasks and outputs required at each stage, taking into consideration BIM and Sustainability.

buildingSMART - www.buildingsmart.org

Worldwide authority driving the transformation of the built asset economy through creation & adoption of open, international standards

BSI - https://shop.bsigroup.com

BSI Group, also known as the British Standards Institution, is the national standards body of the United Kingdom. BSI produces technical standards on a wide range of products and services, and also supplies certification and standards-related services to businesses.

Frameworks Scotland 2 - www.frameworks-scotland2.scot.nhs.uk/

Frameworks Scotland 2 is a procurement programme which provides a wide variety of construction-related services for both new build and refurbishment projects. This national Framework is an agreement with five Principal Supply Chain Partners (PSCPs) selected via an Official Journal of the European Union (OJEU) tender process up to 2019.

Reports

Realising Scotland's full potential in a digital world: a digital strategy for Scotland – Available from www.gov.scot

HFS Contact:

Digital Estate and Asset Management Team

Email - nss.DEandAMTeam@nhs.scot