UK BIM FRAMEWORK

ISO 19650 Guidance 1: Concepts

UK BIM FRAMEWORK HOME

Editions (Guidance 1)

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Edition 1	Unknown	First release.
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Table of contents

List of figures

List of tables

Abbreviations and acronyms

Refer to Abbreviations and acronyms.

Introduction

The BS EN ISO 19650 series of standards (herein after referred to as the ISO 19650 series) supersede some of the existing British Standards and Publicly Available Specifications related to building information modelling (BIM). The ISO 19650 standards are part of a landscape, or ecosystem, of national and international standards supporting information management processes and technical solutions. Some of these standards are noted in Annex A of this guidance where the expected progression of their development is explained.

The ISO 19650 series considers all information [2] whether it's a construction programme, a record of a meeting, a geometrical model or a contract administration certificate.

The ISO 19650 series is an international standard of good practice. It defines information management principles and requirements within a broader context of digital transformation in the disciplines and sectors of the built environment (including construction and asset management industries). Its implementation in the UK is supported by UK National Forewords in ISO 19650 Parts 1 and 2, and a UK National Annex in ISO 19650 Part 2.

This Guidance Framework is being developed particularly to support implementation of the ISO 19650 series in the UK.

[2] The term 'information' can be read to mean data or facts put into context and interpreted by a person (in short, data which has meaning).

1.0 Why does information management matter?

1.1 History and initial motivation

Digital transformation of the UK built environment industry is a cornerstone of the Government Construction Strategy 2016–2020 which seeks to 'embed and increase the use of digital technology'. Pivotal to this shift is adoption of building information modelling (BIM) which is changing the way we design, build, operate and integrate our built infrastructure.

The 2011 BIM Working Group Strategy Paper set out a hypothesis and several tests to develop a strategy for the widespread introduction of BIM with increasing maturity: 'Government as a client can derive significant improvements in cost, value and carbon performance through the use of open sharable asset information'. This was accepted and published as the BIM mandate in the Government Construction Strategy 2011.

Since 2011 central Government departments within the Home Nations [3] and a variety of private sector clients have tested this premise. The outcomes of these early adopter projects have demonstrated a significant value proposition of purpose-driven, structured, verified and validated information models and their managed exchanges in a collaborative and secure environment (some case studies supporting information management can be found at: https://bimportal.scottishfuturestrust.org.uk/page/bim-case-studies).

[3] England, Scotland, Wales and Northern Ireland.

1.2 Goals and opportunities

Information management using building information modelling can enable dramatic improvement in delivery and performance efficiencies by catalysing increasingly innovative ways of working across the built environment. As an information-based industry, this approach is helping to support better strategic decisions, improved predictability through better risk management and – when coupled with a soft landings methodology (Annex B of this guidance) – can lead to certainty of operational outcomes and improved learning.

We are witnessing an ever-increasing rise in capability and capacity for BIM methodologies [throughout the project team] and equally in the opportunities they are unlocking at all levels within the supply chain.

Advancing information management methodologies by making BIM according to the ISO 19650 series as business as usual, and enabling better connections between data and improved decisions and insight, are essential if we are to move to a 'digital built Britain' (DBB). A DBB represents a huge step forward for the UK with its goals in delivering better whole-life economic, social and environmental value from our assets along with the championing of human-centric design. We need to be ambitious in our aspirations to realise transformation across the industry and able to explain them clearly. The ISO 19650 series sets out stages of maturity which can be seen in ISO 19650-1 Figure 1. The Centre for Digital Built Britain has signalled a shift in the UK from the language of 'BIM levels' to a whole-life approach (encompassing Design, Build, Operate and Integrate) to digital transformation, of which BIM implementation has been a fundamental first step, as now encompassed by the shift to ISO 19650. Information management as defined in the ISO 19650 series depends on each party (for example: client, designers, contractor, and subcontractors) taking responsibility for their part of the overall process. This means that clients who simply ask for 'a BIM project' will not meet the requirements of the ISO and will not achieve the benefits. Their part in setting out exactly what they require, as explained in ISO 19650, is fundamental. Similarly, using inappropriate tools (for example, a shared drive as a common data environment solution) will not meet the ISO 19650 requirements either.

1.3 The wider landscape of digital transformation

The digital transformation of the UK built environment sector requires new standards and methods of project delivery. As a result, the role of ontological approaches to information management, consistent information taxonomies and agreed protocols and processes for information exchange have become critical. Having standardised good quality information means it can be exchanged, integrated and interrogated for different purposes across a range of, including cutting edge, technologies.

In response to the low levels of productivity found in the global construction sector, the UK Government's Made Smarter Review sets out a vision and plan for creating an environment where industrial digital technologies will lead the development of the UK economy. A root cause of this low productivity is the high transaction cost of information exchange and lack of transparency in the industry.

There is a movement within both public and private sector clients to develop innovative practices that improve the performance of all sectors within the built environment. These practices include the production of object-based information models and simulations of physical systems and assets, which will help manage risks and provide greater assurance in key decision making. This approach will enable greater automation of standard processes during design and construction and into operations and maintenance. Intelligent models will be able to update in near-real time, using information from sensors and networked devices, and interacting and exchanging information with other systems through the Internet of Things. This will optimise performance, improve health and safety and end-user experience, and in doing so, will enable smart cities to become a reality.

To achieve this requires more than new technologies. It needs new operating models that move from transactional ways of working to incentivised collaboration across industry, plus new standards, policies and capabilities. Developing new integrated business models and exploring the production of a national digital twin or a single unified information framework across infrastructure will enable the industry to capitalise on the digital transformation agenda. Implementation of information management is no longer a question of 'if'; it is now a fundamental part of delivering world-class social and economic infrastructure.

2.0 The rationale for the BS EN 19650 series

This section summarises what the ISO 19650 series means for building information modelling and information management. It also restates the case for implementing this on a project, who the target audiences of the ISO 19650 series are and how the ISO 19650 series relates to other management and process standards.

2.1 What is 'building information modelling according to the ISO 19650 series'?

'Building information modelling (BIM) according to the ISO 19650 series' is about getting benefit through better specification and delivery of just the right amount of information concerning the design, construction, operation and maintenance of buildings and infrastructure, using appropriate technologies. This helps deliver the efficiencies and savings envisaged by the UK Government and others, as explained in Section 1. The standard is about good practice throughout the whole project and asset management team. It applies throughout the whole life cycle of an asset and it applies to all types of asset in the built environment – buildings, infrastructure and the systems and components within them.

A successful outcome from adopting the processes in 'BIM according to the ISO 19650 series' would have the following features:

- Clear definitions for the information needed by the project client or asset owner, and for the standards, methods, processes, deadlines and protocols that will govern its production and review.
- The quantity and quality of information produced being just sufficient to satisfy the defined information needs, whilst not compromising health and safety or security. Too much information represents wasted effort by the supply chain and too little means clients/owners take uninformed decisions about their projects/assets.
- Efficient and effective transfer of information between those involved in each part of the life cycle – particularly within projects and between project delivery and asset operation.
- Informed and timely decision making.

The ultimate result would be the efficiencies gained through reduction of waste/rework in the design, construction, operation and maintenance activities plus the reduction of risk. The high level process is illustrated in ISO 19650-1 Figure 4, which is reproduced in Figure 1.

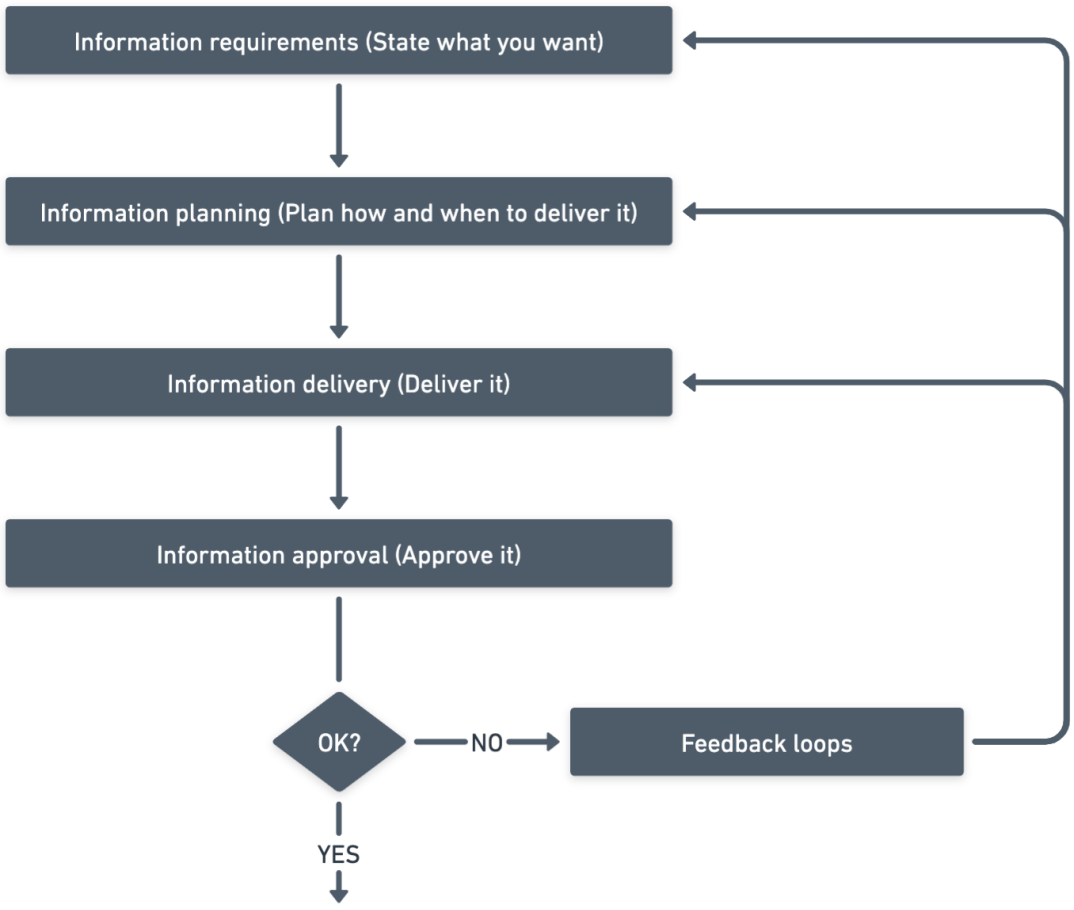

Figure 1: High-level information delivery flow chart (ISO 19650-1 Figure 4)

See also Annex C of this guidance, Section E.5.

2.2 Why implement building information modelling on a project

2.2.1 The technical case

The justification for implementing the ISO 19650 series as the standard for information management using building information modelling (BIM) comes from the industry need to improve its processes and productivity and move towards digital transformation. Some of the 1192 standards, which formed the basis of the UK approach to BIM, are being superseded as the ISO 19650 series of documents is developed. The evolution of these standards facilitates a consistent approach to information management at both a national and international level.

2.2.2 The commercial case

The Government's support for the adoption of building information modelling (BIM) on public sector projects has been a catalyst for change and has demonstrated measured benefits and return on investment across many departments. There have been a number of reports looking at the return on investment of adopting improved process and standards, with drivers around improved quality of product, reduction in risk and greater assurance of meeting the delivery schedule.

There is, potentially, a degree of investment to be made by any organisation transitioning to the ISO 19650 series, in the upskilling of people, learning of new standards, methods and procedures, adoption of new software and technologies and the transition of existing information and resources. The extent of investment and time needed for gradual adoption should be viewed as a long-term investment across all future projects and not be based on just a single project. As an increasing number of clients mandate the use of the ISO 19650 series through their own implementation within appointments and contracts, this is likely to become the primary driver of supply-chain organisations for adoption to ensure the ability to win work. Additional drivers include the long-term benefits across and within organisations of improvement of process and quality, reduction of rework and increasing efficiency.

2.3 Who is the ISO 19650 series for?

The ISO 19650 series is for all people and organisations involved in the whole life cycle of an asset. This is because everybody – across the whole life cycle – requires or produces information. What form this information takes (models, spreadsheets, drawings, certificates, programmes etc.) should not determine whether or not the ISO 19650 series applies. It applies across the board.

Collaboration and effective team working are at the heart of the ISO 19650 series, so it is important to understand actors and activities in the context of the overall project team (Table 2). The standards define three types of actor (referred to as 'party' in the standard) and three types of team – see ISO 19650-2 Figure 2.

Table 2: Types of actors and teams

Table 2: Types of actors and teams

Aa Name	Description	Type
Appointing party	The organisation leasing the project or asset management. For a project this is typically the client, who may also be the asset owner.	Actor
Untitled		
Lead appointed party	The party who is accountable for coordinating information exchange between task teams or between a delivery team and the appointing party.	Actor
Appointed party	Anyone generating information about the project - for example a contractor, subcontractor, supplier, consultant	Actor
Project team	Everyone involved in the project, regardless of appointment/contract arrangement	Team
Delivery team	A lead appointed party and their associated task teams - for example a contractor and its subcontractors and suppliers	Team
Task team	A person or group of people performing a specific task - for example the architecture team or the subcontractor who is designing/constructing curtain walling	Team

ISO 19650-1 allows for an inexperienced appointing party to seek assistance with completing its information management activities. This could be from one of the prospective lead appointed parties or from an independent third party. Also, on any one project there can be multiple lead appointed parties each of which may have their own delivery team. Wherever your position in the project team and whatever activity you are fulfilling, the ISO 19650 series helps you to consider what information you require and what information is needed from you. It also helps you to consider how it should be coordinated and shared with other people and organisations.

2.4 The ISO 19650 series in the context of organisation management

The ISO 19650 series describes and defines information management across the whole life cycle of an asset. To support this there need to be close links with the approaches taken to asset and project management, and to organisational management. This can include adoption of the appropriate ISO management system standards (see Figure 2) but this is not a prerequisite to implementing the ISO 19650 series.

Key

- **AIM** Asset Information Model
- **PIM** Project Information Model
- **A** Start of delivery phase (see ISO 19650-1 clause 3.2.11) - transfer of relevant information from AIM to PIM
- **B** Progressive development of the design intent model into the virtual construction model (see ISO 19650-1 clause 3.3.10 Note 1)

- **C** End of delivery phase - transfer of relevant information from PIM to AIM

Figure 2: Information management in the context of broader management systems (ISO 19650-1 Figure 3)

3.0 Legal and security considerations

3.1 Legal and contractual requirements

An important consideration when preparing an appointment/agreement is the use of terminology. The ISO 19650 series introduces new terminology that is different from the terms typically used in UK legal documents, such as employer. In this instance, it is advised to insert a glossary or mapping table of these terms within the appointment/agreement. ISO 19650-1 and PD ISO 19650-0 provide further guidance on ISO and UK terms.

3.2 Project's information protocol

The ISO 19650 series uses the term appointment to describe the agreement between an appointing party and an appointed party. In most instances in the UK, this will be a legal contract. When drafting an agreement, it is important to recognise the relationship between each party and the assignment of tasks in relation to the information management function. These may change from project to project.

ISO 19650-2 requires an appointing party to establish the project's information protocol. This is to be included within each appointment. Lead appointed parties are then required to include the project's information protocol within all sub-appointments throughout the delivery team. A BIM Protocol compliant with the ISO 19650 series is currently being drafted and will form part of the Guidance Framework. In the meantime if an appointing party uses the CIC BIM Protocol 2nd Edition, then care must be taken to align it with the ISO 19650 series. Care should also be taken to ensure that the CIC BIM Protocol 2nd Edition Appendices are complete to reflect requirements (to ensure the intended obligations form part of the contract). Refer to Annex C for detailed guidance if you are drafting appointments and other legal documentation.

3.3 The ISO 19650 series and security

The ISO 19650 series calls for transparent, collaborative cross-sector ways of working which requires mutual understanding and trust alongside appropriate/proportionate measures and processes to reduce the risk of loss, corruption or disclosure of information. This is important to maintain the safety and security of:

- personnel and other occupants or users of the asset and its services;
- the asset itself;
- asset information; and/or
- the benefits the asset exists to deliver.

Such processes can also be applied to protect against the loss, corruption or disclosure of valuable commercial information and intellectual property.

Understanding the security framework is a fundamental aspect of establishing who can access what information and what they can do with it. It is therefore at the heart of how common data environments are configured and managed.

Note that embedding appropriate and proportionate security should be a basic project requirement. But in addition it aids efficiency and productivity and can enhance global positioning in the international construction market, particularly for high profile and sensitive projects.

PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management sets out the framework for a security-minded approach. This should remain the point of reference until ISO 19650-5 is published4 (expected in 2020). [4]

[4] ISO 19650-5 is currently out for consultation. See https://standardsdevelopment.bsigroup.com/projects/2018-01453

4.0 High-level principles of implementation

4.1 At an industry level

'Building information modelling (BIM) according to the ISO 19650 series' is designed to be complementary to existing management standards used. This is indicated in ISO 19650-1 Figure 3, [5] where the relationship between project delivery and asset operation

is shown within surrounding frameworks of management.

This means that the work practices and processes required by the ISO 19650 series need to be embedded within everyday working arrangements and workflows if the anticipated efficiencies are to be realised. This requires transition to a new ‘business as usual’ which may involve time and financial investment in skills, tools and business process re-engineering. The discipline of the ISO 9001 approach to quality management should assist this transition, but certification to ISO 9001 or any other management system standard is not a requirement for implementing ‘BIM according to the ISO 19650 series’.

[5] See Figure 2 in Section 2.4 of this guidance.

4.2 At a project level

Implementing the ISO 19650 series is a collaborative enterprise, primarily between the people and organisations associated with project delivery and/or asset management. For this collaboration to be successful, a sequence of inputs and outputs across project delivery and asset management is defined in ISO 19650-1 Figure 2 (guidance figure 3). This diagram helps to describe three separate paths through ‘Building information modelling (BIM) according to the ISO 19650 series’:

1. Project delivery with no asset management considerations: PIR-EIR-PIM
2. Asset management with no project delivery considerations: OIR-AIR-AIM
3. Combined project delivery/asset management: OIR-AIR-EIR-PIM-AIM and PIR-EIR-PIMAIM

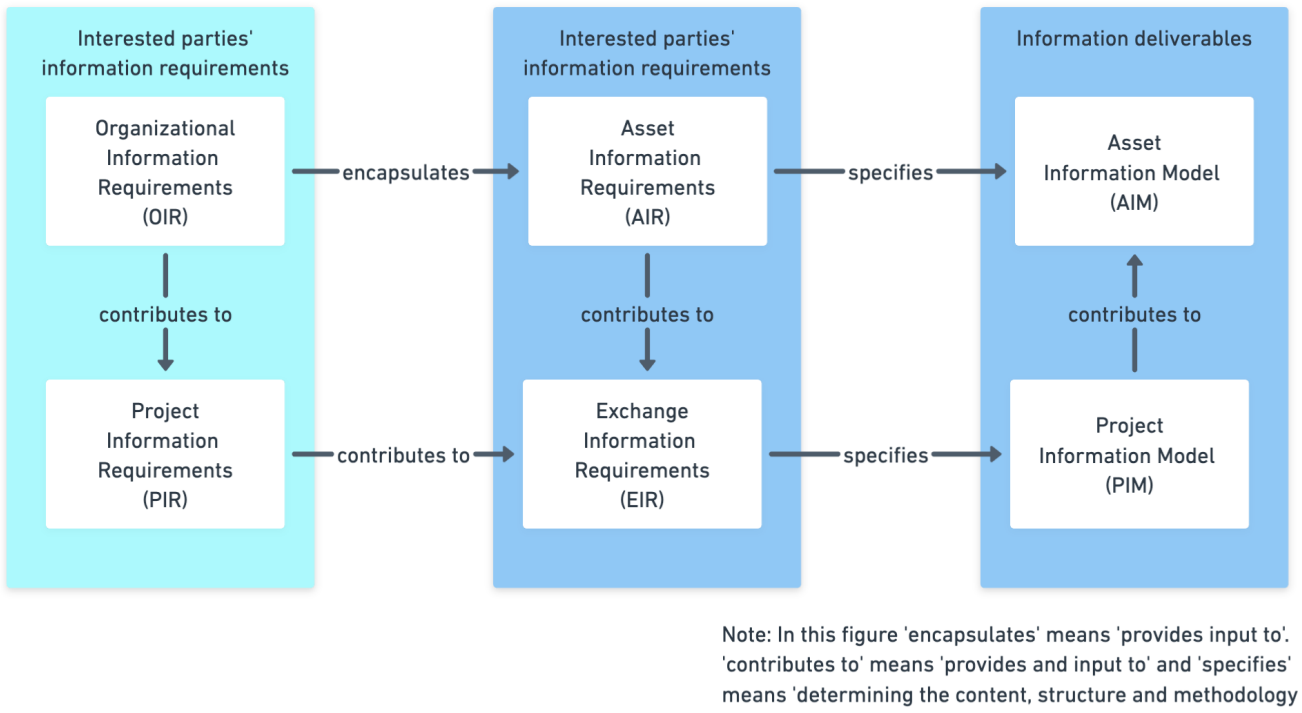

Figure 3: Relationships between information requirements and information models (ISO 19650-1 Figure 2)

This guidance is primarily concerned with the implementation of the ISO 19650 series around the project life cycle. [6]

The ISO 19650 series is designed to be scalable. For example, many of the requirements in BS EN ISO 19650-2 include the phrase ‘shall consider’. This introduces a list of secondary items to be considered as part of the main requirement, but only to the extent that they are relevant to the project or appointment in question. It is good practice to document that all items have been considered, and whether further action is or is not required.

The project-specific information management process is set out in ISO 19650-2 Figure 3, which illustrates the nesting and sequence of information management activities. Activities 1 (assessment and need) and 8 (project close-out) only apply to projects and are driven by the appointing party (client). Activity 1 is crucial as this sets the scene for all the information management on the project including the rules to be followed by the delivery team(s). These scene-setting activities are listed in detail in ISO 19650-2 Clause 5.1. Activity 8 includes the capturing of lessons learned – this is particularly important for repeat clients and repeat project types. This is supported by the principles of soft landings (see Annex B of this guidance).

[6] Path 2 is covered by PAS 1192-3:2014.

4.3 At an appointment level

Implementation of ISO 19650 at the level of an individual appointment is explained further in Section 5.1 of this guidance.

4.4 When to implement the ISO 19650 series

At what point the ISO 19650 series should be implemented, should be assessed on a project-byproject basis alongside requirements that might be determined by clients through contracts and appointments.

It is recommended that existing projects that contractually reference BS 1192:2007+A2:2016 or PAS 1192-2:2013 should continue as such until completion. Existing projects that are based on the superseded PAS 1192-2 and BS 1192 standards, without contractual obligation, can also continue as is. On the other hand, they can elect to transition to the ISO 19650 series. The impact of transition needs to be assessed, in terms of capability, the need for upskilling, risk of change and transitional costs. From a practical standpoint, it is envisaged that transition would normally take place at the beginning of a stage (for example: concept design, developed design, construction, in use), and the earlier in the project life cycle this takes place, the better.

All projects that are transitioning from the 1192 suite to the ISO 19650 series should refer to PD 19650-0:2019 Transition Guidance to BS EN ISO 19650.

New projects can start using the ISO 19650 series with immediate effect, but consideration should be taken of the impact on the wider project team who may be working on existing appointments based on the 1192 suite.

5.0 Explaining information requirements and delivery

This section explains the key steps in implementing the ISO 19650 series. This includes a high-level overview of who is doing what, an explanation of the hierarchy of information requirements, the way responsibility is assigned and the collaborative approach to producing information.

5.1 The information delivery cycle

To successfully implement the ISO 19650 series, the appointing party (for example the client) commences with the statement of need, ensuring the information requirements are clearly defined at the start of the project along with how the concepts and principles of information management are to be implemented and the benefits that are expected. This confirms the types of information and clarifies how different types of information should be structured and exchanged. Management and processes may also be considered at this point and as far as they can be determined by the appointing party. It is helpful for an appointing party to explain principal reasons why information is required, to give additional context to the delivery teams. [7] These considerations are then carried across, as appropriate, for each appointment that the appointing party initiates across the project.

Each prospective lead appointed party (for example: designer, contractor) responds to these information requirements in their (pre-appointment) BIM execution plan which includes their statements of capability and capacity to apply the ISO 19650 series. The appointing party should consider the contents of the BIM Execution Plan when selecting the lead appointed party. Where prequalification is used then this forms the initial stage of the appointment process, ahead of the pre-appointment BIM execution plan (see Annex D relating to PAS 91).

During mobilisation, the appointing party (for example the client), the lead appointed party (for example the contractor) and the appointed party/parties (for example the subcontractors) collaborate to agree key roles and responsibilities and to agree an information delivery plan (in the form of the BIM execution plan, the master information delivery plan and the task information delivery plans) that outlines coordination and delivery mechanisms (see ISO 19650-2 Clauses 5.4 and 5.5). Briefings and training ensure everyone has an agreed level of competency and an understanding about what is required.

These parties then establish the level of information need required at every project stage and approval, authorisation and acceptance procedures. This enables the configuration and implementation of appropriate information management systems. These information systems must provide and consider the needs of people (the project team and stakeholders), the process of information delivery and the selection and use of appropriate technologies required for delivery.

At the end of every project stage (and potentially within a project stage) assurance is provided that the information requirements have been met appropriately (see ISO 19650-1 Clause 6.3.3). It might be possible to do this through a mixture of manual and automated methods. Relevant asset information, assembled during the appointment/project, is handed over at completion to inform operation and maintenance in a timely fashion.

See also Annex C of this guidance, Section E.1.

[7] Note that in accordance with BS 1192-4:2014 Collaborative production of information the employer (client) should state which purposes are included and excluded in respect of BS 1192-4:2014 Clauses 5.2–5.4.

5.2 Information requirements

Clearly defined, value-driven information requirements prepared at the outset of the project are a key enabler to collaborative and effective information management. As stipulated in ISO 19650-1 Clause 5.1:

the appointing party should understand what information is required concerning their asset(s) or project(s) to support organisational or project objectives.

To enable effective information requirements, the appointing party (for example the client) should clearly express these requirements to other organisations and individuals through their exchange information requirements to specify or inform their work. A clear hierarchy of information should be set out linked to the project, asset(s) and organisational objectives (see ISO 19650-1 Clause 5).

Getting this right is critical; absence of clearly defined information requirements may increase the likelihood that delivery teams will not be able to provide complete and correct information to support decision-making and project progression.

There are four key documents or resources which set out the appointing party's information requirements:

1. Organizational information requirements (OIRs) – In relation to organizational objectives
2. Project information requirements (PIRs) – In relation to the purpose, design and construction of an asset
3. Asset information requirements (AIRs) – In relation to the operation and maintenance of an asset
4. Exchange information requirements (EIRs) – in relation to an appointment

These are illustrated in ISO 19650-1 Figure 2 (see Section 4.2 Figure 3 of this guidance). Inexperienced appointing parties (clients) are likely to need help, particularly to avoid the trap of developing overdetailed EIRs that may stifle delivery team innovation. They are advised to enlist the help of one of the lead appointed parties or a third party.

Information requirements should pass along delivery teams and task teams to the point where information can be most efficiently produced. Information should be then collated as it is passed back to the party requiring it.

Beyond the appointing party's hierarchy of information requirements, the appointed parties including lead appointed parties may choose to add further requirements when passing down to their supply chain (see ISO 19650-2 Clause 5.4.3). This should be done in a proportionate manner and ensure information requirements are placed with the most appropriate party who is best able to deliver the information efficiently.

See also Annex C of this guidance, Section E.1.

5.3 Risk assessment for delivery of information

ISO 19650-1 Clause 6.3.1 identifies that an information-based risk assessment should be incorporated within the overall risk management approach. This should be addressed during preparation of the (pre-appointment) BIM execution plan (ISO 19650-2 5.3.6).

5.4 Responsibility matrices

To improve collaborative working, clearly defined responsibilities in relation to activities and information deliverables must be understood by all parties. The ISO 19650 series proposes two types of responsibility matrix:

1. Information management activities – A responsibility matrix to allocate parties to a list of information management functions/activities. This is referenced in ISO 19650-2 Clause 5.1.1 and Annex A of ISO 19650-2 provides an indicative template.
2. Information deliverables – A responsibility matrix for information deliverables against the required information exchange stages – see ISO 19650-2 Clauses 5.3.2(d), 5.4.1(c), 5.4.2, 5.4.4 and 5.4.5). No templates are included within the ISO 19650 series for this responsibility matrix.

5.4.1 Responsibility matrix – Information management activities

Within ISO 19650-2, all activities within the information management process are to be undertaken within a defined information management function.

Refer to ISO 19650-2 Clauses 5.1.1 and 5.3.1. The appointing party (or a party on their behalf) will carry out (or delegate) its information management function, then each lead appointed party needs to organise its own information management function.

The template responsibility matrix contained within Annex A of ISO 19650-2 can be used by the appointing party to assign each activity relating to the information management function to themselves, an appointed party or third party.

5.4.2 Responsibility matrix – Information deliverables

A well-defined responsibility matrix is a key part of the BIM execution plan. The level of detail of the responsibility matrix increases during the project development process, moving from a highlevel responsibility matrix at tender stage through to a detailed responsibility matrix at the appointment stage. This reflects the need of the lead appointing party to develop the matrix when confirming the deliverables within their supply-chain appointments.

See also Annex C of this guidance, Section E.2.

5.5 Collaborative production of information

The success of construction projects boils down to the parties involved and how well they work together to meet both their own objectives and those of the project. Working together not only involves the regular exchange of information but also understanding what happens to the information once it is delivered; this is fundamental in ensuring it is produced to meet a purpose. This could be, for example, to help the receiving party to perform a task (such as design, analysis) or to make a decision. Ultimately information needs to be useful and for this to happen content, structure and format need to be considered.

5.5.1 Why we need to work collaboratively to produce information

When information isn't useful it becomes wasteful and impacts on those needing to use it to do their job. This can cause delays, for example, if the information needs to be reworked, or it can create risk of error arising from misinterpretation.

Collaborative working requires us to communicate and be transparent with each other, to plan what we are doing as a team. Effective planning also allows information to be reused for multiple purposes resulting in information cascaded up, down and across project teams.

5.5.2 How we work in a collaborative information environment according to the ISO 19650 series

To enable work in a collaborative environment, information needs to be produced in line with ISO 19650-2 Clause 5.6.2. Construction information tends to build on the work of others and should not be created in isolation. Therefore, information should be shared on a regular basis during project stages across the project's common data environment (CDE) (which may employ a number of different technologies). During design, information needs to be exchanged with other parties for use as reference or background information to aid coordination. Coordination should be conducted as the design develops both geometrically (for example spatially) and nongeometrically (performance). Delays in sharing information can impact those needing to use it, which can cause a snowball effect across the project.

This shared information together with the concepts covered in the ISO 19650 series provide the rules and constraints in which information should be created. The project's information production methods and procedures are particularly important as they establish the rules for collaboration within the CDE. Information should be produced in line with the project's information standard to ensure successful exchange with other technologies, using open data formats where possible (see ISO 19650-1 Clause 6.1 and ISO 19650-2 Clause 5.1.6).

Sharing of information also allows information (including but not limited to geometrical models) to be combined for other purposes. This could include, for example, analysing cost, project programming and understanding energy use. Within delivery teams this should be co-ordinated by the lead appointed parties and across delivery teams managed by, or on behalf of, the appointing party (see ISO 19650-2 figure 2).

In conjunction with these tasks there are several layers of review which should be carried out and these are noted in ISO 19650-2 Clauses 5.6.3–5.6.5 and 5.7.1–5.7.4. It is important that information is reviewed prior to information exchanges to reduce errors percolating through the project which may impact both time and cost. This includes individual task team reviews of their own information plus reviews of multiple sources of information by the lead appointed party and appointing party (for example spatial coordination and information compliance). These reviews should not be seen as a substitute for ongoing issue avoidance during design.

Information review processes and procedures should be set out in the project's information production methods and procedures (see ISO 19650-2 Clause 5.1.5) noting that lead appointed parties can propose amendments in their delivery team's BIM execution plan for discussion and agreement with the appointing party (see ISO 19650-2 Clauses 5.3.2 and 5.4.1).

Final acceptance reviews at the appointing party key decision points should facilitate comparison of delivered information back to the original requirements. This helps to reduce the performance gap so that at handover the appointing party receives what they originally asked for and a soft landings process is supported.

See also Annex C of this guidance, Section E.3.

6.0 Explaining practical management of information

This section goes into a bit more detail on the practicalities behind implementation of ISO 19650, including the common data environment workflow, the idea of federating information, using metadata and classification. It also describes the new concept of ‘level of information need’ as a framework for describing how much information to deliver.

6.1 Understanding common data environments

A common data environment (CDE) is defined in ISO 19650-1 Clause 3.3.15.

ISO 19650-1 then distinguishes between a CDE workflow (the process) and the solution (the technology). This helps in understanding what a CDE is and how it plays its part. A CDE uses solutions to support processes which ensure that information is managed and readily available for those who need it, when they need it.

The concept of the CDE is not new. The importance of having a disciplined and collaborative approach to the production and exchange of information using integrated solutions and workflows was formally defined in 2007 with the release of the now superseded BS 1192.

There is a common industry misconception that the CDE is a technology solution only and that it is always a single solution. ISO 19650-1 Clause 11.1 clarifies that a range of technologies might be required. It is therefore important to establish the functionality needed, and how single or multiple systems might support this functionality, early in a project. Where multiple systems are needed, consideration should be given to how they interface with each other as necessary.

This common misconception that the CDE concept is a technology or solution overshadows the most important aspect which is the process or ‘workflow’. It is this combination of ‘Solution’ and ‘Workflow’ that principally defines the CDE (see ISO 19650-1 Clause 3.3.15 Note 1).

ISO 19650-1 Figure 10 depicts this concept in a simple graphical form whereby information exists in various states including Work In Progress, Shared and Published, whilst continuously archiving the information. This principle is explained in detail in ISO 19650-1 Clause 12.

How recommended CDE workflow procedures are applied should be considered on a project-byproject basis. Reference should be made to those procedures contained within the National Annex such as status codes. It should be considered that, at each of the various states, the manner in which CDE solutions interact in an integrated process may vary in complexity and type.

See also Annex C of this guidance, Section E.4.

6.2 Explaining information models

Information models are made up of one or more information containers. It is very important that the term ‘model’ is understood in the abstract sense. An information model is not just a single or federated geometrical model but a collection of information containers however they are created or presented. Information models exist at asset, project and delivery team levels.

An information container is defined in ISO 19650-1 Clause 3.3.12. To support more digital and automated ways of working, the ISO 19650 series requires that information containers are produced and organised around standard defined rules.

During the process of defining information delivery plans these information containers are given a unique ID.

6.3 Information container breakdown structure and federation strategy

The term ‘information container’ is explained in Section 7.2, below.

An information container breakdown structure is a pre-determined, detailed way to define manageable units of information across the project and/or delivery team. The evolving project information model can be complex and will comprise many information containers. Defining the information container breakdown structure therefore enables multiple appointed parties to create information simultaneously within different containers in an efficient manner. This eases information exchanges whilst at the same time removing the risk of them overwriting each other’s information.

The federation strategy is a higher-level description of how and why the information model is being divided up via the information container breakdown structure, to make the production and management of the information easier (see ISO 19650-1 clause 10.4). Together, the federation strategy and information breakdown structure provide the rules for combining and segregating information containers for specific purposes such as management of security, spatial coordination or information transmission, as well as enabling specific tasks to be undertaken with combined information. They also aid retrieval of information containers. ISO 19650-1 Annex A provides examples of information container breakdown structures and federation strategies.

The information container breakdown structure and federation strategy apply to all information container types, not just geometric models.

6.3.1 Management of the information container breakdown structure and federation strategy

The lead appointed party determines the information container breakdown structure in collaboration with the delivery team. It should be considered in the development of the detailed responsibility matrix (see ISO 19650-2 clause 5.4.2) and could be communicated in the BIM execution plan.

The appointing party may determine the federation strategy where they have specific projectwide requirements. In this case their federation strategy will be communicated in the project's information production methods and procedures and the lead appointed party will confirm the federation strategy for the delivery team in the BIM execution plan. The lead appointed party determines the federation strategy (again in collaboration) if there are no specific appointing party requirements.

Both the federation strategy and the information container breakdown structure should be communicated to all members of the delivery team. Note that both could evolve throughout the life of an appointment.

6.3.2 Application according to ISO 19650

The information container breakdown structure is reflected in the information container's unique ID.

It is commonly via the 'Volume/System' field, although all fields are ways of segregating and then federating information. Additional federation approaches can be via the 'Classification' metadata attached to an information container.

A fuller explanation of information container naming is given in Section 7.2 below.

6.4 Use of metadata

A project should agree where specific metadata should reside, directly on a construction element, on an information container or in a linked database or associated container. It is good practice to put metadata contents onto any printed or displayed material from the information container. BS EN ISO 7200 gives guidance on placement of metadata within documents. Where metadata is repeated, this should be managed to ensure consistency, for example through automated processes.

The attribute name for each piece of metadata, along with any standards for the formatting of the value that the metadata holds, should also be agreed in advance, to ensure consistency.

Refer to Section 7.2 to understand UK-specific requirements for metadata.

6.5 Level of information need

6.5.1 What is the level of information need and why do we need it?

Information is required for a purpose, such as to perform a task or support a decision.

The level of information need is used to enable the right level of information to be provided to satisfy the information-related purposes at each information exchange. It is important to avoid the delivery of too little information, which increases risk, and the delivery of too much information, which is wasteful.

The level of information need is a broad concept which represents the framework for how the 'richness' of each information deliverable is going to be defined. There are many different ways to express the level of information need, including the richness of geometrical details and the richness of datasets.

Note that 'level of information need' is not abbreviated.

6.5.2 How does the level of information need apply to ISO 19650?

The concept of the level of information need is introduced in ISO 19650-1 Clause 11.2. The method for defining it is established by the appointing party as part of the project's information standard. This method is then applied by the appointing party when defining the Exchange Information Requirements for each appointment.

The level of information need is identified for each information container and this should be considered when defining the federation strategy and information container breakdown structure. The delivery of the specified level of information need is recorded in the Task Information Delivery Plans.

The level of information need should be defined so that information can be read by both people and technology for verification (i.e. does the content of the information container meet the requirements of the level of information need) and validation (i.e. is the content of the information container as complete as it needs to be to satisfy the intended purpose). Use of technology is encouraged to automate the process and reduce human error, for example defining aspects of the level of information need around a data schema and using automated rules to check that the data meets the naming requirements in the project's information standard.

There are various ways to define and specify the level of information need. At present in the UK, there are definitions for level of detail and level of information in the NBS BIM Toolkit for many systems and products. This is an example of a level of information

need framework. At the time of writing there is also specific further work on level of information need being done within CEN (European standards).

6.6 Organisation of information (classification)

6.6.1 Classification systems for assets and projects

Classification systems are lists of things which relate to the same subject. A classification system may be based around an organised structure which can become progressively more granular as it breaks down into further subsets.

For example, the NBS describe a classification system as ‘a hierarchical suite of tables that support classification of all “things” from a university campus or road network to a floor tile or a kerb unit’.

6.6.2 The need for classification

We have huge amounts of complex information which we need to file, retrieve and refer to. This is particularly true for a construction project where there can be a vast breadth and depth of information and fields of specialism which use different terminology. Classification allows us to order this information in a controlled and consistent manner, to provide a common understanding between specialisms.

Some form of code may form the structure of the classification which allows the grouping of information with similar characteristics. A great example of this is the Dewey Decimal Classification, a system used for the cataloguing of books around similar subjects. It assigns classification as labels which allow people to search and sort books. Digitally, we are taking the same concept using metadata to allow us to use technology to search, filter and sort information.

6.6.3 How classification applies to ISO 19560

ISO 19650-1:2018 recommends that classification is in line with ISO 12006-2. This standard defines the framework for classification systems internationally. Each country or region might have its own version aligned to this standard and in the UK this classification system is Uniclass 2015 (authored by the NBS – see https://toolkit.thenbs.com/articles/classification). This can be applied to all forms of information whether it is in the form of construction elements, activities, roles, spaces or even the whole facility. Object information should be in line with ISO 12006-3.

To allow the indexing and retrieval of information within a common data environment, ISO 19650-2 Clause 5.1.7 requires each information container to be classified using a metadata attribute. It also allows us to map information to other industry-based classification systems or structured, coded lists such as the measurement rules found in the RICS New Rules of Measurement series or the maintenance standard SFG20. [8]

[8] SFG20 is the product name for the BESA standard technical maintenance schedules.

7.0 Explaining the National Annex

7.1 Use of the National Annex to ISO 19650-2:2018

The ISO 19650 series is the internationally agreed approach to information management using building information modelling. However, for certain requirements detailed in ISO 19650 Part 2, each region/country can add its own recommendations in the form of a National Annex.

Requirements in ISO 19650-2 that are clarified in the UK National Annex are the project’s:

- information requirements;
- information standard;
- information production methods and procedures;
- common data environment.

Note that when working on international projects there may be a requirement for organisations to adopt another region/country’s National Annex depending upon the appointing party’s (for example the client’s) preference.

7.2 The National Annex and common data environments

The UK’s National Annex describes the naming standard for information containers within a common data environment (CDE) and is based on the same convention set out in superseded BS 1192:2007.

In the National Annex, the term ‘information container’ is used to describe the unique identification of a file. [9] For a construction project, an information container could be a cost plan, a programme, a drawing, a geometric model etc. National Annex Clause NA3.6 lists common types of information containers and how these can be named. It is not a definitive list and there is an option to specify project-specific codes if required.

Each information container should be identified through a unique ID and National Annex Clause NA2.2 provides the structure for this ID. A structural steel specification produced by the structural engineer ABC for project NEWP (a multi-storey building) would have a unique ID of:

NEWP-ABC-XX-ZZ-SP-S-0001

The unique ID shows us that the information container is the first (0001) structural engineer’s (S) specification (SP), which is relevant to all levels (ZZ). It isn’t related to a specific volume or system (XX), it has been produced by ABC (the originator) and is for NEWP (the project). Reading the description back to front is helpful in understanding the contents of the information container.

The unique ID does not define the specification as a steel frame specification because this will be identified through classification metadata.

The National Annex also requires the project’s CDE(s) to enable attributes (metadata) against each information container to record its status, revision and classification. Metadata requirements are covered in National Annex Clause 4.

The CDE should prompt the addition of metadata according to the National Annex plus the update of metadata when an information container is revised. The CDE may also enable configuration so that additional metadata can be added if required.

Also documented are the typical open data formats for information exchanges that should apply in the UK such as IFC, xlsx and PDF.

A CDE solution might present the example information container as given in Table 3.

Table 3: Presentation of example information container

	Metadata		
Unique ID	Status	Revision	Classification
NEWP-ABC-XX-ZZ-SP-S-0001	S2	P01	PM_35_20_80

The status and revision identify the information container as being suitable for information (S2) and it is the first version of the information container (P01). PM_35_20_80 refers to the Uniclass 2015 Project Management code for structural design performance requirements.

Adoption of the National Annex methodology (i.e. the unique ID plus metadata) means that information descriptions, if needed, can be kept to a bare minimum. This aids efficiency and consistency for information identity (which is essential when a CDE contains a large volume of information containers) but importantly supports a security-minded approach to information management.

Adopting the unique ID and metadata for information containers within a CDE can create a disconnect if the same approach is not taken by the originator in their own file management system, particularly where a folder system is used and revisioning is not structured. For the example above the structural engineer might have adopted different number sequencing, filed the information container against a folder of Specifications and called the information container Steel frame 8001 – see Figure 4:

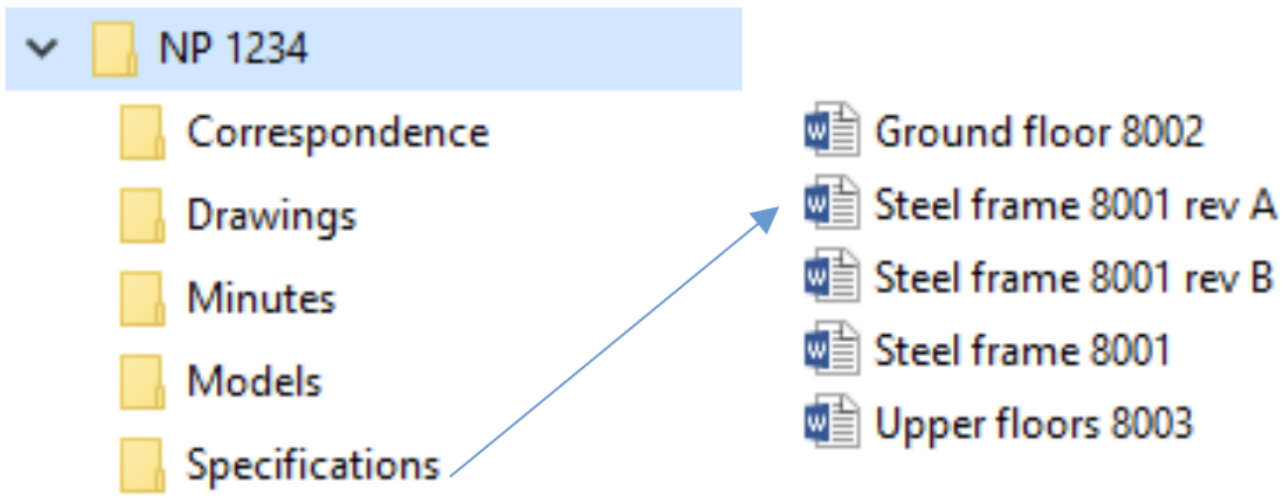

Figure 4: Example folder system and file naming

Note there is no relationship between the information container in the CDE NEWP-ABC-XX-ZZSP-S-0001 and the original information container Steel frame 8001. Some CDEs might store the originating information container identity but this is not

guaranteed. The National Annex unique ID and metadata approach for back-office systems should therefore be adopted. [10]

It is also worth understanding the extent to which a Windows-based approach (or other proprietary operating system) supports metadata to align with the CDE.

The project's information standard should determine requirements for the unique ID, status codes, revisions and numbering. The information standard forms part of the tendering documentation, along with the exchange information requirements (see ISO 19650-2 Clause 5.2) created by the appointing party (for example the client).

[9] The unique ID structure described in the National Annex should not be applied to other information containers such as folders (which represent a selection of files) or layers.

[10] Note that National Annex Clause NA.3.2 identifies that the project identifier should be different from an organisation's internal job number.

8.0 Summary

This concept-level guidance has provided an overview of the rationale, ideas and principles relating to the ISO 19650 series.

The accompanying process-level guidance (due for publication in summer 2019) explains the step-by-step application of ISO 19650-2, and this should be referred to by practitioners and those implementing the ISO 19650 series across a project, within an appointment or within an organisation.

At the time of writing, the ISO 19650 series is still very new, albeit based on former UK standards, so it is anticipated that as experience of implementing the standard is gained over the coming months and year, this guidance will be updated to reflect both this and any comments/feedback received.

Annexes

Annex A Building information modelling related standards

Table A.1 summarises the existing suite of building information modelling (BIM) standards which were developed to support BIM Level 2. Some of these are now evolving to enable information management according to ISO 19650.

Table A1: Standards

Aa BIM Standards 2018	Standard Type	Standards Changes 2018/2019 Now Published	Standards Changes 2020 Onwards Exact Date TBC
BS 1192:2007+A2:2016 Collaborative production of architectural, engineering and construction information, and PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling	Core Standards	BS EN ISO 19650-1:2018 Information management using building information modelling – Concepts and principles, and BS EN ISO 19650-2:2018 Delivery phase of the assets	No Change
PAS 1192-3:2014 Specification for information management for the operational phase of assets using building information modelling	Core Standards	No Change	BS EN ISO 19650-3 Operational phase of assets
PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management	Core Standards	No Change	BS EN ISO 19650-5 Security-minded approach to information management
BS 8536-1:2015 Briefing for design and construction (buildings) and/or BS 8536-2:2016 Briefing for design and construction (infrastructure)	Core Standards	No Change	No Change
BS 1192-4:2014 Fulfilling employer's information exchange requirements using COBie	Core Standards	No Change	No Change
PAS 1192-6:2018 Specification for collaborative sharing and use of structured Health and Safety information using BIM	As Required	No Change	No Change

Aa BIM Standards 2018	Standard Type	Standards Changes 2018/2019 Now Published	Standards Changes 2020 Onwards Exact Date TBC
BS 7000-4:2013 Design management systems – guide to managing design in construction	As Required	No Change	No Change
BS 8541 series Library objects for architecture, engineering and construction	As Required	No Change	ISO 22014 and ISO 22057 are under development at the time of writing to supersede BS 8541 Parts 1 to 6

For standards where no further changes are noted, as of the date of publication of this guidance, no work item has been agreed with ISO to develop an equivalent ISO standard. Any British Standard listed which is superseded by an ISO standard will be withdrawn by the British Standards Institution. However these standards will still be available for reference.

The transition guidance to ISO 19650 provides a helpful summary of the key changes from the originating documents that have occurred within ISO 19650-1 and ISO 19650-2. To access the standards and transition guidance listed above, please refer to the BSI website https://www.bsigroup.com/en-GB/standards/.

Annex B Soft landings

The principle of soft landings describes the planned, structured and graduated handover of an asset from the design and construction team to the operation and maintenance team. BSRIA developed the soft landings process in association with the Usable Buildings Trust. In 2013, the UK Government reviewed and tailored the process to embed it within public sector procurement and commonly referred to it as Government Soft Landings (GSL). The process is supported by BS 8536-1:2015 and BS 8536-2:2016.

The aim of soft landings is to improve operational performance; as a process it aligns the interests between those who design and construct an asset and those who subsequently use it.

The principle of soft landings drives better outcomes for assets through early engagement with the operational team and the opportunity to benefit from appropriate operational asset information. It encourages early consideration of operation requirements, ideally determined in collaboration with the people who will be operating and maintaining the asset in use. It is therefore not just a handover protocol but a commitment from the design team, through construction and into operation providing emphasis on improving operational readiness and performance in use.

Building information modelling and the ISO 19650 series actively support the soft landings process through the Exchange Information Requirements incorporating relevant Asset Information Requirements. The process of information exchange, coupled with modelling and simulation, allows end users and project teams to visualise and understand how the asset will perform in use.

Annex C Legal and contractual guidance note

A. Introduction

A.1. This note provides guidance on legal and contractual issues arising under BS EN ISO 19650-1:2018 (‘ISO 19650-1’) and BS EN ISO 19650-2 2018 (‘ISO 19650-2’) as referred to in PD 19650-0:2018, and is for use by both the legal community and the construction industry. ISO 19650-1 and ISO 19650-2 came into effect in the UK in January 2019 and supersede two of the existing 1192 standards, that is BS 1192:2007+A2:2016 and PAS 1192-2:2013 respectively (further parts of BS EN ISO 19650 may follow to supersede other 1192 suite documents).

A.2. To facilitate parties’ immediate implementation of ISO 19650-1 and ISO 19650-2, this annex provides guidance on the key contractual impact of ISO 19650-1 and ISO 19650-2 whilst more detailed guidance is prepared. [11]

B. Equivalent terms

B.1. ISO 19650-1 and ISO 19650-2 introduced a number of new terms in replacement of the terms used in the 1192 suite. Table 2 of PD 19650-0 maps the most significant changes to the terms in the 1192 suite. Some of the key terms to highlight from a legal and contractual perspective are given in Table C.1 but refer to PD 19650-0 Table 2 for explanatory comments.

Table C1: Equivalent terms

Aa 1192 term	ISO 19650 term
Contract	Appointment
Employer	Appointing party, lead appointing party (Tier 1) and appointed party (Tier 2 and below)
Employer's Information Requirements (EIR)	Exchange information requirements (EIRs)
Level of model definition/level of detail (LOD)/level of information (LOI)	Level of information need
Responsibility matrix	Responsibility matrix/Assignment matrix
Suitability	Status
Supplier	Lead appointment party (Tier 1)/ appointed party (Tier 2 and below)

B.2. Contract documents may use conflicting terminology, or a combination of terminology from different sources. Contract terms will not automatically be as defined in ISO 19650-1 and -2, as above, unless the contract states this is the case. Consider how this can be resolved, for example by inserting a glossary (confirming which contract terms have the same/identical meaning) or insert clarification within the definition of each relevant term (for example which terms are, or are not, derived from ISO 19650-1 and -2).

B.3. For ease of reference this note indicates in italics any terms used that are defined in ISO 19650-1 and -2.

[11] This note seeks to provide non-exhaustive guidance on BS EN ISO 19650-1, BS EN ISO 19650-2 and PD 19650-0:2019. This note is not legal advice and advice should be obtained from legal advisers on the contents. This note is obviously not a substitute for reviewing the full contents of ISO 19650-1, ISO 19650-2 and PD 19650-0:2019 to understand the legal and contractual issues arising under those documents.

C. Key contractual and legal documents under BS EN ISO 19650

C.1. BS EN ISO 19650 sets out the key supporting documentation for an appointment, and is summarised here as applies to the UK within a contractual setting as follows:

- Appointments – any contract or instruction concerning goods, works or services.
- Project information requirements – explaining the information needed to answer or inform high-level strategic objectives within the appointing party in relation to a particular asset project.
- Exchange information requirements – setting out the requirements for production of project information in such a way so as to be incorporated into appointments and aligning with trigger events representing the end of project stages (in the delivery phase).
- Responsibility matrix – identifying information management functions; and either project or asset information management tasks, or information deliverables as appropriate.
- Assignment matrix – to help establish the scope of services needed where a prospective appointed party or third party is appointed to undertake all or part of the information management function. See the example in Annex A of ISO 19650-2 at Table A.1.
- Master information delivery plan – an aggregated version of the task information delivery plans for each task team.
- BIM execution plan – a plan that explains how the information management aspects of the appointment will be carried out by the delivery team.
- Information protocol – a means of capturing requirements in respect of ISO 19650-1 and ISO 19650-2 into appointments and contracts.

D. Project’s information protocol

D.1. ISO 19650-1 and -2 do not (and are expressly not intended to) provide a prescriptive direction on the composition of BIM contract documents. However, ISO 19650-2 takes the familiar route of requiring that an information protocol for any project is established at the outset of the project and subsequently and appropriately incorporated into all appointments. Note that if you elect to use the CIC BIM Protocol (either Edition) in an ISO 19650 series-compliant contract, it will need to be amended to match the terminology, processes and requirements of ISO 19650-1 and -2.

D.2. A template information protocol compliant with ISO 19650-1 and -2 is being drafted and will be released in 2019.

✔️ Action: Ensure any protocol used is amended to take into account, at a minimum, the matters listed in Section 5.1.8 of ISO 19650-2.

E. ISO 19650 legal and contractual checklist

E.1. Information delivery cycle

The principles of the information delivery cycle under ISO 19650-1 are to be applied to both the asset management and project delivery context but this note provides legal and contractual guidance on the project delivery cycle in particular as specified in ISO 19650-2, as ISO 19650-3 in relation to the asset management cycle has not yet been published. The need for additional or updated guidance will be considered following the publication of ISO 19650-3.
Key ISO 19650-1 recommendations:

- the appointing party specifies the requirements for information on any project, and the delivery teams plan the delivery and deliver the information.
- information requirements should be passed down to the most relevant party or the point at which the information can be most easily provided. The requirements may not be identical, that is only those requirements that are relevant to each appointed party should be passed down.
- at the start of the delivery phase relevant information should transfer from the asset information model to the project information model and at the end of the delivery phase relevant information should transfer from the project information model to the asset information model.
- a risk assessment for delivery of asset and project information should be carried out to help understand, communicate and manage information delivery risks.

✔️ Action:
(1) The requirements for information should be clearly established in the contractual documentation by the appointing party at the outset, including the criteria for information requirements, level of information need, acceptance criteria, supporting information and dates (see ISO 19650-2, Section 5.2.1).
(2) Information requirements should be reflected in appointments throughout the supply chain.
(3) Consider what binding obligations and processes are required in the information protocol to implement the transfer of information between parties and within the project information model and the asset information model.
(4) Take the outcome of the risk assessment into account when preparing any information protocol.

E.2. Information delivery planning

ISO 19650-1 makes each lead appointed party and appointed party accountable for planning for information delivery.
Key ISO 19650-1 recommendations:

- Each information delivery plan should reflect the principles of ISO 19650-1 Section 10.1. At least some of the planning should be carried out prior to appointment and before any technical design, construction or asset management tasks start the necessary appointment conditions and amendments should be agreed.
- Information should be issued at predefined information delivery milestones which can take place between the appointing party and the lead appointed parties and between lead appointed parties.
- Delivery of information in accordance with the information requirements should be one of the criteria for completion of project (or asset information) activity.

✔️ Action:
(1) Agree necessary appointment conditions and amendments in connection with information delivery plan before any key tasks are commenced.
(2) Reflect the information exchange requirements and the extent and timing to which information is being exchanged between lead appointed parties in the information protocol, including any obligations to provide updates where there are changes in information in between the predefined information exchanges.
(3) Take information delivery requirements into account in the definitions of tasks, stages and completion in appointments.

E.3. Managing the collaborative production of information

Key ISO 19650-1 recommendations:

A common data environment solution and workflow should allow information containers, and the information itself, to be accessed by those who require it when undertaking their function. Issues in the information model should be resolved during the production of information rather than after delivery.

Each deliverable should have a specified level of information need which should include the quality, quantity and granularity of information required. Metrics for determining levels of information need should be defined and used across a whole project or asset.

✔️ Action:
(1) Consider process and protocols for access of information containers, and for checking for and resolving issues in the information models during production.
(2) Implement the same level of information need methodology in preparing all information protocols on the same project.

E.4. Common data environment

Key ISO 19650-1 recommendations:

The common data environment (CDE) solution and workflow should support the information management processes in ISO-19650-2:2018, 5.6 and 5.7 and at the end of the project, information required for asset management should be moved to the asset information model, with all other information retained for the time defined in the information production methods and procedures.

The container-based collaborative working process of ISO 19650 allows for the CDE workflow to be distributed across different computer systems or technology platforms.

✔️ Action:
(1) Consider the CDE solution and the approach to ownership of and access to information in it at the end of the project (given the risks highlighted in case law of failing to do so). [12]
(2) Consider requirements and processes for security and storage of information in the CDE workflow when appointments are prepared and ensure these are set out consistently in the project's information protocol and/or other binding contract documentation of the parties.

[12] Trant Engineering v Mott Macdonald Ltd [2017] EWHC 2061.

E.5. 'BIM according to the ISO 19650 series'

Section 4 of ISO 19650-1 provides a short explanation of 'BIM according to the ISO 19650 series' (also known as 'Stage 2'), and PD 19650-0 further explains that it consists of BIM Level 2, with elements of BIM Level 1 and BIM Level 3 (using the 1192 suite terminology). Figure 2 of PD 19650-0 provides a graphical comparison between 'BIM according to the ISO19650 series', and the previous Levels under the 1192 suite.

It is important to bear in mind that there is no legal definition of 'BIM according to the ISO 19650 series'. It is therefore insufficient for tenders, appointments and related documents to simply specify a requirement to 'achieve BIM according to the ISO 19650 series', or similar. Appointing parties will need to set out insofar as possible what they expect and require from the information

management process provided for in the ISO 19650 series and the parties should agree and clarify what ‘BIM according to the ISO 19650 series’ means to them, from the perspective of duties, rights and deliverables.

✔️ Action:
(1) Appointing parties should follow pre-appointment processes in ISO 19650.
(2) Clear statements of the duties, rights and deliverables in connection with the ISO 19650 processes to be included in tender documents and appointments.

E.6. ISO 19650-2 Section 5.1: Information management process – assessment and need

Key ISO 19650-2 recommendations:

- The appointing party shall have regard to the effective management of information throughout the project and reflect the long-term asset information management strategy and asset information requirements (or appoint a prospective lead appointed party or a third party to do so).
- The appointing party shall establish the project’s information requirements. If the appointing party does not do so it will be extremely difficult for the rest of the information management process to be followed.

✔️ Action:
(1) Clarify in appointments and other documents, which party bears responsibility for management of information.
(2) Clarify long-term asset information management strategy and asset information requirements.
(3) Ensure the project’s information requirements and other needs cover, as a minimum, the matters listed at Sections 5.1.2–5.1.7 of ISO 19650-2 and, in particular, the key decision points and ensure these are taken into account in the preparation of the exchange information requirements and other contract documents.

E.7. ISO 19650-2 Cl 5.2: Information management process – invitation to tender

Key ISO 19650-2 recommendations:

- The appointing party shall establish their exchange information requirements to be met by the prospective lead appointed party during the appointment.
- The appointing party shall consider their organizational information requirements, asset information requirements, establish the level of information need required to meet each information requirement etc.
- The appointing party shall establish the dates, relative to the project’s information delivery milestones and appointing party’s key decision points.
- The appointing party shall assemble the reference information or shared resources that they intend to provide to the prospective lead appointed party during the tender process or appointment. The appointing party shall establish the requirements that tendering organisations shall meet within their tender response.

✔️ Action:
(1) Ensure the exchange information requirements consider, as a minimum, the matters listed at Section 5.2.1.
(2) Consider which parties need to have early involvement, to ensure accurate requirements, for example FM/asset management contractors.
(3) Ensure all dates/milestones work in harmony with other milestones within the rest of the tender and appointment documentation and consider if they will/may impact subsequent award or payment milestones.
(4) Consider any copyright, confidentiality and security (including GDPR) issues in assembling and providing access to this information, and how such issues need to be dealt with in the tender documentation.
(5) Consider how the information and shared resources may be securely shared, bearing in mind different information/resources may be shared with different parties during the tender process and on appointment.
(6) Ensure the tender documentation covers, at a minimum, the matters listed in Sections 5.2.2–5.2.4 (including consideration of the project’s information protocol).

E.8. Information management process – tender response

Key ISO 19650-2 recommendations:

- The prospective lead appointed party shall have regard to the effective management of information throughout the appointment by nominating individuals from within its own organisation to undertake the information management function on behalf of the lead appointed party (or appoint a prospective appointed party or third party to do so).
- Each task team shall undertake an assessment of their capability and capacity; the delivery team's capability and capacity and proposed mobilisation plan shall be assessed by the prospective lead appointed party; the prospective lead appointed party shall establish the delivery team's risk register.

✔️ Action:
(1) Consider how the information management function and scope will be recorded within the contract documentation (if relevant) in the event of a successful tender; is this clear within the tender documentation?
(2) Consider how capability and capacity will be assessed and measured in the tender process

E.9. Information management process – appointment

Key ISO 19650-2 recommendations:

- The lead appointed party shall confirm the delivery team's BIM execution plan in agreement with each appointed party.
- The lead appointed party shall further refine the high-level responsibility matrix to establish the detailed responsibility matrix.
- A task information delivery plan and master information delivery plan, covering the matters detailed in Sections 5.4.4 and 5.4.5 is to be established by the task teams and lead appointed party respectively.
- The completed appointment documents should contain the matters listed in Sections 5.4.6 and 5.4.7 and managed via change control throughout the duration of the appointments. Ensure the change control process within the appointment will cover the matters listed. Consider how these matters should impact a party's rights to claim additional time and costs during the appointment.

✔️ Action:
(1) Ensure that the matters set out in Section 5.4.1 are detailed clearly within the contract documentation.
(2) Ensure the responsibility matrix is reflected in the contract documents and does not conflict with any other contractual responsibility matrix or programme. Ensure the responsibility matrix included in the contract (including if the CIC Protocol is used) reflects the requirements of Section 5.4.2.
(3) Ensure the task information delivery plan and master information delivery plan are included or referred to in binding contractual documents and cover, at a minimum, the matters detailed in Sections 5.4.4 and 5.4.5. Consider how these plans may impact the deliverables and milestones in the rest of the appointment documentation and ensure there is no discrepancy or contradiction; consider how they may or should impact any relevant payment milestones.
(4) Ensure the change control process within the appointment will cover the matters listed in Sections 5.4.6 and 5.4.7. Consider how these matters impact a party's rights to claim additional time and costs during the appointment.
(5) Have the requirements of PAS1192-5 (which relates to a security-minded approach) been incorporated into the appointment documentation, for example within the Protocol?

E.10. Information management process – mobilisation

Key ISO 19650-2 recommendations:

- The lead appointed party shall mobilise the resources and information technology, as defined within the delivery team's mobilisation plan.
- The lead appointed party shall test the project's information production methods and procedures, as defined within the delivery team's mobilisation plan.

✔️ Action:
(1) Ensure the appointment documentation sets out the parties' respective responsibilities for the execution of the mobilisation plan, and what entitlement there is to mobilisation costs. Ensure it is clear who is responsible for the accuracy and viability/feasibility of the mobilisation plan.
(2) Ensure the appointment documentation clarifies who is responsible for the outcome of tests of the information production methods and procedures, including any resulting additional time and costs.

E.11. Information management process – collaborative production of information

Key 19650-2 recommendations:

- Each task team shall generate information in accordance with their respective task information delivery plan.
- Each task team shall undertake a quality assurance check of each information container, in accordance with the project's information production methods and procedures, prior to undertaking a review of the information within it.

✔️ Action:
(1) Ensure the obligations within the appointment documentation include, at a minimum, the matters detailed in Section 5.6.2. Ensure any entitlement to claim additional time and costs resulting directly or indirectly from these obligations is made clear within the contract documentation.
(2) Ensure the appointed party/lead appointed party's standard of care in producing such information and carrying out any reviews is expressly stated, where relevant.
(3) Ensure that the appointment documentation clarifies the level of quality assurance checks that need to be carried out, and the timetable/programme for doing so. Ensure it is also clear what level of responsibility a party has for issues or errors within the information reviewed. These same comments apply to the requirement for each task team to undertake a review of the information within the information container prior to sharing within the project's CDE, and the delivery team undertaking a review of the information model.

E.12. Information management process – information model delivery

Key ISO 19650-2 recommendations:

- Each task team shall submit their information to the lead appointed party for authorisation within the project's CDE prior to the delivery of the information model to the appointing party. The lead appointed party shall review the information model in accordance with the project's information production methods and procedures, taking account of the matters listed in Section 5.7.2 and either accepts or rejects the information.
- If the information is rejected the task teams are instructed to amend the information and resubmit.
- If the review is successful, the lead appointed party authorizes the model and instructs each task team to submit their information for approval by the appointing party within the project's CDE. The appointing party then reviews the information, taking account of the matters listed in Section 5.7.4 and either accepts or rejects the information.
- If the information is rejected the lead appointed party is instructed to amend the information and resubmit.
- If the review is successful the appointing party accepts the information model as a deliverable in the project's CDE.

✔️ Action:
Ensure that the process for submission, authorisation, rejection and acceptance is clearly set out in the master information delivery plan and each task information delivery plan.

E.13. Information management process – project close-out

Key ISO 19650-2 recommendations:

- upon acceptance of the completed project information model, the appointing party shall archive the information containers within the project's CDE(s) in accordance with the project's information production methods and procedures.

✔️ Action:
(1) Ensure both the duration and manner of storage of information (including format) is clear within the appointment documentation.
(2) Does the appointment documentation make it clear who shall have continuing access to the information containers and/or the CDE(s), and the duration/limitations of such access?
(3) Does the appointment documentation make it clear who is responsible for the continuing integrity of the archived data, and responsible for hacking, degradation and/or corruption?

Annex D PAS 91:2013+A1:2017 Construction pre-qualification questionnaires

BSI PAS 91 sets out the content, format and use of pre-qualification questions for construction related tendering. Suppliers must demonstrate that they possess or have access to the governance, qualifications and references, expertise, competence and other essential capabilities to undertake work and deliver services for potential clients.

PAS 91 includes an optional question set for projects where building information modelling (BIM) is required; this is largely focused on a supplier’s capability and experience of delivering the now superseded PAS 1192-2:2013. These questions were aimed at UK Government procured projects for departments that have commenced implementation of their BIM strategy or other clients adopting a similar path.

It may take suppliers some time to embed and gain experience of the new BS EN ISO 19650 standards. In the meantime, clients might continue to require that project teams demonstrate their experience and capability in respect of the 1192 suite. Where the PAS 91 BIM questions are used the following note can be added:

> The appended Table 8 – Optional Question Module 4: Building information modelling should be completed by suppliers. Whilst PAS 1192-2:2013 has now been superseded by BS EN 19650-1 and -2, your response may be written with regards evidenced experience of delivering PAS1192-2 or BS EN ISO 19650 to reflect your organisation’s current position.

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