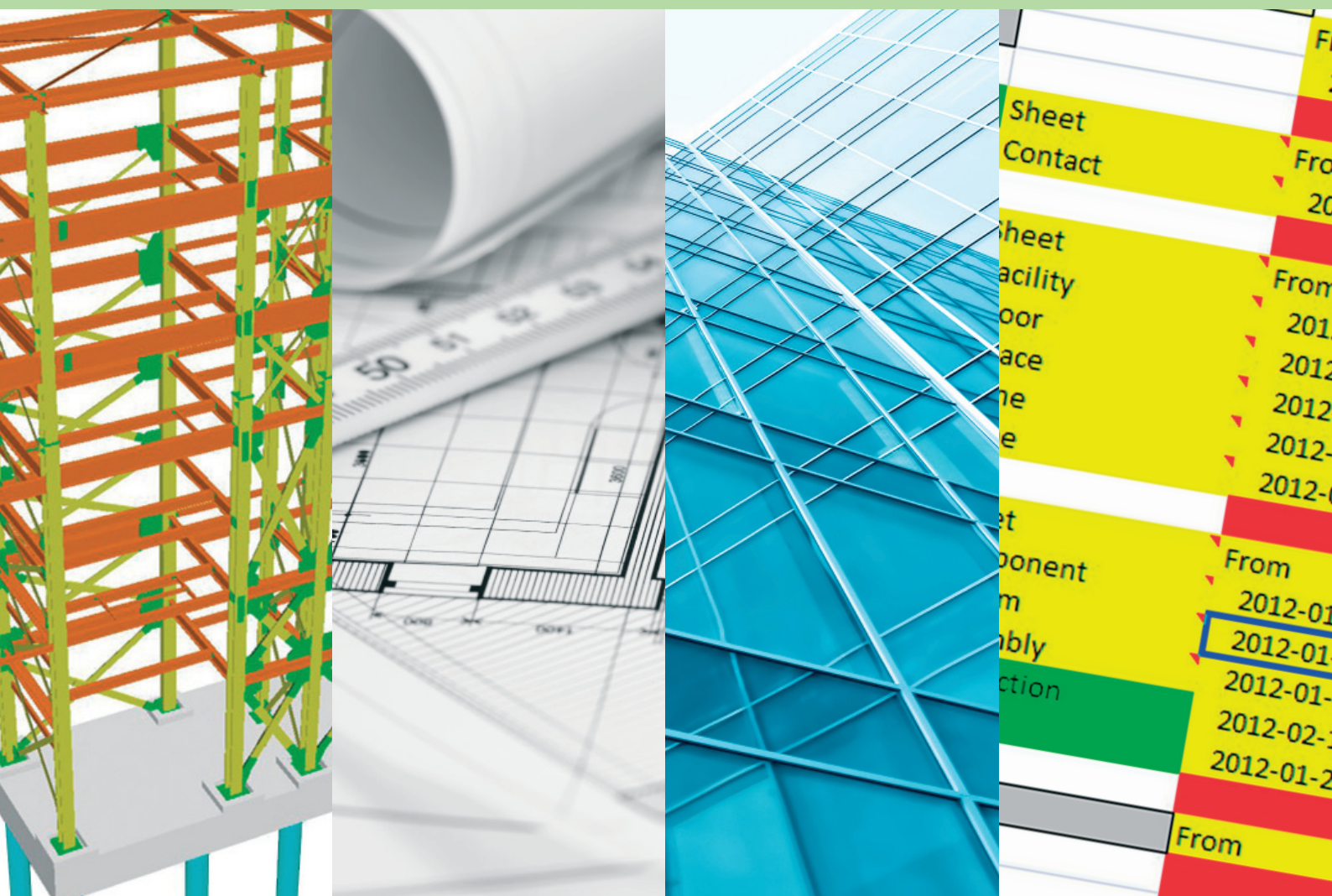


PAS 1192-2:2013

Incorporating Corrigendum No. 1

Specification for information management for the capital/delivery phase of construction projects using building information modelling



Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2013. Published by BSI Standards Limited 2013.

ISBN 978 0 580 82666 5

ICS 91.010.01

No copying without BSI permission except as permitted by copyright law.

Publication history

First published February 2013

Amendments issued since publication

Date	Text affected
28 March 2013	Corrigendum No. 1 to correct Figures 2, 7, 14, 20 and 21

Contents

Foreword	iii
Introduction	v
1 Scope	1
2 Normative references	2
3 Terms and definitions	3
4 Overview of documents referenced from this specification	7
5 Information delivery – Assessment and need	9
5.1 General	9
5.2 Origin of the employer's information requirements (EIR)	10
5.3 Contents of the employer's information requirements (EIR)	10
6 Information delivery – Procurement	12
6.1 General	12
6.2 Production of the pre-contract BIM execution plan (BEP)	14
6.3 Project implementation plan (PIP)	14
6.4 Supplier BIM assessment form	14
6.5 Supplier information technology (IT) assessment form	15
6.6 Supplier resource assessment form	15
6.7 Supply chain capability summary form	15
7 Information delivery – Post contract-award	16
7.1 General	16
7.2 Production of the post contract-award BIM execution plan (BEP) ..	16
7.3 Production of the master information delivery plan (MIDP)	17
7.4 Task information delivery plan (TIDP)	17
7.5 Project delivery team roles, responsibilities and authority	17
7.6 Volumes	20
8 Information delivery – Mobilization	23
9 Information delivery – Production	24
9.1 General	24
9.2 Common data environment (CDE)	25
9.3 File and layer naming conventions	29
9.4 Spatial co-ordination	29
9.5 Publication of information	32
9.6 Design for bespoke manufacture	32
9.7 Using assemblies and library information	32
9.8 Levels of model definition	33
9.9 Levels of model detail and model information	33
9.10 Classification	41

10 Information delivery – Asset information model (AIM) maintenance	42
10.1 General – information delivery – Asset information model (AIM) maintenance	42
10.2 Handover process between CAPEX and OPEX	43

Annexes

Annex A (informative) Terms, definitions and abbreviations for BIM documentation	44
--	----

Bibliography	53
---------------------	-----------

List of figures

Figure 1 – BIM maturity levels	vii
Figure 2 – The information delivery cycle	viii
Figure 3 – The relationships between the contract and the associated documents	7
Figure 4 – Relationship between documents used for information management	8
Figure 5 – Information delivery – Assessment and need	9
Figure 6 – Information delivery – Procurement	12
Figure 7 – The whole supply chain contributes information to answer the Plain Language questions	13
Figure 8 – Relationship between documents used for information management	14
Figure 9 – Information delivery – Post contract-award	16
Figure 10 – Roles, responsibilities and authority	18
Figure 11 – Volumes within a tunnel design for spatial co-ordination	21
Figure 12 – Volumes within a building for spatial co-ordination	22
Figure 13 – Information delivery – Mobilization	23
Figure 14 – Information delivery – Production	24
Figure 15 – Extending the common data environment (CDE)	26
Figure 16 – Architect's issue to SHARED	31
Figure 17 – Structural engineer's issue to SHARED	31
Figure 18 – MEP engineer's issue to SHARED	31
Figure 19 – Design review of models in SHARED	32
Figure 20 – Levels of model definition for building and infrastructure projects	35
Figure 21 – Information delivery – AIM maintenance	42

List of tables

Table 1 – Information modelling maturity Level 2	x
Table 2 – Information exchange activities	19
Table 3 – Status codes in the CDE	28
Table 4 – Application of different classification systems	41

Foreword

This PAS was sponsored by the Construction Industry Council (CIC). Its development was facilitated by BSI Standards Limited and published under licence from The British Standards Institution. It came into effect on 28 February 2013.

Acknowledgement is given to the following organizations that were involved in the development of this specification as members of the Steering Group:

- AEC3
- Atkins Limited
- Autodesk
- Bentley
- BIM4IUK
- Building SMART
- Cabinet Office
- Construction Project Information Committee
- Construction Industry Council (CIC)
- Department of Business, Innovation and Skills (BIS)
- EC Strategies
- Evolve
- Hitherwood Consulting
- HM Treasury
- Kier
- Ministry of Justice
- MR1 Consulting Ltd
- OakleyCAD
- Operam Ltd
- Parsons Brinckerhoff
- Skanska
- TfL
- URS Scott Wilson
- West One Management Consulting

The British Standards Institution retains ownership and copyright of this PAS. BSI Standards Limited as the publisher of the PAS reserves the right to withdraw or amend this PAS on receipt of authoritative advice that it is appropriate to do so. This PAS will be reviewed at intervals not exceeding two years, and any amendments arising from the review will be published as an amended PAS and publicized in *Update Standards*.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS may be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Relationship with other publications

This PAS builds on the existing code of practice for the collaborative production of architectural, engineering and construction information, defined within BS 1192:2007.

A forthcoming document, PAS 1192-3, will offer guidance on the use and maintenance of the asset information model (AIM) to support the planned preventative maintenance programme and the portfolio management activity for the life of the asset.

Information about this document

The start and finish of text introduced by Corrigendum No. 1 is indicated in the text by tags **[C1]** and **[C1]**.

Copyright is claimed on Figure 1. Copyright holders are Mark Bew and Mervyn Richards.

Copyright is claimed on Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20. Copyright holder is Mervyn Richards.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”. The use of the auxiliary verb “can” indicates that something is technically possible and the auxiliary verb “may” indicates permission.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Spelling conforms to The Shorter Oxford English Dictionary. If a word has more than one spelling, the first spelling is used.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Introduction

General information

The production of co-ordinated design and construction information is a task- and time-based process, independent of which procurement route or form of contract is used. Each task needs to be carried out in a particular order for the mutual benefit of all those involved, otherwise known as “collaborative working”. In a collaborative working environment, teams are asked to produce information using standardized processes and agreed standards and methods, to ensure the same form and quality, enabling information to be used and reused without change or interpretation. If an individual, office or team changes the process without agreement, it will hinder collaboration – a participant insisting on “my standard” is not acceptable in a collaborative working environment.

This approach does not require more work, as this information has always been required to be produced. However, true collaborative working requires mutual understanding and trust within the team and a deeper level of standardized process than has previously been experienced, if the information is to be produced and delivered in a consistent timely manner. The benefits of working in this way can include fewer delays and disputes within the team, better management of project risk and better understanding of where costs are being incurred.

Wherever possible, the principles of lean should also be applied to reduce the expenditure of resources for any goal other than the creation of value for the employer. For example, BS 1192:2007 promotes the avoidance of wasteful activities such as:

- waiting and searching for information;
- over-production of information with no defined use;
- over-processing information, simply because the technology can; and
- defects, caused by poor co-ordination across the graphical and non-graphical data set which require rework.

However, for the production of information to be truly lean, it is critical to understand its future use. This is achieved by “beginning with the end in mind” and identifying the downstream uses of information, to ensure information can be used and re-used throughout the project and life of the asset. It is to this end that PAS 1192-2 has been produced.

It is anticipated that this document is of equal value to small practices as well as large multi-nationals. The impact of poor information management and waste is potentially equal on all projects. Where appropriate we have offered some advice as to how the process and methods described here can be implemented in a scalable fashion to suit all organizations.

Background and context of PAS 1192-2

In May 2011, the UK Government published the Construction Strategy aimed at reducing the cost of public sector assets by up to 20% by 2016. The strategy calls “for a profound change in the relationship between public authorities and the construction industry to ensure the Government consistently gets a good deal and the country gets the social and economic infrastructure it needs for the long-term”.

Basic problems exist with procuring public assets, which have been known for over 100 years, but little as yet has been achieved in resolving them. The Construction Strategy defines a number of strategic objectives, which collectively will overcome these problems. In particular, a strategic objective has been set to achieve maturity Level 2 building information modelling (BIM) on all public sector asset procurement, with equal applicability to private sector building, infrastructure, refurbishment and new-build projects. This will address the problem of information that is inaccurate, incomplete and ambiguous and results in unnecessary additional capital delivery costs amounting to 20-25% – see Avanti case studies at <http://www.cpic.org.uk/en/publications/avanti>.

It was envisaged that the advent of Computer Aided Design solutions had the potential to improve the consistency of information, but at best it has only served to perpetuate the problem.

This additional 20-25% is considered waste and can be reduced if the standards, processes and procedures outlined in BS 1192:2007 and this document are implemented.

This PAS is one of a number of documents published on the BIM Task Group website (<http://www.bimtaskgroup.org>) in support of these strategic objectives. These are as follows:

- CIC Scope of Services, First Edition, 2007;
- Outline Scope of Services for the Role of Information Management, First Edition, 2013;
- COBie-UK-2012, the first edition of the UK edition of the schema for Construction Operations Building Information Exchange;
- CIC BIM Protocol, First Edition, 2013;
- Employer's Information Requirements.

Additional information can also be found on the BIM Task Group website <http://www.bimtaskgroup.org>.

The BIM maturity model setting out the progression from CAD ultimately to Level 3 BIM is shown in Figure 1. More detail regarding Level 2 is given under the heading "Fundamental principles for Level 2 information modelling", below.

The process of BIM generates information models and their associated information that are used throughout the lifecycle of building/infrastructure facilities or assets. The information delivery and project management cycle in Figure 2 shows in BLUE the generic process of identifying a project need (which may be for design services, for construction or for supply of goods), procuring and awarding a contract, mobilizing a supplier and generating production information and asset information relevant to the need. This cycle is followed for every aspect of a project, including the refinement of design information through the seven project stages shown in GREEN.

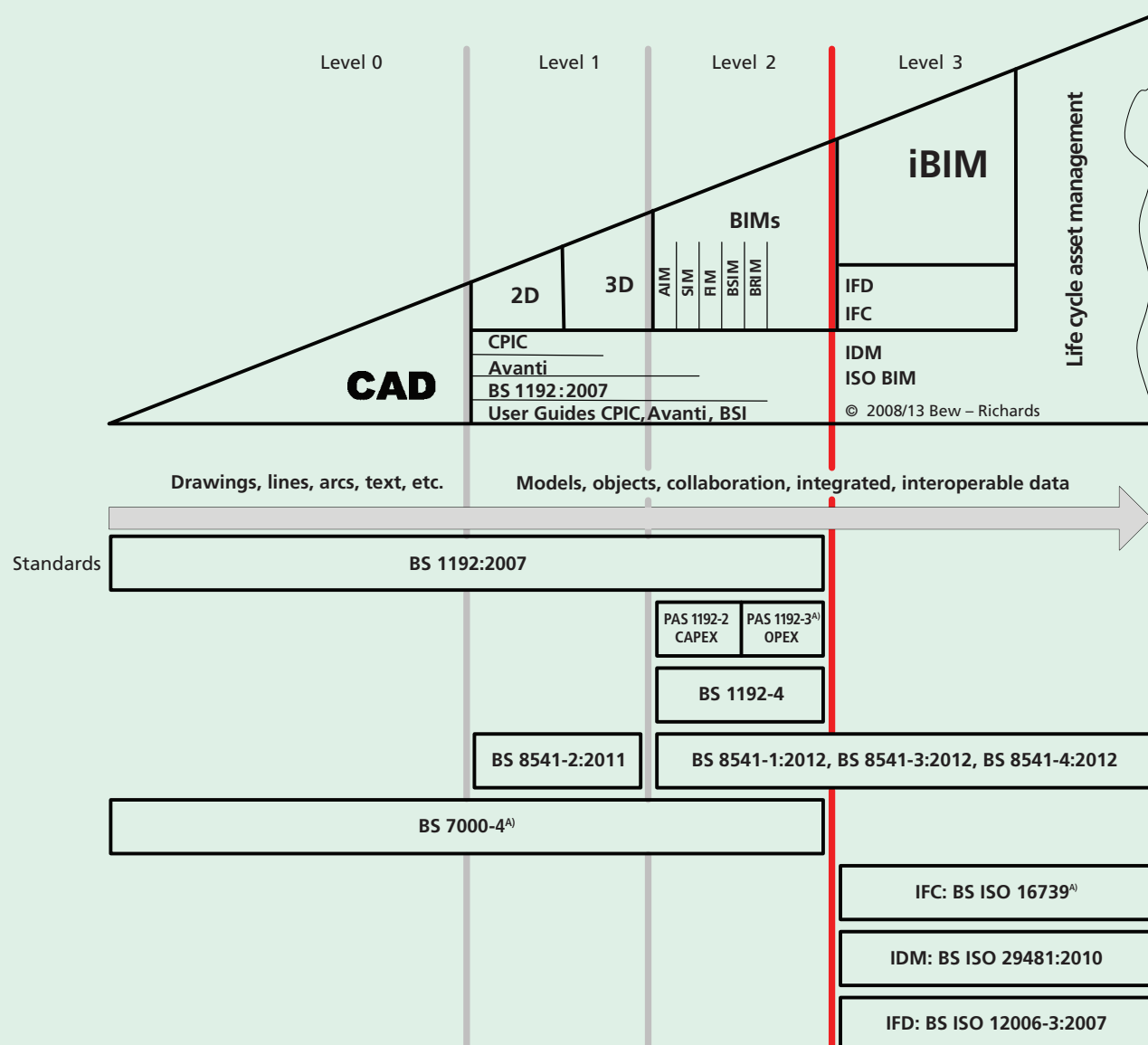
The GREEN elements of the diagrams represent the information delivery process known as the common data environment (CDE).

A forthcoming document, PAS 1192-3, to be developed, will offer guidance on the use and maintenance of the asset information model (AIM) to support the planned preventative maintenance programme and the portfolio management activity for the life of the asset.

This document provides a framework, from which a number of supplementary documents will provide detailed guidance. Collectively, these documents will be developed further, from the learning taken from the Government's "early adopter" projects, and may be considered for further development as a British Standard.

PAS 1192-2 provides specific guidance for the information management requirements associated with projects delivered using BIM. Not all information on a project will be originated, exchanged or managed in a BIM format. This information will also need to be managed in a consistent and structured way to enable efficient and accurate information exchange. BS 1192:2007 provides details of the standards and processes that should be adopted to deliver these outcomes. Only information exchanges specific to BIM are described in this PAS. It is assumed for the purposes of this standard that non-BIM information exchanges between a principal supplier and employer and within the supply chain will be managed using equivalent information management standards. Furthermore, and for the avoidance of doubt, all project information, whether in BIM environments or in conventional data formats should be shared using a single collaborative data environment (CDE).

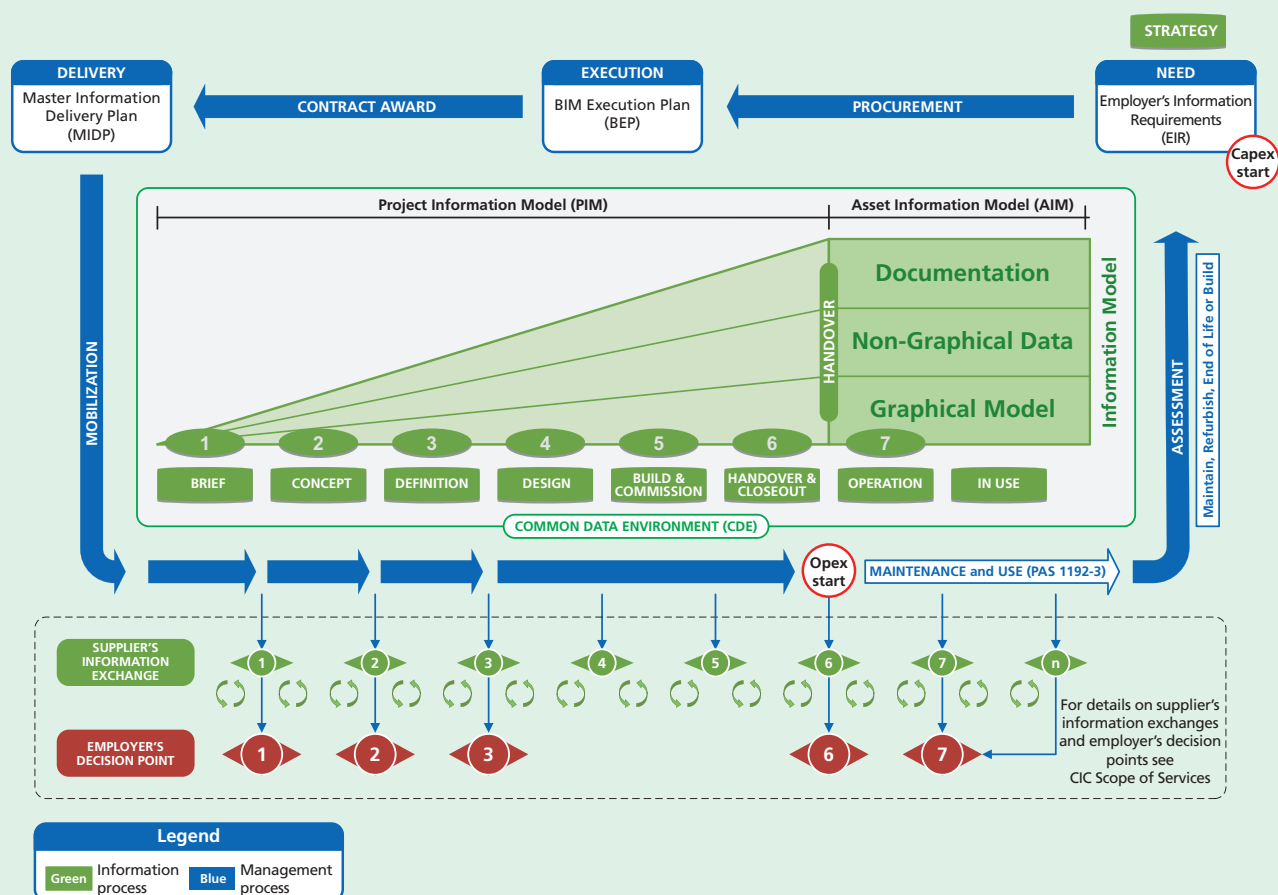
Figure 1 – BIM maturity levels



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

^{A)} In preparation.

Figure 2 – The information delivery cycle



NOTE 1 The information delivery cycle as shown in Figure 2 has two distinct points of entry. For stand-alone new-build projects, start at the top right box "Need", but for projects that are part of a larger portfolio or estate, or for projects working on existing buildings and structures, then start at the right-hand arrow "Assessment" which draws on the information in the existing AIM. These points of entry are also referenced in the CDE – see 8.2. It is assumed that use will be made at both start points of portfolio information to inform decisions.

NOTE 2 The information delivery cycle shows in BLUE the generic process of identifying a project need (which may be for design services, for construction or for supply of goods), procuring and awarding a contract, mobilizing a supplier and generating production information and asset information relevant to the need. This cycle is followed for every aspect of a project, including the refinement of design information through the seven project stages shown in GREEN.

NOTE 3 The GREEN numbered ovals and annotated lozenges refer to the CIC Scope of Services stages. The GREEN image represents the CDE that will collect, manage, disseminate, exchange and retrieve information through the lifecycle.

NOTE 4 Information exchanges between project team members are indicated by small GREEN balloons.

NOTE 5 Information exchanges between the project team and the employer are indicated by larger red balloons to answer the Plain Language questions posed by the employer defined in the employer's information requirements (EIR) and referred to in Figure 7 (see 4.1.5).

NOTE 6 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Fundamental principles for Level 2 information modelling

The fundamental principles of Level 2 information modelling are:

- a) originators produce definition information in models which they control, sourcing information from other models where required by way of reference, federation or direct information exchange;
- b) provision of a clear definition of the employer's information requirements (EIR) and key decision points (to form part of the contract possibly through adoption of the CIC BIM Protocol) – see Clause 5;
- c) evaluation of the proposed approach, capability and capacity of each supplier, and their supply chain, to deliver the required information, prior to contract award – see Clause 6;
- d) a BIM execution plan (BEP) shall be developed by the supplier containing:
 - 1) assigned roles, responsibilities and authorities;
 - 2) standards, methods and procedures; and
 - 3) a resourced master information delivery index, aligned with the project programme;
 – see Clauses 6, 7 and 8;
- e) provision of a single environment to store shared asset data and information, accessible to all individuals who are required to produce, use and maintain it – see Clause 9;

***NOTE** The single environment can look very different on small and large projects, which can use free web-based file sharing applications or sophisticated enterprise bridge software.*
- f) application of the processes and procedures outlined in the documents and standards indicated in Table 1; and
- g) information models to be developed using one of the following combinations of enabling tools:
 - 1) discipline-based software, with individual proprietary databases, that have limited interoperability between them or with associated design analysis software;
 - 2) discipline-based software, with individual proprietary databases, that are fully interoperable, but with limited interoperability with associated design analysis software;
 - 3) discipline-based software, with individual proprietary databases, and associated design analysis software that are fully interoperable; or

- 4) single source platform software, with a single external relational database, and associated design analysis software that are fully interoperable.

This list of combinations of enabling tools is not exhaustive.

***NOTE 1** The above principles involve the delivery of a co-ordinated project information model to the employer containing graphical and non-graphical information through a single point of responsibility, likely to be the lead designer or the contractor.*

***NOTE 2** One of the key Level 2 requirements is the exchange standard of COBie and PDF, as well as copies of the native files.*

***NOTE 3** The definition of BIM maturity Level 2 was originally developed as part of the UK Government BIM strategy in 2011. The terminology has been adopted widely. Level 2 is defined in this PAS with reference to best practice and the adoption of tools and standards. Given the early stage of adoption of managed methods of working in BIM at the time when this PAS was drafted, it can be expected that Level 2 practice will continue to evolve and that the scope of information sharing and exchange will vary from project to project. For this reason, it can be anticipated that the definition of Level 2 BIM will continue to evolve around the core principle of the shared use of individually authored models in a common data environment.*

Table 1 – Information modelling maturity Level 2

Enabling tools	Many software solutions in combination with many variable interoperable capabilities. Design through manufacture and construction. Discipline-based production/analysis software. File-based collaboration and library management.
BSI Standards	Available: • BS 1192:2007 • BS 7000-4:1996^{A)} • BS 8541-1:2012 • BS 8541-2:2011 • BS 8541-3:2012 • BS 8541-4:2012 • PAS 1192-2:2013 • PAS 91:2012 To be developed: • PAS 1192-3 • BS 1192-4
CPI/BSI documents	Available: • A standard framework and guide to BS 1192:2007 Under development: • CPlx Protocol • CPI Uniclass (unified) To be developed: • CPI Uniclass supporting guidance
Other documents	Under development CIC Scope of Services for the Role of Information Management, First Edition, 2013 To be developed: • Early adopters learning report • Institutional plans of work • CIC BIM Protocol, First Edition, 2013 • Employers Information Requirements • Government Soft Landings (policy title to be confirmed)

NOTE 1 This table has been developed from the diagram shown in the Building Information Modelling (BIM) Working Group Strategy Paper, published in March 2011.

NOTE 2 All the above documents will be available from BIM Task Force website at <http://www.bimtaskgroup.org>.

^{A)} Revision in preparation.

1 Scope

This Publicly Available Specification (PAS) specifies requirements for achieving building information modelling (BIM) Level 2 – see Figure 1 and Table 1. The requirements within this PAS build on the existing code of practice for the collaborative production of architectural, engineering and construction information, defined within BS 1192:2007.

PAS 1192-2 focuses specifically on project delivery, where the majority of graphical data, non-graphical data and documents, known collectively as the project information model (PIM), are accumulated from design and construction activities.

The intended audience for this PAS includes organizations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings and infrastructure assets. Where possible, generic language has been used, but where necessary, specific definitions are in Clause 3.

Commencing at the point of assessment (for existing assets) or statement of need (for new assets) and progressively working through the various stages of the information delivery cycle, the requirements within this PAS culminate with the delivery of the as-constructed asset information model (AIM). This is handed over to the employer by the supplier once the PIM has been verified against what has been constructed.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 1192:2007, *Collaborative production of architectural, engineering and construction information – Code of practice*

CIC BIM Protocol, First Edition, 2013
<http://www.bimtaskgroup.org>

RICHARDS, M. *Building Information Management – A Standard Framework and Guide to BS 1192*. London, UK: BSI, 2010

Uniclass documents, <http://www.bimtaskgroup.org>

3 Terms and definitions

For the purposes of this PAS the following terms and definitions apply.

3.1 archive

component of the common data environment (CDE)

NOTE *The archive section of the CDE is for inactive or superseded information. Such information will provide a history of the project information transfers, sharing, change orders and knowledge retention, and can be used for other contractual purposes or “discovery”.*

3.2 as-built

as-constructed

component of the common data environment (CDE)

3.3 asset information model (AIM)

maintained information model used to manage, maintain and operate the asset

3.4 attribute

piece of data forming a partial description of an object or entity

3.5 author

originator of model files, drawings or documents

3.6 building information modelling execution plan (BEP)

plan prepared by the suppliers to explain how the information modelling aspects of a project will be carried out

3.7 building information modelling (BIM)

process of designing, constructing or operating a building or infrastructure asset using electronic object-oriented information

3.8 CIC Scope of Services

multi-disciplinary scope of services published by the Construction Industry Council (CIC) for use by members of the project team on major projects

3.9 clash rendition

rendition of the native format model file to be used specifically for spatial coordination processes

NOTE *Used to achieve clash avoidance or to be used for clash detection.*

3.10 classification

systematic arrangement of headings and sub-headings for aspects of construction work including the nature of assets, construction elements, systems and products

3.11 client

individual or organization commissioning a built asset

NOTE *The client may be different from the employer.*

3.12 COBie (Construction Operation Building information exchange)

structured facility information for the commissioning, operation and maintenance of a project often in a neutral spreadsheet format that will be used to supply data to the employer or operator to populate decision-making tools, facilities management and asset management systems

NOTE *Templates for the preparation of COBie-UK-2012 information exchange files (the schema developed for UK projects) can be downloaded from the website: <http://www.bimtaskgroup.org/cobie-uk-2012>.*

3.13 common data environment (CDE)

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

NOTE *A CDE may use a project server, an extranet, a file-based retrieval system or other suitable toolset.*

3.14 configuration management

co-ordinated activities to direct and control configuration

[BS ISO 10007:2003]

3.15 data

information stored but not yet interpreted or analyzed

3.16 design intent model

initial version of the project information model (PIM) developed by the design suppliers

3.17 document

information for use in the briefing, design, construction, operation, maintenance or decommissioning of a construction project, including but not limited to correspondence, drawings, schedules, specifications, calculations, spreadsheets

NOTE Documents must either be immutable or incorporate a means of controlling changes.

3.18 drawing

static, printed, graphical representation of part or all of a project or asset

3.19 electronic document management system (EDMS)

system for storing, retrieving, sharing and otherwise managing electronic documents

3.20 employer

individual or organization named in an appointment or building contract as the employer

3.21 employer's information requirements (EIR)

pre-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

3.22 gate

stage

division of a standardised process map for the acquisition of a facility, at some of which the requirements can be delivered

NOTE The stages at which information exchanges are required should be specified in the EIR by reference to the agreed stage and gate names. See the CIC Scope of Services.

3.23 graphical data

data conveyed using shape and arrangement in space

3.24 information

representation of data in a formal manner suitable for communication, interpretation or processing by human beings or computer applications

3.25 information exchange

structured collection of information at one of a number of pre-defined stages of a project with defined format and fidelity

3.26 information management

tasks and procedures applied to inputting, processing and generation activities to ensure accuracy and integrity of information

3.27 information model

model comprising: documentation, non-graphical information and graphical information

NOTE The model is conveyed using PDF, COBie and native model files.

3.28 information modelling

use of data to provide information through better understanding, by applying logic or mathematical functions to derive new data

3.29 lean

production focused on delivering value for the employer or client and eliminating all non-value-adding activities using an efficient workflow

3.30 level of definition

collective term used for and including “level of model detail” and the “level of information detail”

NOTE The “level of model detail” is the description of graphical content of models at each of the stages defined for example in the CIC Scope of Services. The “level of model information” is the description of non-graphical content of models at each of the stages defined, for example, in the CIC Scope of Services

3.31 master information delivery plan (MIDP)

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

3.32 non-graphical data

data conveyed using alphanumeric characters

3.33 project delivery team

group of organizations or individuals contracted either directly or indirectly to deliver services or products to the project

3.34 project implementation plan (PIP)

statement relating to the suppliers’ IT and human resources capability to deliver the EIR

NOTE In this PAS a PIP relates solely to information capabilities and should not be confused with any more generic project management plan.

3.35 project information model (PIM)

information model developed during the design and construction phase of a project

NOTE The PIM is developed firstly as a design intent model, showing the architectural and engineering intentions of the design suppliers. Then, when ownership has been transferred to the construction suppliers, the PIM is developed into a virtual construction model containing all the objects to be manufactured, installed or constructed.

3.36 RACI indicator

abbreviation used to identify which of a group of participants or stakeholders are responsible for (“R”), authorize (“A”), contribute to (“C”) or are to be kept informed about (“I”) a project activity

3.37 soft landings

graduated handover of a built asset from the design and construction team to the operation and maintenance team to allow structured familiarization of systems and components and fine tuning of controls and other building management systems

3.38 standard method and procedure (SMP)

set of standard methods and procedures covering the way information is named, expressed and referenced

3.39 supplier

provider of services or goods either directly to the employer or to another supplier in a supply chain

3.40 supplier information modelling assessment form

form conveying the capability and experience of a supplier to carry out information modelling in a collaborative environment

3.41 supplier information technology assessment form

form conveying the capability and IT resources of a supplier for exchanging information in a collaborative environment

3.42 supply chain capability assessment form

form summarizing the human resource and IT capability of each organization in a supply chain

3.43 task information delivery plan (TIDP)

federated lists of information deliverables by each task, including format, date and responsibilities

3.44 third party capability assessment form

form conveying the information management and IT capabilities of non-design, non-construction organizations in a supply chain

3.45 user

individual using a built asset for its designed purpose

3.46 virtual construction model

subsequent version of the project information model developed from the design intent model by the construction supplier and their supply chain

3.47 volume

manageable spatial subdivision of a project, defined by the project team as a subdivision of the overall project that allows more than one person to work on the project models simultaneously and consistent with the analysis and design process

NOTE 1 *Analogous to the volume strategy defined by the lead designer to allocate volumes within the project to different disciplines into which they carry out their system models (walls, structure, pipework, ductwork, electrical, etc).*

Also achieves spatial co-ordination prior to detail design.

Each volume or subdivision is a reference file. When one or more referenced files is viewed, the full floor plan or site plan can be represented. This subdivision also becomes important when using extranets, as it allows the files to be kept to a manageable file size.

NOTE 2 *This term is defined as “zone” in BS 1192:2007.*

4 Overview of documents referenced from this specification

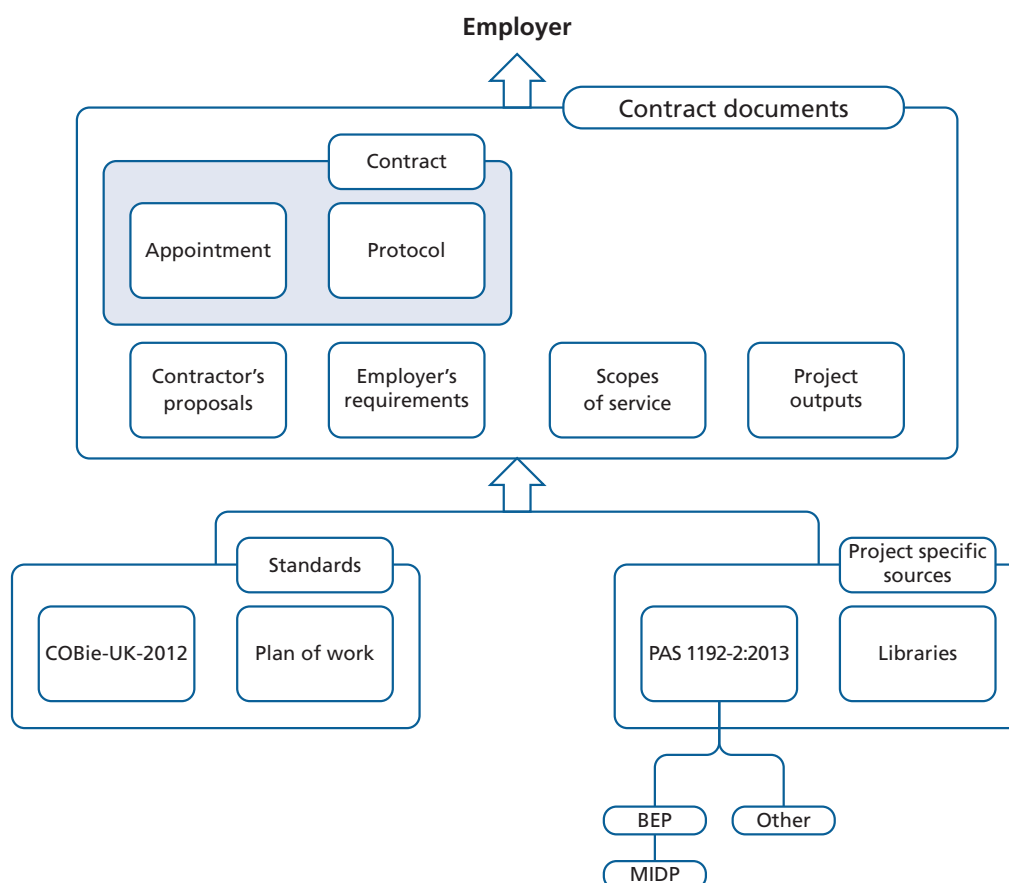
NOTE 1 This PAS formalizes and makes explicit many of the existing information management practices seen in UK construction projects. It is the UK government's express objective that BIM Level 2 has minimal impact on existing contracting methods. This clause describes the documents used and their relationships as shown in Figures 3 and 4.

NOTE 2 This PAS is designed to be used with all contract forms. Specific project or contract requirements are achieved by the use of a "Protocol" document which lays out the specific precedence of all documents.

NOTE 3 Various documents are used between the employer and the supplier (contractor) and between the supplier (contractor) and their supply chain. Management of the various supply chain tiers are described in Clauses 5, 6 and 7.

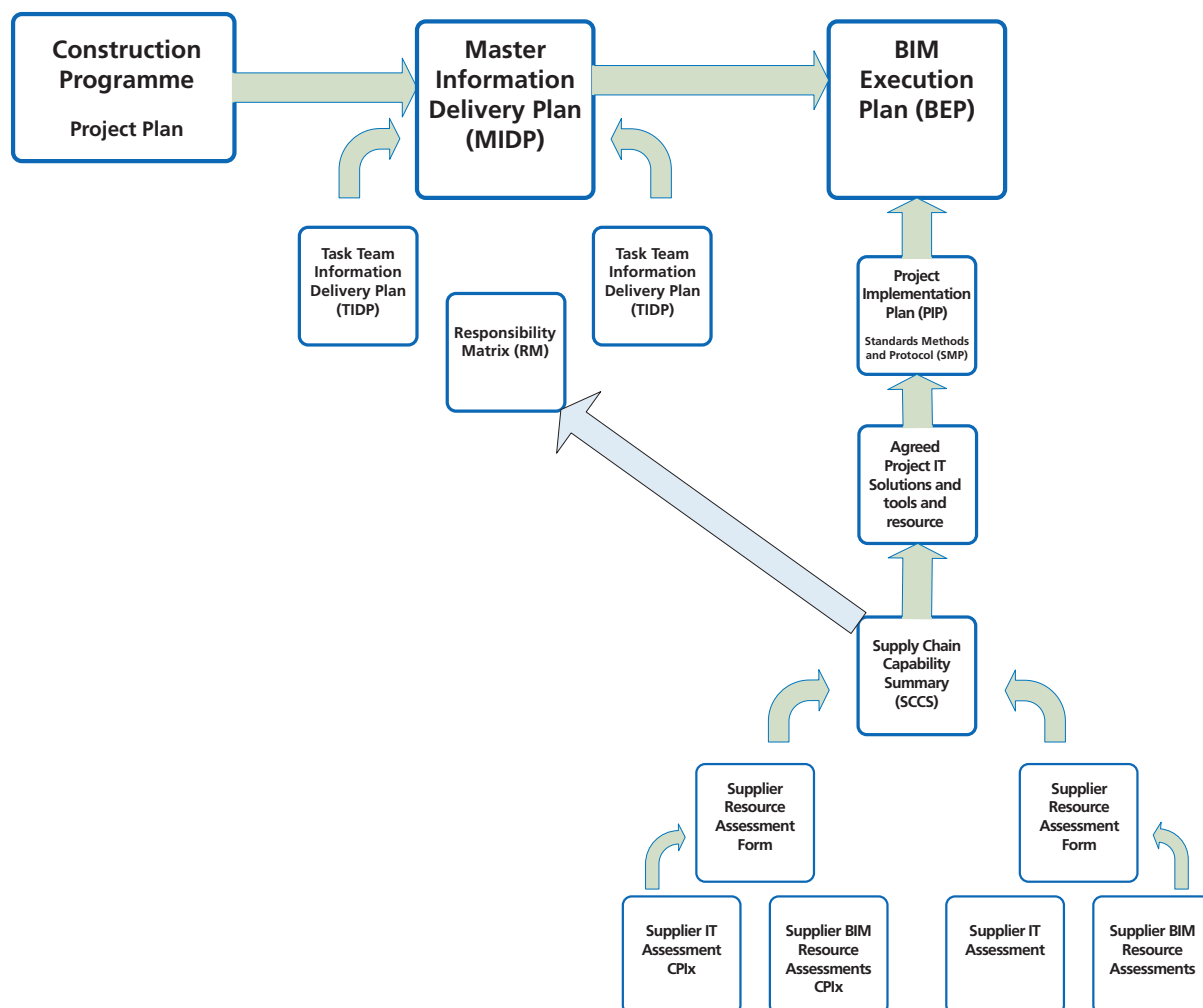
NOTE 4 To manage capability, selection and delivery, various documents are used by suppliers in each tier. These documents are indicated towards the lower section of Figure 4 and are described from an information management point of view in 6.3. For a more detailed "design management point of view" see guidance at BS 7000.

Figure 3 – The relationships between the contract and the associated documents



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 4 – Relationship between documents used for information management



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

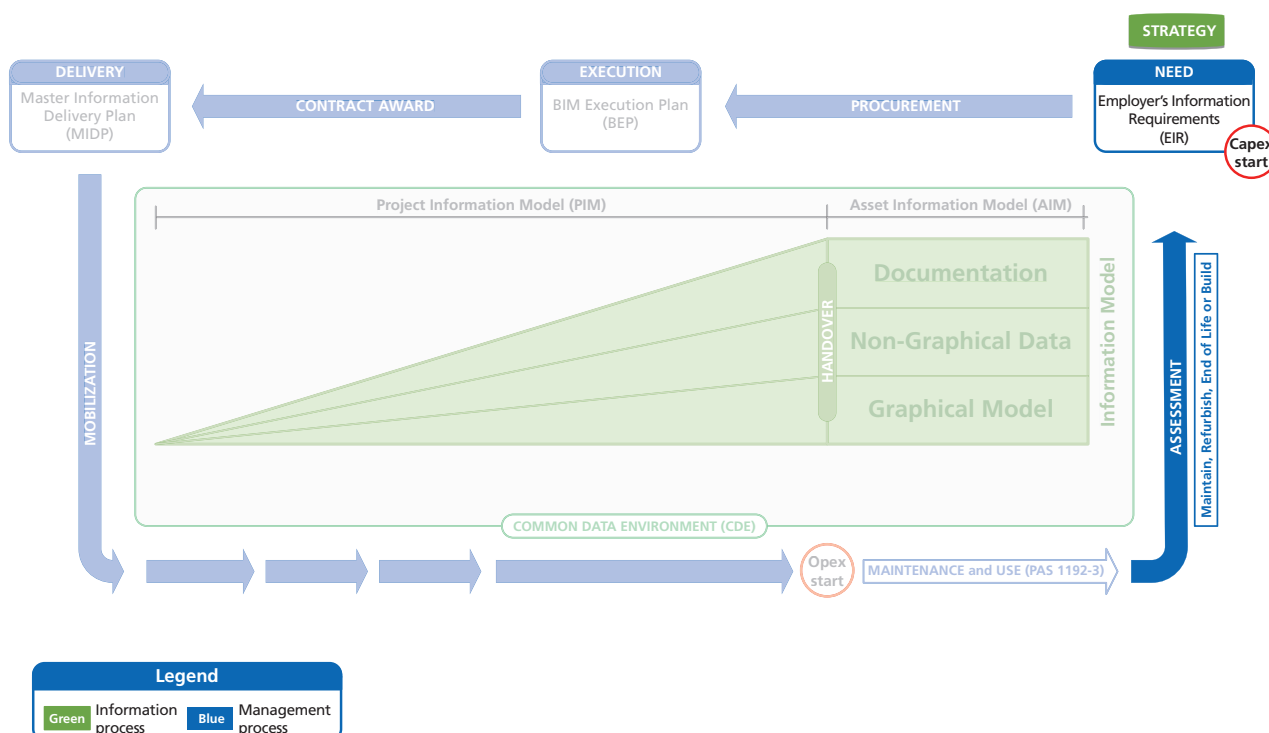
Documents for information management shall be prepared by CPI and referred to as the Construction Project Information Xchange (CPIx):

- a) the Project Implementation Plan (PIP) which is submitted pre-contract-award to convey each potential supplier's capability related to information management;
- b) the Task Information Delivery Plan (TIDP) which is submitted by each task team working on the project to set out each team's responsibility for delivering information;
- c) the Responsibility Matrix which sets out the relationship between disciplines and production of information or models;

- d) the Master Information Delivery Plan (MIDP) which collates all the TIDPs against the construction programme; and
- e) the BIM Execution Plan (BEP) which is submitted firstly pre-contract to address the issues raised in the EIR and then with more detail post-contract-award to explain the supplier's methodology for delivering the project using BIM.

5 Information delivery – Assessment and need

Figure 5 – The information delivery – Assessment and need



NOTE 1 The headings of Clauses 5 to 10 follow the stages of the lifecycle as noted in the blue arrows from the information delivery cycle (Assessment, Procurement, etc.).

NOTE 2 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

5.1 General

NOTE Figure 5 shows how this part of the information delivery cycle fits into the overall process.

5.1.1 The information delivery cycle and the project stages described in this PAS shall begin at "CAPEX start" (see Figure 5) and end at Handover.

NOTE "CAPEX start" represents one of two states, either where a project begins with no pre-existing information or where a project begins based on the assessment of pre-existing information from an asset portfolio.

5.1.2 Definition of the information exchange and collaborative working requirements shall be undertaken in parallel with other procurement and project definition activities. Information exchange and collaborative working requirements are described in the EIRs, which form part of the employer's requirements and will in turn be incorporated by a supplier into their Project Execution Plan. The contents of the EIRs are aligned to employer decision points which in turn will coincide with project stages. The EIRs shall be consistent with other appointment and contract documents in use on the project, which in turn should be aligned with industry standards such as the RIBA Plan of Work or APM Project Stages. Information requirements set out in the EIRs shall only provide enough information to answer the "Plain Language Questions" required at a particular stage, at an appropriate level of detail.

NOTE 1 Where possible these will be based on standards such as the CIC Scope of Services and the various Plans of Work. Specific requirements of delivery and operation should be established with the employer's advisors with a view to minimizing data to that which is needed at each stage.

NOTE 2 This document describes the generic methods for contract management, and design information production management. The detailed methods of design management and the specifics of the procurement strategy and documentation will need to be referenced in detail for actual delivery. These will be described in the project implementation plan (PIP) and contract documents.

NOTE 3 Responsibility for the delivery of information in principle rests with the employer who discharges accountability to the design or construction team as appropriate. Allocation of these responsibilities shall be project specific and documented in the contract. For further information on generic roles, refer to the various Scopes of Services such as those published by CIC.

NOTE 4 Any use of data provided in library form shall be documented in the EIR.

5.1.3 Information requirements shall be specific, measureable, achievable, realistic and time-bound against, for defined project stages and information exchanges.

NOTE These are set out in various Plans of Work including the CIC Scope of Services, to enable suppliers to determine the most effective and efficient method of delivery.

5.1.4 The EIR shall be incorporated into the tender documentation, to enable suppliers to produce their initial BIM execution plan (BEP) – see Clause 6 – upon which their proposed approach, capability and capacity can be evaluated.

5.1.5 The employer, or the employer's representative, shall be responsible for ensuring that information requirements are included in project contracts in such a way as to avoid duplication of responsibilities.

NOTE 1 For more information on producing the EIR see 5.3.

NOTE 2 Employers are strongly advised to assign the role of project delivery manager to one or more individuals as early as possible to develop these requirements. Under the CIC BIM Protocol (2013) the employer is obliged to appoint a party to undertake the role of Information Manager.

5.2 Origin of the employer's information requirements (EIR)

5.2.1 EIRs are produced as part of a wider set of documentation for use during project procurement and shall typically be issued as part of the employer's requirements or tender documentation. The development of the EIR shall start either with the assessment of an existing asset, leading to the development of the employer's need, or directly with the employer's need if no existing asset or asset information model is to be considered.

5.2.2 Irrespective of which starting point is used in the information delivery cycle, the steps in the cycle shall be applied separately to the procurement and engagement of each tier 1 supplier required for the project as a whole.

NOTE A tier 1 supplier can provide services to the project (for example, development of the project brief, architectural services, engineering services, construction management services), or can provide goods to the project (for example, constructed assets).

5.3 Contents of the employer's information requirements (EIR)

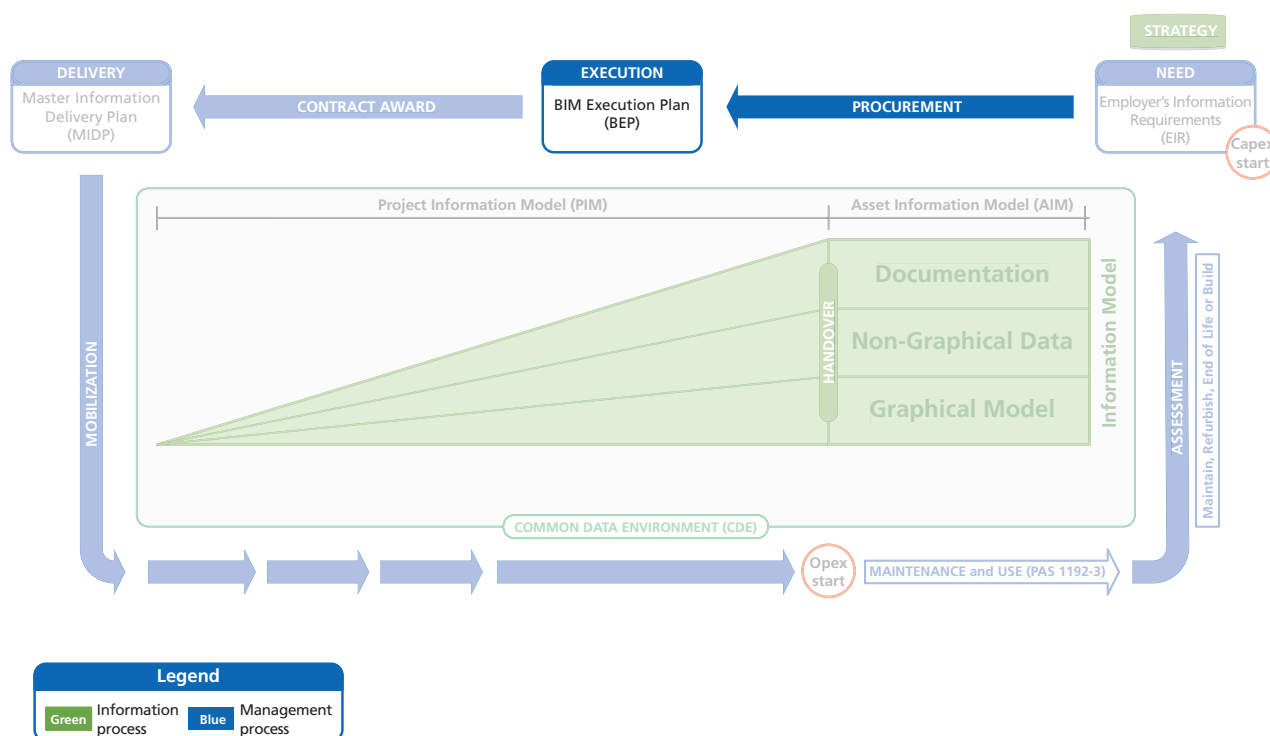
The EIR shall include the following contents, as a minimum:

- a) information management:
 - 1) levels of detail – e.g. requirements for information submissions at defined project stages. This is needed to populate the Model Production and Delivery Table required under the Protocol;
 - 2) training requirements – not likely to be mandatory;
 - 3) planning of work and data segregation – requirements for bidders' proposals for the management of the modelling process (e.g. model management, naming conventions, etc.);
 - 4) co-ordination and clash detection – requirements for bidders' proposals for the management of the co-ordination process;
 - 5) collaboration process – requirements for bidders' proposals for the management of the collaboration process;
 - 6) HSE/CDM – requirements for bidders' proposals for BIM/CDE-supported H&S/CDM management;

- 7) a schedule of any security and integrity requirements for the project;
 - 8) a schedule of any specific information to be either excluded or included from information models;
 - 9) a schedule of any particular constraints set by the employer on the size of model files, the size of extranet uploads or emails, or the file formats that can define the size of a volume;
***NOTE** In addition to the generic contents listed above, the EIR may also include project specific items such as pre-construction surveys or a requirement for the employer to receive information models describing newly-generated products and assemblies.*
 - 10) compliance plan – requirements for bidders' proposals for the management of the co-ordination process;
 - 11) a definition of any co-ordinate origin/system (3 dimensions) that the employer requires to be used to place graphical models, for example Ordnance Survey locators, geospatial and location with respect to an agreed origin;
 - 12) a schedule of any software formats, including version numbers, that shall be used by the supply chain to deliver the project;
***NOTE** Public sector employers may not wish to or be able to specify software packages to be used by their suppliers, but may instead specify the formats of any outputs. Private sector employers may choose to specify software packages and/or output formats.*
- b) commercial management:
- 1) exchange of information – alignment of information exchanges, work stages, purpose and required formats;
 - 2) client's strategic purposes – details of the expected purposes for information provided in models (See Figure 7 at 6.1.5);
 - 3) a schedule of any software formats, including version numbers, that shall be used by the supply chain to deliver the project;
***NOTE** Public sector employers may not wish to or be able to specify software packages to be used by their suppliers, but may instead specify the formats of any outputs. Private sector employers may choose to specify software packages and/or output formats.*
- 4) an initial responsibility matrix setting out any discipline responsibilities for model or information production in line with the defined project stages;
 - 5) a schedule of the standards and guidance documents used to define the BIM processes and protocols to be used on the project;
 - 6) a schedule of any changes to the standard roles, responsibilities, authorities and competences set out in the contract;
- c) competence assessment:
- 1) details of the competence assessment which bidders must respond to;
 - 2) changes to associated tender documentation (e.g. PQQ, PEP, tender questionnaire, tender evaluation plan);
 - 3) BIM tender assessment details.

6 Information delivery – Procurement

Figure 6 – Information delivery – Procurement



6.1 General

NOTE 1 Figure 6 shows how this part of the information delivery cycle fits into the overall process.

NOTE 2 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

6.1.1 As part of the main contract selection process, the employer shall request in the EIRs that bidders shall submit details of their approach to project information management, sufficient to demonstrate the supplier's proposed approach, capability, capacity and competence to meet the EIR.

NOTE 1 The purpose of the pre-contract BEP is to demonstrate the supplier's proposed approach, capability, capacity and competence to meet the EIR – see 6.2.1.

NOTE 2 It is likely that the BEP will be developed in two phases, pre- and post-contract award.

6.1.2 The BEP shall enable the employer to determine if the requirements within the EIR are achievable, allowing for adjustment or negotiation of the supply chain's capabilities if necessary.

6.1.3 Post contract award, the BEP shall be re-submitted by the supplier to the employer confirming the supply chain's capabilities and the master information delivery plan (MIDP) – see 6.2.2 and Figure 7 (6.1.5) – and that all relevant parties have agreed and committed to the BEP.

6.1.4 This BEP shall be submitted by the supplier to the employer on behalf of the whole supply chain and shall include a summary of their capabilities and responsibilities.

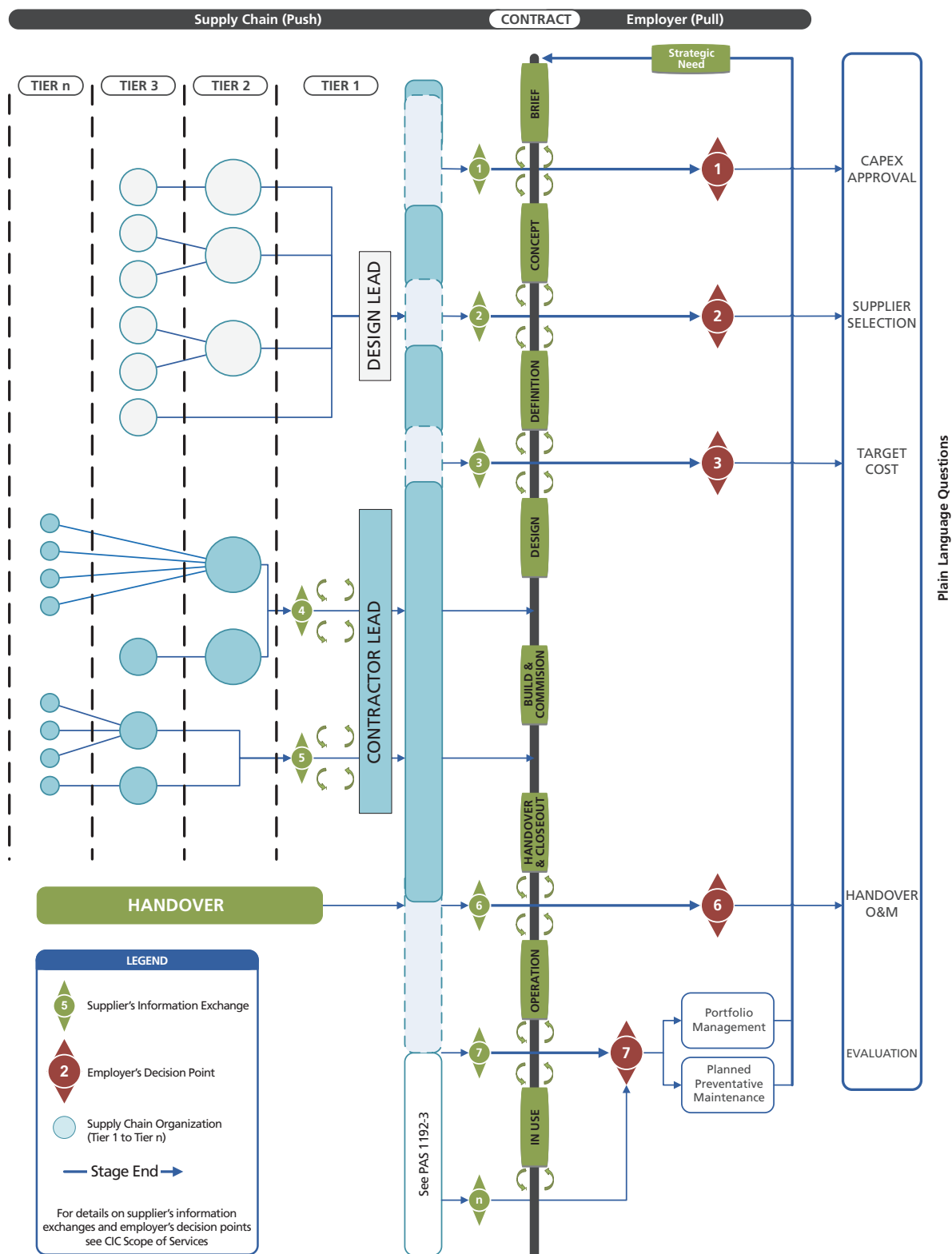
6.1.5 Suppliers shall be responsible for the cascade of information through their supply chain.

NOTE 1 This is a critical activity and the employer should take steps through the bid process that details of the supplier's information cascade process are suitable, well documented and capable of verification.

NOTE 2 The rationale for employing the supply chain to provide information is to support key employer questions (the Plain Language Questions in Figure 7 (6.1.5)). The relationship between these questions, the contract and the subsequent engagement of the supply chain is illustrated in Figure 7 (6.1.5).

NOTE 3 The approach that a tier 1 supplier may take to this offers much opportunity to remove waste and improve efficiency. However, appropriate steps should be used for each supply chain tier. Guidance is available in BS 11000-1:2010.

Figure 7 – The whole supply chain contributes information to answer the Plain Language Questions



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

6.2 Production of the pre-contract BIM execution plan (BEP)

The contents of the pre-contract BEP shall consist of everything requested in the EIR plus the following information:

- the project implementation plan (PIP) – see 6.3;
- project goals for collaboration and information modelling;
- major project milestones consistent with the project programme; and
- project information model (PIM) deliverable strategy (for example the CIC Schedule).

NOTE 1 An example partial template for the preparation of the BEP is shown at <http://www.cpic.org.uk>.

NOTE 2 The contents of the post contract-award BEP are given at 7.2.

6.3 Project implementation plan (PIP)

6.3.1 The PIP shall be submitted, as part of the initial BEP, by each organization bidding for a project.

NOTE The PIP is one of the documents used by an employer to assess the capability, competence and experience of potential suppliers bidding for a project, along with quality documentation.

6.3.2 The PIP shall include the supply chain capability summary form, incorporating, as described in 6.4 to 6.7 and as shown in Figure 8 which reproduces part of Figure 4 (4.1):

- the supplier building information management assessment form(s);
- the supplier information technology assessment form(s); and
- the supplier resource assessment form(s).

NOTE 1 Templates of the documents listed in this section are included in the Construction Project Information Exchange (CPIx) Protocol, available via the CPI website – <http://www.cpic.org.uk>.

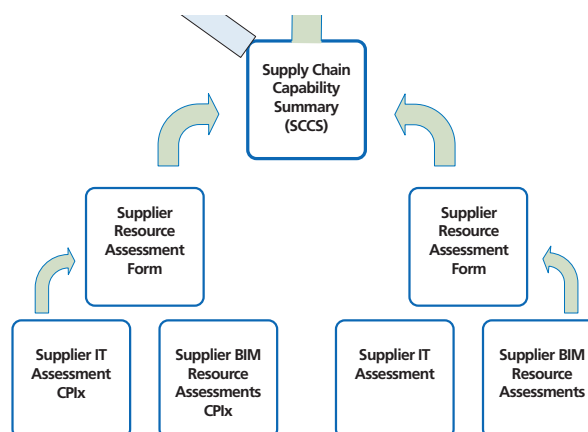
NOTE 2 Alternatively, project teams can submit their response online using CPIx Online (<http://www.cpic.org.uk/en/cpix-on-line-tools>). The CPIx Protocol Guide and Toolkit is a set of guidance notes, forms and checklists to help employers and their project teams develop a Construction Project Information Xchange (CPIx) Protocol for their projects.

NOTE 3 Use of the supply chain capability summary form means that a supplier does not need to submit assessment forms from each supply chain organization.

NOTE 4 The following clauses relate to supply chain capability assessment and that the purpose of the assessment is primarily for the principal contractor to

use the supply chain bidding process to confirm that capability is in place so as to be able to deliver the proposed BEP submitted with the main contract bid. Principal contractors are advised to review supply chain capability as part of their main contract bid process so as to ensure that capability is in place and that supply chain bids are based on proposed information production and management practice.

Figure 8 – Relationship between documents used for information management



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

6.4 Supplier BIM assessment form

6.4.1 A supplier BIM assessment form shall be completed by all appropriate organizations within the supply chain, so as to demonstrate their competence in and understanding of BIM and provide a comparable document by which to assess their capability.

6.4.2 A supplier BIM assessment form shall include questions examining the following areas of competence:

- gateway questions – a set of key questions about willingness to exchange data and the quality of that data (an extract from a template is shown on CPIx Online);
- BIM analysis – an opportunity for each organization to demonstrate its understanding of each of the analysis methods that could be used on the project;
- BIM project experience – an opportunity for each organization to highlight up to three projects where the benefits of building information management have been realised; and

- d) BIM capability questionnaire – a set of questions to help the project team to identify training, coaching and support requirements.

6.5 Supplier information technology (IT) assessment form

6.5.1 Completed by all appropriate organizations within the supply chain, usually in conjunction with the organization's IT department, the supplier IT assessment form shall enable organizations to demonstrate their information exchange capability and IT maturity, and provide a meaningful method of assessing differences and similarities with the project IT systems.

6.5.2 The supplier IT assessment form shall include questions examining the following areas of capability and competence:

- a) general information and company policies on information exchange – intended to show what electronic data and information the company is willing to exchange (an extract from a template is shown on CPiX Online at <http://www.cpic.org.uk/en/cpix-on-line-tools>); and
- b) technical information on software and systems – intended to enable the company to give the project team confidence that IT Systems and procedures are mature and robust.

6.5.3 Based on responses from the supply chain, methods of information sharing shall be reviewed and resolved by the principal supplier. Agreed solutions shall be documented by the final BEP submitted to the employer.

NOTE 1 *If models from one task team cannot be exchanged or read in conjunction with the models from other task teams then drawing production may be difficult to achieve.*

NOTE 2 *Problems of model, document exchange or interoperability need to be resolved as early as possible, ideally before design is started.*

6.6 Supplier resource assessment form

The supplier resource assessment form shall be used to assess an organization's current resource capability and capacity. The form shall be completed by all appropriate organizations within the delivery team as part of the sub-contract procurement process.

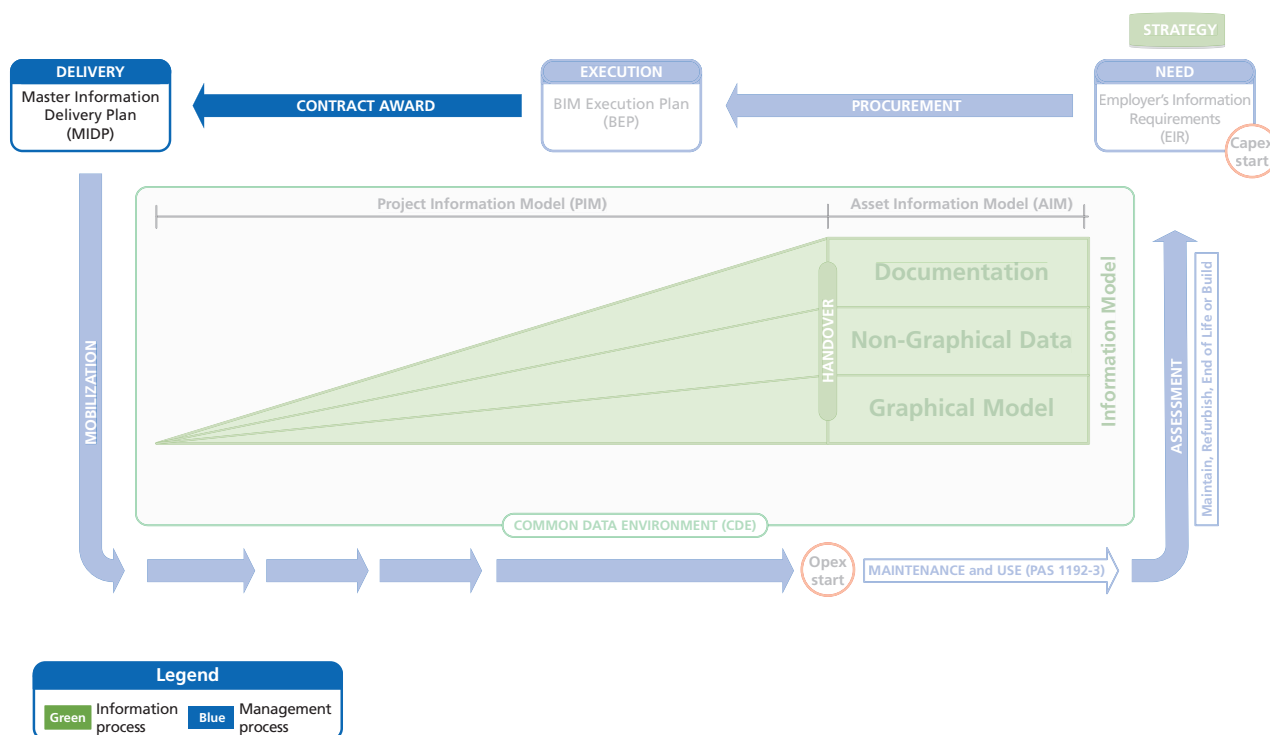
6.7 Supply chain capability summary form

The supply chain capability summary form shall be used to facilitate rapid comparison of the information within the team IT and resource assessment forms provided by each organization (an extract from a template is shown in CPiX Online). The form shall be completed by all appropriate organizations within the Delivery Team as part of the sub-contract procurement process.

NOTE *This section is for the principal supplier to obtain enough information concerning the capability, capacity and intent of supply chain members to be assure that it has secured appropriate capability to meet the requirements of the contract and the EIRs in a timely and efficient manner.*

7 Information delivery – Post contract-award

Figure 9 – Information delivery – Post contract-award



7.1 General

NOTE 1 Figure 9 shows how this part of the information delivery cycle fits into the overall process.

NOTE 2 Post contract award, the purpose of the BIM Execution Plan is to facilitate the management of delivery on the project. This includes the contractual information exchange requirements set out in a BIM protocol alongside the wider project deliverables established by the contract.

NOTE 3 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Suppliers shall ensure that information delivered by their supply chain is to a standard consistent with the contract (the employer information exchanges), and shall deliver information to their supply chain partners at pre-defined points during the project (the supply chain information exchanges).

7.2 Production of the post contract-award BIM execution plan (BEP)

7.2.1 The contents of the post contract-award BEP shall consist of everything requested in the EIR plus the following information:

- management:
 - roles, responsibilities and authorities;
 - major project milestones consistent with the project programme;
 - project information model deliverable strategy (for example the CIC Schedules);
 - survey strategy including the use of point clouds, light detecting and ranging (LIDAR) or global navigation satellite systems (GNSS);
 - existing legacy data use;
 - approval of information; and
 - PIM authorization process;
- planning and documentation:
 - revised PIP confirming the capability of the supply chain;

- 2) agreed project processes for collaboration and information modelling;
 - 3) agreed matrix of responsibilities across the supply chain;
 - 4) TIDP; and
 - 5) MIDP;
- c) the standard method and procedure:
- 1) the volume strategy;
 - 2) PIM origin and orientation (which may also be geo-references to the earth's surface using a specified projection);
 - 3) file naming convention;
 - 4) layer naming convention, where used;
 - 5) agreed construction tolerances for all disciplines;
 - 6) drawing sheet templates;
 - 7) annotation, dimensions, abbreviations and symbols; and
 - 8) attribute data;
- d) the IT solutions:
- 1) software versions;
 - 2) exchange formats; and
 - 3) process and data management systems.

7.3 Production of the master information delivery plan (MIDP)

7.3.1 Following contract award, the project delivery manager (PDM) (see 7.5) shall initiate a project induction meeting to:

- confirm resource availability and capability in relation to the responsibility matrix issued as part of the EIR;
- identify training and education needs, and;
- collaborate to develop the MIDP with reference to the team members' TIDPs.

7.3.2 The MIDP shall be used by the PDM to manage the delivery of information during the project.

7.3.3 The MIDP shall list the information deliverables for the project, including but not limited to models, drawings or renditions, specifications, equipment schedules, room data sheets, and shall be managed via change control.

7.4 Task information delivery plan (TIDP)

7.4.1 Each task team manager shall compile their own TIDP, with its milestones. These shall be used to convey the responsibility for delivery of each supplier's information.

7.4.2 Milestones within each TIDP shall be aligned with the design and construction programmes to produce the MIDP (see 7.3).

7.4.3 For each deliverable, the TIDPs shall be used to indicate the team member responsible or to note that such responsibility has yet to be allocated.

7.4.4 The TIDPs shall be used to show how responsibility for the preparation of project documents transfers from one team member to another.

7.4.5 The TIDPs shall be used to take account of the required sequence of model preparation for any work packages used in the project.

NOTE The TIDP is part of the BEP.

7.5 Project delivery team roles, responsibilities and authority

7.5.1 General information

NOTE 1 Clarity of roles, responsibility and authority are an essential aspect of effective information management. Roles should be embedded into contracts, either through a specific schedule of services or more general obligations. Information management roles are likely to be embedded into more extensive project roles – design team leader, principal contractor, etc.

NOTE 2 This PAS identifies the types of roles that should be considered and likely responsibilities. It should be remembered that this specification should be read in conjunction with other contract documentation such as the Plans of Work and Schedule of Services. The roles indicated here are for guidance only and will differ from project to project depending upon market sector, project size and the supply chain tier you are positioned in. Key to the allocation of roles, responsibility and authority is the appropriateness and ability of the organization to be able to deliver. In smaller businesses many of these roles may be executed by the same individual.

NOTE 3 On projects led with the CIC BIM Protocol (2013), a key role is the information manager. The information manager has a role in facilitating the management of the federated model and the production of project outputs. The information manager is also responsible for managing the operation, standards and culture of the common data environment. The information manager is not a stand-alone role and is expected to shift from design team to contractor prior to start on site. Under the BIM Protocol, a client is obliged to appoint an information manager at all project stages.

7.5.1.1 At the induction meeting as many of the information management roles shall be identified and confirmed as possible.

NOTE This may be done through a stage-based deliverables matrix and this should be revisited during successive project stages as specialists and supply chain members join the delivery team.

7.5.1.2 The roles and responsibilities of individual team members shall be defined, as shall the schedule of responsibilities for deliverables of the overall team, bearing in mind that one person may deliver multiple roles.

7.5.1.3 The roles shall not be confused with the titles of the managers, which can differ from organization to organization, but the important factors are the ownership, responsibility and authority.

NOTE 1 The factors in 7.5.1.1 to 7.5.1.3 can be conveyed using the "RACI" indicators (to identify "R" the responsible party, "A" the authorizing party, "C" the contributing parties and "I" the parties to be kept informed).

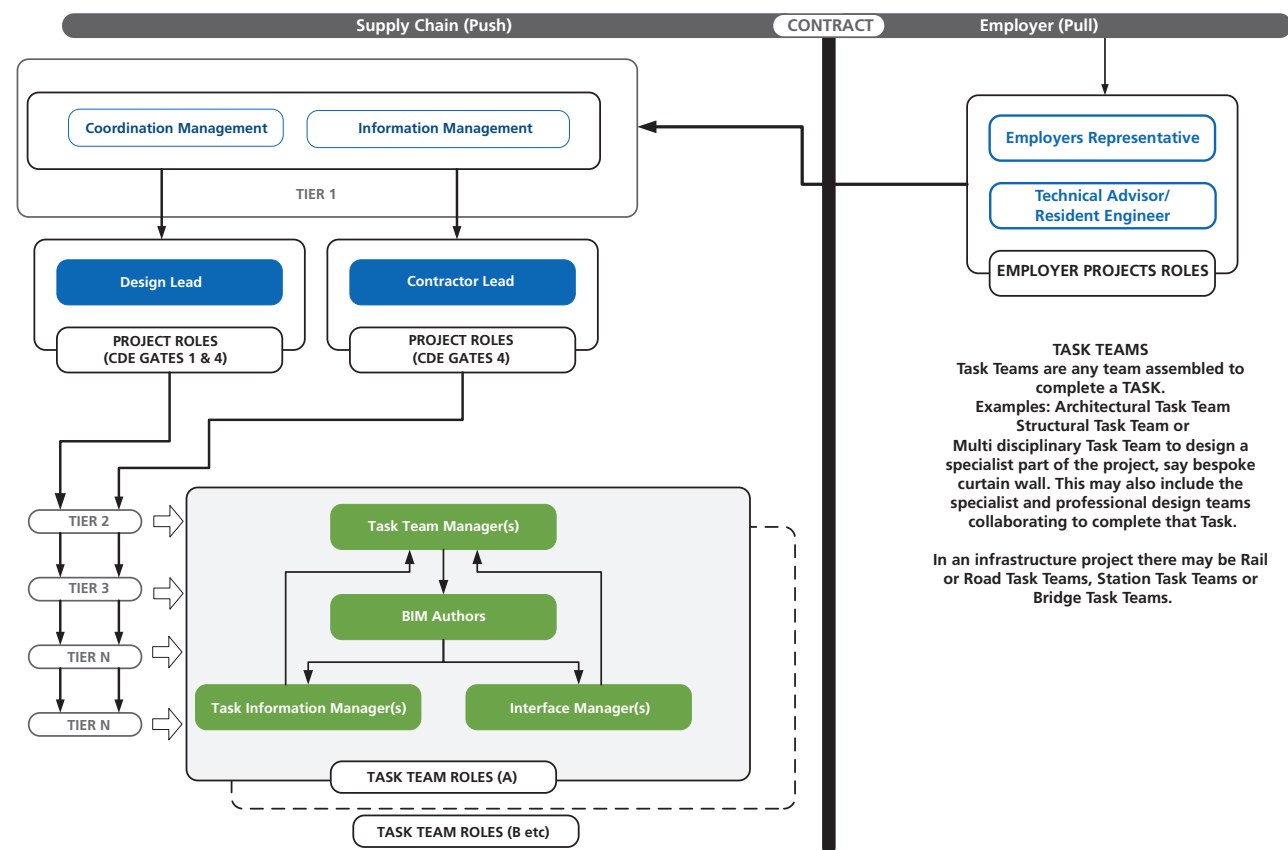
NOTE 2 Information management is part of everyone's job.

7.5.1.4 At the start of a project, roles shall be assigned and recorded and all contact information shall be listed against each role.

7.5.1.5 Roles are either per-project or per-task team and shall be responsible to one another as shown in Figure 10.

7.5.1.6 For successful information management exchange the following activities listed in Table 2 shall be undertaken at all stages of a project.

Figure 10 – Roles, responsibilities and authority



NOTE 1 All the roles defined in this PAS, and their respective responsibilities and authorities, are stated only in connection with information management. Other arrangements may be put in place for other aspects of the overall project.

NOTE 2 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Table 2 – Information exchange activities

Information management	Project delivery management	Lead designer	Task team manager	Task information manager	Interface manager	Information originator
Activities						
Enable reliable information exchange through a common data environment	Assure delivery of information exchanges	Co-ordinated delivery of all design information	Production of design outputs related to a discipline-specific, package-based or time-based task	Direct the production of task information in compliance with standards and methods	Manage spatial co-ordination on behalf of a task team	Develop constituent parts of the information model in connection with specific tasks
Maintain and receive information into the Information Model	Confirm suppliers ability to deliver information requirements	Manage information development and information approvals		Direct the production of task information using agreed systems	Propose resolutions to co-ordination clashes	Production of project outputs
Enable integration and co-ordination of information within Information Model		Confirm design deliverables				
Configure information for Project Outputs		Overall lead for configuration management				
Populate the information exchange format for the Information Model						

Table 2 – Information exchange activities (*continued*)

Information management	Project delivery management	Lead designer	Task team manager	Task information manager	Interface manager	Information originator
Authorities						
Accept reject information exchanges within the common data environment	Accept reject information exchanges within the common data environment	Confirm status and approve information for issue within the common data environment	Issue approved information within the common data environment	Confirm that information is suitable for issue within a common data environment	Propose resolutions to clashes	Ownership of model information
No design responsibility or right to issue instructions		Approve design changes proposed to resolve clashes				

7.6 Volumes

7.6.1 Where necessitated by technical limitations, the project shall be broken into a number of volumes.

NOTE 1 The selection of volumes and their allocation to project team members should be considered very carefully.

NOTE 2 The volume strategy should be owned and managed at the highest level of the project management team.

NOTE 3 Use of volumes enables concurrent work on models, information security, file size and other key information activities tasks to be managed effectively.

7.6.2 All members of the design team shall agree volumes as fully as possible at the start of a project and publish them as a shared document. This document shall be reviewed at successive project stages and amended and re-published as necessary.

NOTE 1 A volume may be based on important aspects of design, such as structure or cores, on specialized functions such as HVAC (heating, ventilating and air conditioning) systems or on strategic elements such as cladding.

NOTE 2 Individual design team members may require differing arrangements of volumes for their individual needs. Different sets of volumes do not have to relate to the same sub-divisions of the project. See Figure 11 (7.6.3) for a tunnel design example.

NOTE 3 Volumes are not drawing areas, and do not relate to the amount of the project shown on any given drawing.

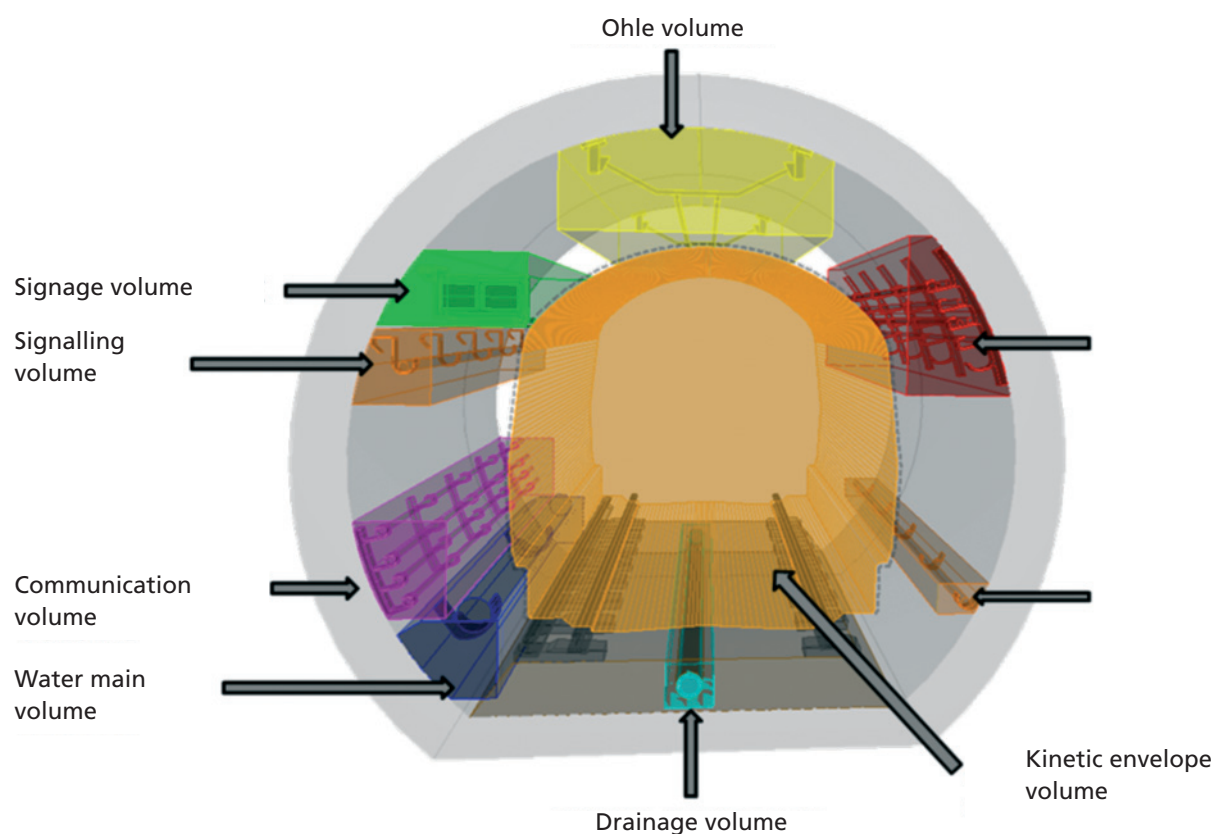
NOTE 4 Volumes may overlap in 2-dimensional space (plan view) but they cannot overlap in their 3-dimensional space such that clash avoidance is achieved.

NOTE 5 Volumes are the responsibility of the designers.

7.6.3 If a project is divided into a number of volumes for modelling purposes, then COBie-UK-2012 files shall be issued from each discipline volume-specific model file at each employer information exchange and shall be combined into a single co-ordinated COBie-UK-2012 deliverable for the whole project, unless specified in the EIR.

NOTE See Figure 12 for a building spatial co-ordination example.

Figure 11 – Volumes within a tunnel design for spatial co-ordination

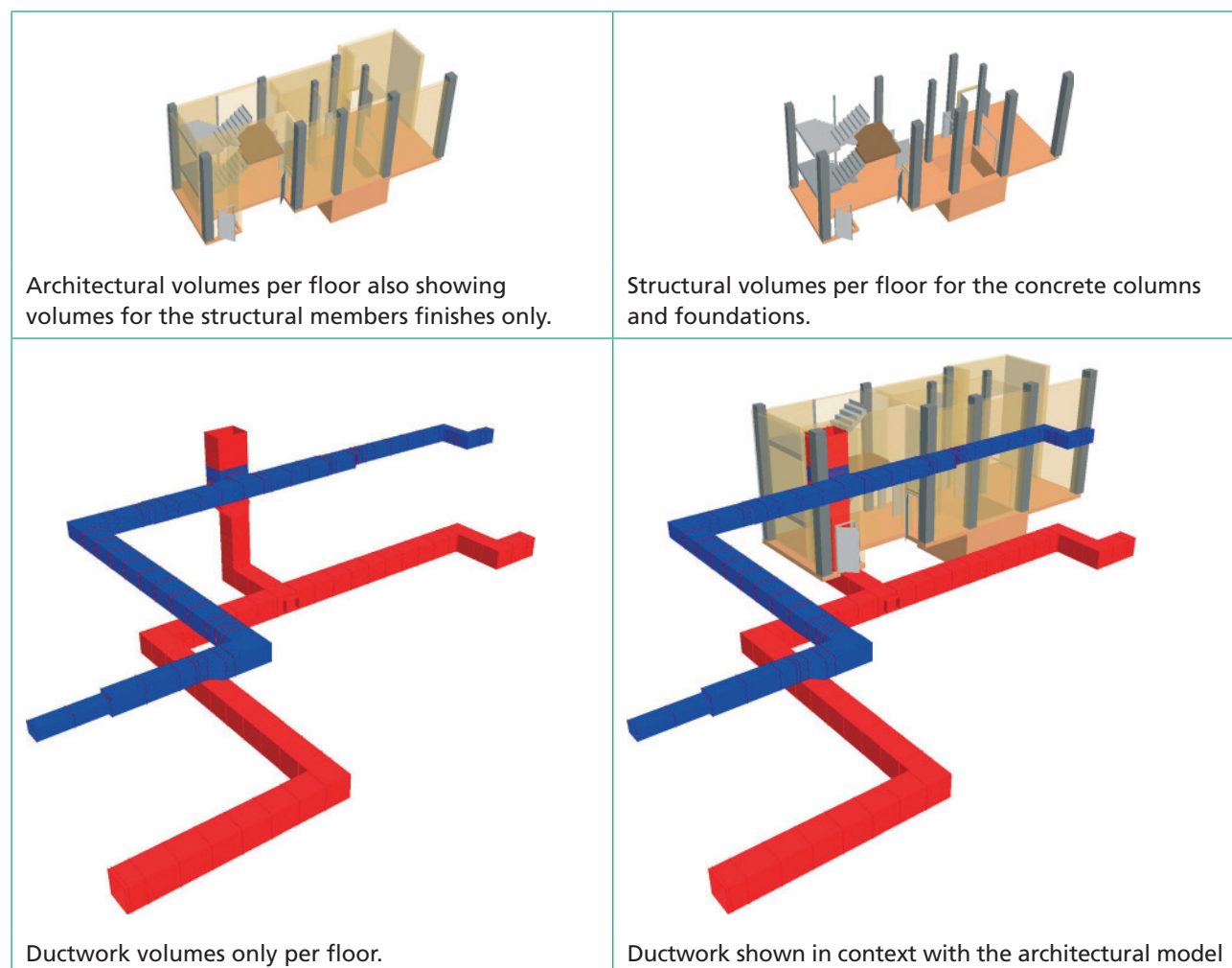


NOTE 1 An example of volumes for spatial co-ordination in a tunnel design is shown above. Volumes are organised by discipline around the periphery of the tunnel (e.g. catenary volume, evacuation walkway and emergency accessway, etc.)

NOTE 2 Soft Volumes shall also be taken into account for spatial co-ordination. Such items as the “kinetic envelope” should be provided and owned.

NOTE 3 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 12 – Volumes within a building for spatial co-ordination



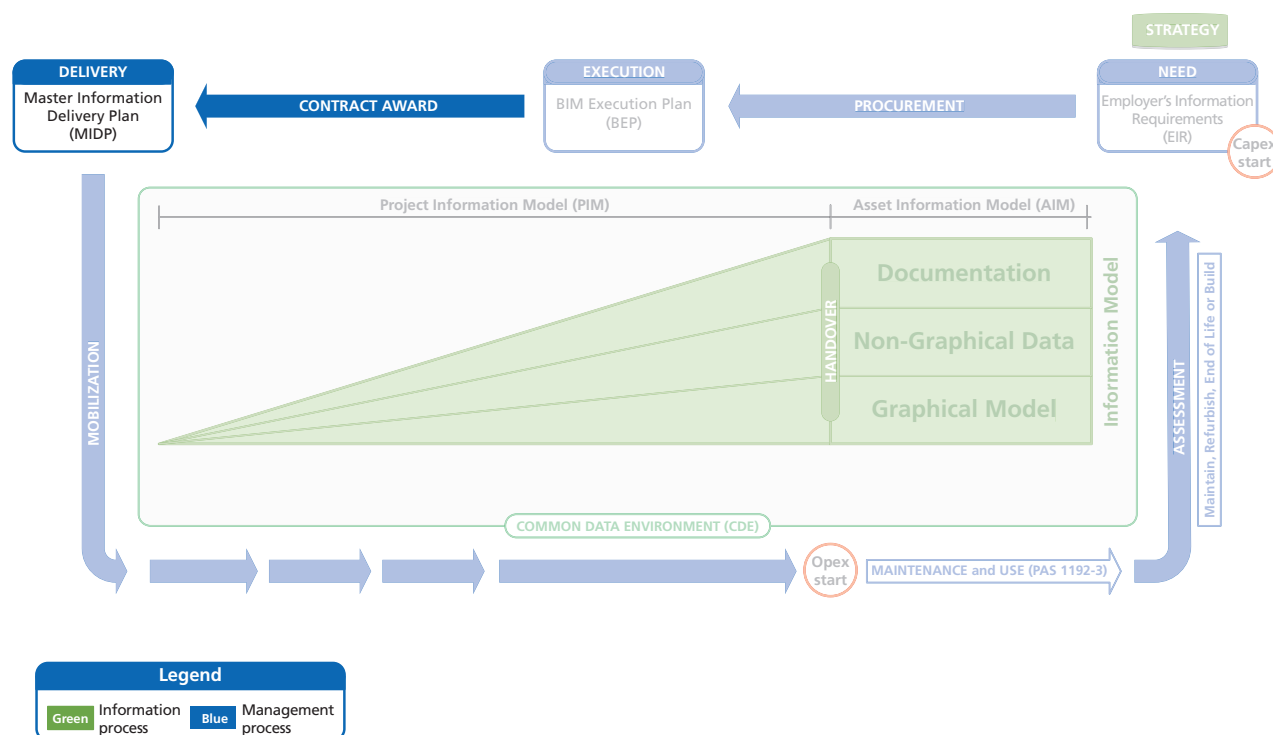
NOTE 1 Examples taken from Building Information Management – A Standard Framework and Guide to BS 1192:2007, Richards, 2010.

NOTE 2 Volumes are by discipline per floor or level of building to produce a federated model.

NOTE 3 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

8 Information delivery – Mobilization

Figure 13 – Information delivery – Mobilization



NOTE 1 Figure 13 shows how this part of the information delivery cycle fits into the overall process.

NOTE 2 Mobilization is important because it provides the opportunity for the project delivery team to make sure that the information management solution works before any design work is started. This includes making sure that the necessary documents have been prepared and agreed, the information management processes are in place, the team has the appropriate skills and competences, and that the technology supports and enables the management of information according to this PAS.

NOTE 3 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

8.1 The agreed BEP, and any subsequent changes, shall be communicated to all members of the project delivery team.

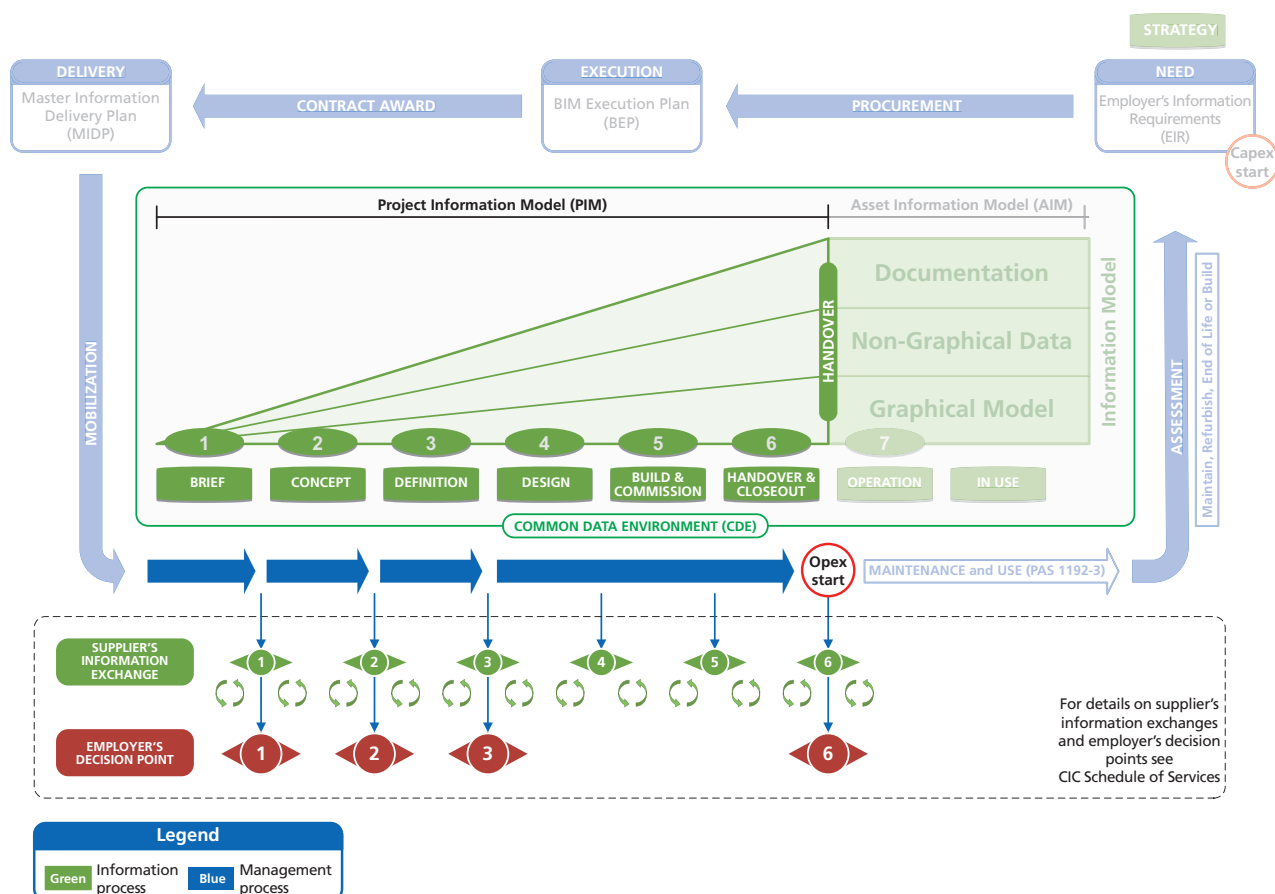
8.2 The selected software, IT systems and infrastructure, including the CDE, shall be procured, implemented and tested.

NOTE One element not defined in BS 1192:2007 or in this document is a solution to the problem of interoperability between the different CAD and BIM solutions used within a project. Generally the guidance would state that whenever possible data/information should be made in the native format of the solutions being used. In addition, the project teams should agree on the number of data renditions required, and check these renditions to ensure their interoperability or to understand the limitations of the solutions they relate to.

8.3 The training and education needs of all members of the project delivery team who are involved in the production, analysis and review of the PIM shall be assessed and appropriate action taken, with particular reference to the sub-sections of the BEP: management, planning and documentation; the standard method and procedure, and the IT solutions.

9 Information delivery – Production

Figure 14 – Information delivery – Production



9.1 General

NOTE 1 Figure 14 shows how this part of the information delivery cycle fits into the overall process.

NOTE 2 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

9.1.1 The PIM shall be progressively developed and delivered to the employer through a series of information exchanges as defined within, for example, the CIC Scope of Services, at key points to coincide with the employer's decision-making processes as defined by the EIRs and the CIC BIM Protocol (2013).

NOTE 1 In Level 2 the PIM is likely to comprise of a set of federated building information models rather than just a single integrated building information model, along with associated non-graphical data and associated documentation.

NOTE 2 The PIM is likely to start as a design intent model and then be developed into a virtual construction model as ownership passes from design suppliers to the construction supplier and their supply chain. The arrangements for this transfer of ownership, including its timing, should be defined in the conditions of engagement or contracts between the employer and the suppliers.

9.1.2 The PIM shall be developed in accordance with the MIDP.

9.1.3 The PIM shall consist of graphical data and non-graphical data documents as defined in the MIDP.

NOTE The following clauses describe the managed business processes that need to be executed to enable the delivery of the defined data delivery to the employer. The exact definition of the nature of the deliveries is defined in the various plans of work. For the purpose of this PAS the proposed CIC plan of work has been selected by way of example. If an alternative method is selected an appropriate strategy will need to be defined to enable delivery.

9.1.4 Data delivery shall include some all of the following data entities: native (product-proprietary) file formats, COBie-UK-2012 and read-only PDF; to enable a complete Level 2 project.

9.1.5 The process of delivery management as defined in 9.2 shall be followed to ensure the data at each information exchange is accurate, appropriate and unambiguous.

NOTE Further information on COBie-UK-2012 is available on the BIM Task Force website <http://www.bimtaskgroup.org/COBie-UK-2012>.

9.1.6 The process of creation, sharing and issuing of production information shall be consistent so that information is managed and delivered in a lean and timely manner. The CDE shall be used to enable this process.

NOTE The CDE process can be implemented in a number of ways, depending on organizational preference.

9.2 Common data environment (CDE)

9.2.1 General

NOTE 1 The CDE described in BS 1192:2007 and Building Information Management – A Standard Framework and Guide to BS 1192, Richards, 2010, remains the core of the delivery process. With the addition of the operational phases and the requirement to deliver non-graphical data the model has been enhanced for PAS 1192-2, as shown in Figure 15.

NOTE 2 The CDE is a means of providing a collaborative environment for sharing work and can be implemented in a number of ways. For the development of various forms of collaboration within organizations and across project teams refer to BS 11000-1 and -2.

NOTE 3 Advantages of adopting such a CDE include:

- ownership of information remains with the originator, although it is shared and reused, only the originator shall change it;
- shared information reduces the time and cost in producing co-ordinated information;
- any number of documents can be generated from different combinations of model files.

If the procedures for sharing information are consistently used by the design teams, spatial co-ordination is a by-product of using the CDE processes, and will deliver production information that is right first time.

Information can subsequently be used for construction planning, estimating, cost planning, facilities management and other downstream activities.

Data within a CDE is finely granulated and structured to ease its re-use. It provides the ability to produce traditional drawings or documents as views of multi-authored data within the CDE. It also gives greater control over the revisions and versions of that data.

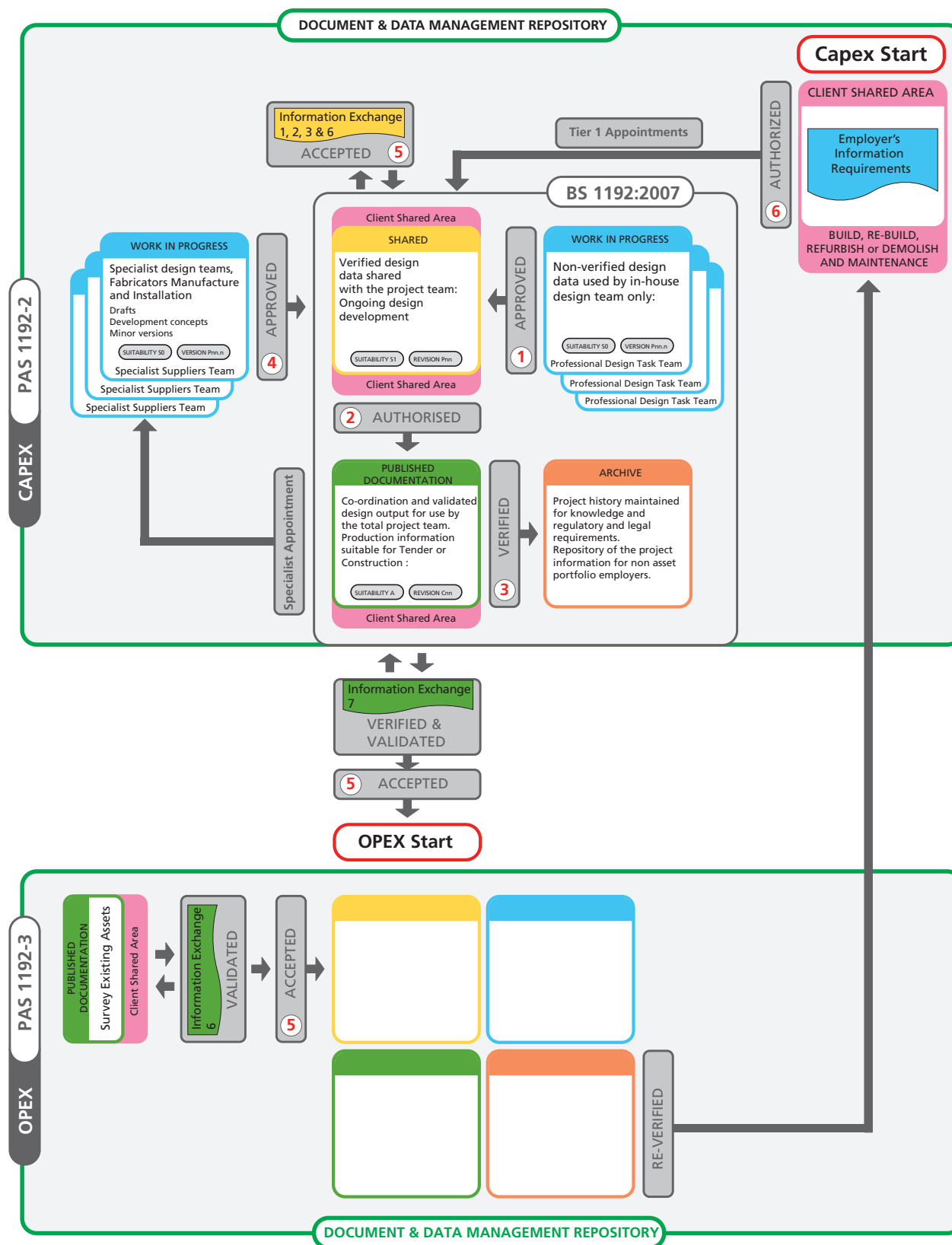
The structured use of a CDE requires strict discipline by all members of a design team in terms of adherence to agreed approaches and procedures, compared with a more traditional approach. The benefits listed above can only be realized with a commitment to operate in a disciplined and consistent manner throughout a project.

NOTE 4 The information delivery cycle has two distinct points of entry, but they both lead to Gate 6. For stand-alone new-build projects, start at the top right box "Client shared area/Employers Information Requirements (see Figure 15), as there is no legacy data from an existing asset. But for projects that are part of a larger portfolio or estate, or for projects working on existing buildings and structures, then the starting point will be with the existing AIM. An assessment will need to be made whether to refurbish, build new, or demolish and re-build.

NOTE 5 The overlap between PAS 1192-2 and PAS 1192-3 (to be developed) occurs in the transfer of handover information from the PIM to the AIM and the extraction of legacy information to form part of the employers information requirements for re-build and refurbishment project as defined in Note 4.

NOTE 6 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 15 – Extending the common data environment (CDE)



9.2.2 Functional sections of the common data environment (CDE) (processing work through the CDE)

NOTE There are “gates”, or sign-off procedures, that allow data/information to pass between the sections. The naming of the gates is significant.

9.2.2.1 The WIP section of the CDE shall be used to hold unapproved information for each organizational role.

NOTE The WIP section concludes with the Approval Gate (“1” in Figure 15 (9.2.1)) which represents the transition to SHARED, where the information is checked, reviewed and approved by the lead designer.

9.2.2.2 To pass through the Approval Gate (Gate 1) a check, review and approval process shall be carried out before issue to the SHARED area. The checks shall include:

- a) model suitability check;
- b) SMP check;
- c) technical content check;
- d) COBie completeness check;
- e) drawings extract checks along with any additional documentation that is shared as a co-ordinated package of information; and
- f) approval by the task team manager.

9.2.2.3 The SHARED section of the CDE shall be used to hold Information which has been approved for sharing with other organizations to use as reference material for their own design development. When all design has been completed, the information shall be placed for authorization in the Client Shared Area.

9.2.2.4 To pass through the Authorized Gate (“2” in Figure 15 (9.2.1)) the information in the Client Shared Area shall be authorized by the employer or the employer’s representative.

NOTE 1 Published documentation includes Project Outputs required at defined project stages, discrete deliverables including planning and regulatory submissions together with issues for construction.

This represents the transition to PUBLISHED DOCUMENTATION.

NOTE 2 It is recognized that some contract forms make this process difficult. In these cases it should be made clear to the employer who within the delivery team is responsible for undertaking these processes. This should be documented in the EIR and BEP.

9.2.2.5 Checks for authorization shall include checking for compliance with the EIR deliverables and completion of the Plain Language Questions.

9.2.2.6 The PUBLISHED DOCUMENTATION section of the CDE shall be used to hold published information. This

section concludes with the Verified Gate (“3” in Figure 15 (9.2.1)), which represents the transition to ARCHIVE.

9.2.2.7 The ARCHIVE section of the CDE shall be used to record all progress as each project milestone is met and shall hold a record of all transaction and change orders to provide an audit trail in the event of a dispute.

9.2.2.8 In addition, as-constructed information shall be checked and verified in the PUBLISHED section to allow transition through the Verified Gate to the ARCHIVE section.

9.2.2.9 An additional WIP section of the CDE shall be used to hold unapproved information for the specialist contractors and designers. It shall also conclude with the Approved Gate (“4” in Figure 15 (9.2.1)) which represents the transition to SHARED where the information is checked, reviewed and approved by the main contractor and the designers who have responsibility for ensuring compliance to the design, using the same approval checks as Gate 1.

NOTE The work processes in this activity replicate the status, revision and versions as for the professional design activities. There will be additional status for information that is issued to the fabrication or manufacturing workshops or directly to CNC machines.

9.2.2.10 There shall be a “change of ownership” procedure for the information and objects that specialist sub-contractors introduce to replace the original designers’ intent such that the resulting graphical models can be used for fabrication, manufacture and installation.

NOTE This change of ownership should be fully understood, specialist teams do not alter the models produced by the professional designers: they build new models defining the virtual construction model (VCM).

9.2.2.11 In the PIM only the objects representing those elements or products that are to be actually constructed by the specialist sub-contractors shall be included. The objects representing design intent shall not appear unless they are also the items to be built.

NOTE For example, a brick wall may not be owned by the specialist, but shall instead remain owned by the architect. However, all objects shall appear in the project archive. See also 9.2.2.7.

9.2.2.12 The Accepted Gate (“5” in Figure 15 (9.2.1)) shall be used for information to be verified (Information Exchanges 1, 2 & 3 in Figure 15 (9.2.1)) and validated (Information Exchange 6 in Figure 15 (9.2.1)) when it is delivered as an AIM for use in operation of the facility.

NOTE This process will be iterative if the sign-off process finds that the requirements for the information exchange have not been met.

9.2.3 Status codes in the common data environment (CDE) (data definitions for the CDE)

The specialist contractors and designers shall use the same processes and status as for the professional design development and co-ordination procedures.

The specialist contractor and construction process status codes are shown in Table 3.

NOTE 3 Additional codes have been introduced to allow for the delivery of the PIM and AIM plus the manufacturing models or documentation sign-off process.

Table 3 – Status codes in the CDE

Status	Description
Work in Progress (WIP)	
S0	Initial status or WIP Master document index of file identifiers uploaded into the extranet.
Shared	
S1	Issued for co-ordination The file is available to be “shared” and used by other disciplines as a background for their information.
S2	Issued for information
S3	Issued for internal review and comment
S4	Issued for construction approval
S5	Issued for manufacture
S6	Issued for PIM authorization (Information Exchanges 1-3)
S7	Issued for AIM authorization (Information Exchange 6)
D1	Issued for costing
D2	Issued for tender
D3	Issued for contractor design
D4	Issued for manufacture/procurement
AM	As maintained
Published documentation	
A	Issued for construction
B	Partially signed-off: For construction with minor comments from the client. All minor comments should be indicated by the insertion of a cloud and a statement of “in abeyance” until the comment is resolved, then resubmitted for full authorization.
AB	As-built handover documentation, PDF, native models, COBie, etc.

NOTE 1 Additional codes S6 and S7 are highlighted.

NOTE 2 Status codes are provided by information originators to define how information may be used during different phases of the CDE. The SHARED suitability codes are stated as “Issued for...” but this does not infer any contractual or insurable purpose. Their purpose is to limit the reuse of the information at that stage. See also BS 1192 and Building Information Modelling – A Standard Framework and Guide to BS 1192, Richards, 2010.

NOTE 3 Status codes are used in connection with the gateways in the CDE. They are not related to version numbering, the levels of detail or the stages in the plan of work.

9.3 File and layer naming conventions

9.3.1 General

File and layer naming conventions shall be extended from those defined in BS 1192:2007.

NOTE Employers with legacy databases of objects or details can migrate these to the extended naming conventions using a controlled process.

9.3.2 File naming

9.3.2.1 The standard file types to be used in naming files shall be extended to include file type "CR" for a clash rendition, and file type "IE" for information exchange files which would include COBie-UK-2012.

For example:

SH-CA-00-LG1-CR-A-00001

- "SH" is the project location
- "CA" is the two-character code for the originator
- "00" indicates that the file covers more than one volume
- "LG1" indicates the file relates to the Lower Ground floor level 1
- "CR" indicates the file is a clash rendition
- "A" indicates the discipline that created the drawing is an architect
- "00001" is the unique number when concatenated with "file type" and "discipline"

SH-CA-00-LG1-IE-A-00001

- "SH" is the project location
- "CA" is the two-character code for the originator
- "00" indicates that the file covers more than one volume
- "LG1" indicates the file relates to the Lower Ground floor level 1
- "IE" indicates the file is an information exchange, for example COBie
- "A" indicates the discipline that created the drawing is an architect
- "00001" is the unique number when concatenated with "file type" and "discipline"

9.3.2.2 The standard file types for drawings and models and for documents are shown on <http://www.bimtaskgroup.org>.

9.3.2.3 Any additional file types required for a particular project shall be defined and agreed at the start of the project and registered in the EIR and BEP.

9.3.2.4 All other aspects of file naming shall be as defined in BS 1192:2007 and as explained in section 6.1 of *Building Information Modelling – A Standard Framework and Guide to BS 1192*, Richards, 2010.

A file naming convention has been retained in PAS1192-2 to assist organizations without electronic document management systems using metadata. File naming means that Windows Explorer or Macintosh Finder can be used to search for relevant files.

9.4 Spatial co-ordination

9.4.1 General

NOTE A number of tools and processes are used to develop and deliver the design. These include; architectural, engineering, services, environmental elements, programme, cost, carbon, etc.

Information on these tools is proprietary in nature and not expressly covered in this PAS. However all data both geometric and tabular (COBie) is managed in the CDE. A key part of the delivery processing is spatial co-ordination.

9.4.2 Each task team shall take ownership of their own WIP information and model(s) and check and review these with their task team manager before issuing the information and model(s) to the SHARED part of the CDE.

NOTE The process for collaborative design and clash avoidance is shown in Figures 16 to 19 (9.4.10).

9.4.3 If a clash is detected which cannot be resolved by the task team interface manager then the lead designer shall be involved in the discussion to reach agreement and make the necessary changes to the models.

9.4.4 Once the lead designer is satisfied that clashes have been resolved, the CAD and technical checks have been completed and the COBie-UK-2012 files and drawings in PDF have been extracted then all information shall be SHARED.

NOTE If separate COBie-UK-2012 files have been produced by each task team then these shall be co-ordinated prior to forwarding to the employer. See also 6.5.3.

9.4.5 Revision numbering and version control shall be kept in step between any model and its related information, whenever either the model or the information is changed.

This is explained in BS1192:2007 and *Building Information Modelling – A Standard Framework and Guide to BS 1192*, Richards, 2010.

Revision numbers in WIP are P1.1, P1.2 ... P1.n, P2.1, P2.2 ... P2.n, etc. The relevant status code is S0. Revision numbers in SHARED are P1, P2, P3, etc. The relevant status codes are S1-S7, D1-D4 and AM. Revision numbers in PUBLISHED are C1, C2, C3 etc. The relevant status codes are A, B and AB.

Version numbers are subdivisions of a revision.

9.4.6 Specialist design, manufacturing and fabrication models shall be reviewed for clashes in the same way as described in Figures 16 to 19 (**9.4.10**).

Clash checking shall be carried out during design, with particular focus on hard clashes and construction tolerances.

9.4.7 Clash avoidance/checking shall be carried out during specialist design and development of the virtual construction model, with particular focus on soft clashes (for example, positioning of insulation around ductwork and pipework) and proximity checks (for example, the placement of oxygen and other gases or flammable substances in hospitals).

NOTE Checks can also be made for health and safety issues (for example trip hazards from low-level pipework and reach hazards relating to positioning of equipment such as valves).

9.4.8 Clash avoidance/checking shall continue during the construction process as the models are updated with as-constructed information and checked against the construction tolerances specified in the contract.

9.4.9 Construction or manufacturing defects or deviation out of tolerance shall be measured and the models updated within a time agreed across the project (e.g. 24 or 48 hours) so that impact on following trades can be checked and appropriate decisions can be taken. Responsibility for this activity should be defined in the PEP.

NOTE 1 For example, if foundations have been cast too high or too low then changes may be required to the structural steel frame before frame elements are fabricated to avoid site re-work and delays.

NOTE 2 If the actual construction is within tolerance then no report needs to be made to update the model.

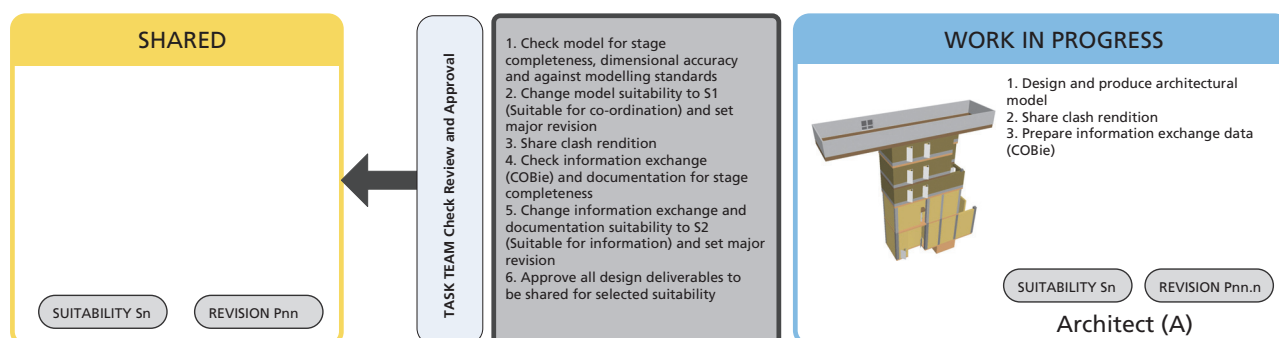
NOTE 3 This clause does not mean that the whole project has to be continually resurveyed but the check is to see if the constructed items are as defined, in terms of size and position, that would normally be carried out during construction.

9.4.10 To achieve spatial co-ordination when the software solutions of the individual teams are incapable of a reasonable level of interoperability then clash renditions shall be used. The clash renditions shall be made in the format of the viewing tool that has been chosen for the project. The clash rendition for each model for each discipline shall be issued to the SHARED area along with all other deliverables.

NOTE 1 The individual SHARED models may be combined for design review by the lead designer. Design decisions or clashes that cannot be resolved by the interface managers can then be reviewed and resolved.

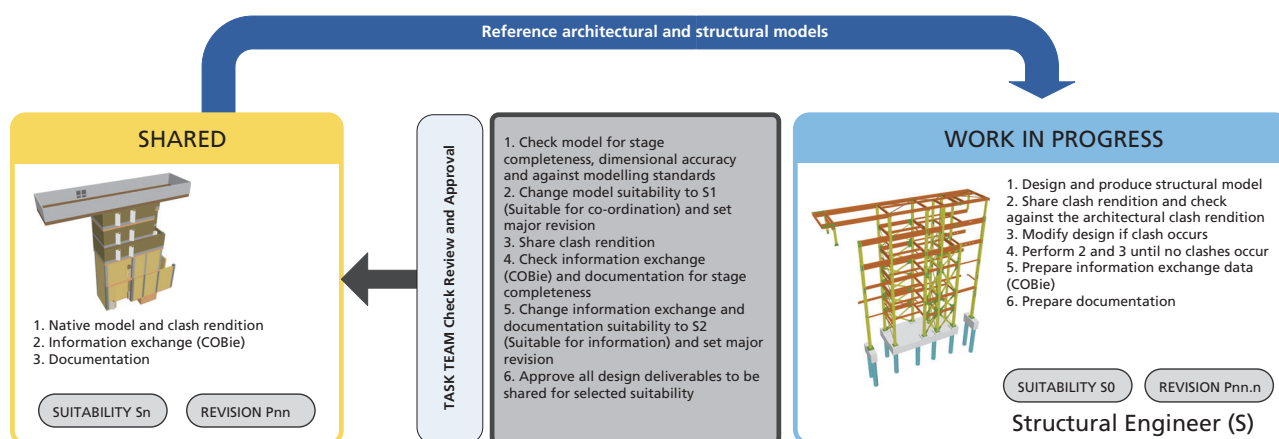
NOTE 2 Clash avoidance and detection is continuous throughout project delivery.

Figure 16 – Architect's issue to SHARED



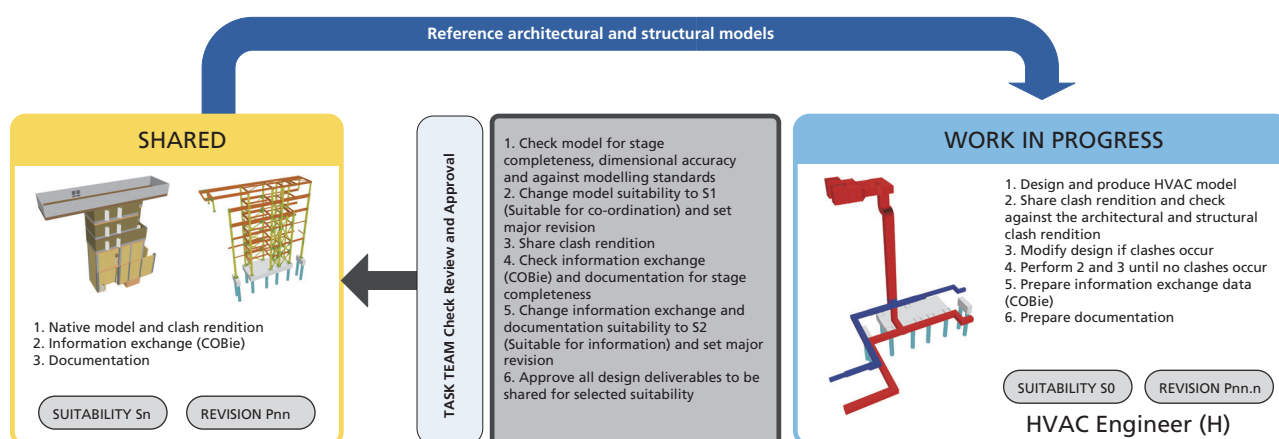
NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 17 – Structural engineer's issue to SHARED



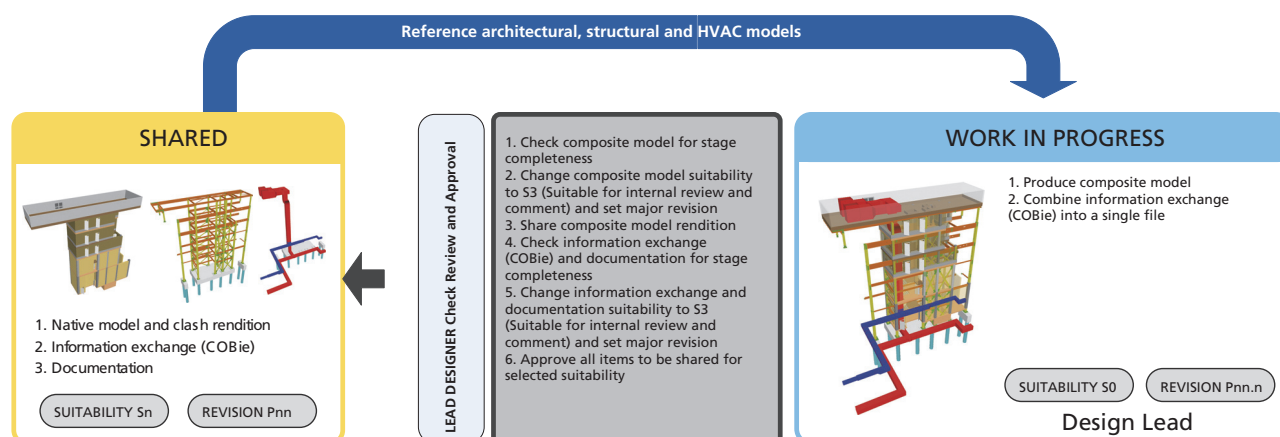
NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 18 – MEP engineer's issue to SHARED



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

Figure 19 – Design review of models in SHARED



NOTE Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

9.5 Publication of information

9.5.1 The employer or the employer's representative (who may be the lead designer or the supplier) shall sign-off the information and request publication.

NOTE It is recognized that some contract forms make this process difficult. In these cases it must be made clear to the employer who within the delivery team is responsible for undertaking these processes. This should be documented in the EIR and BEP.

9.5.2 Each task team manager shall change the status of their team's signed-off information, update the revision and issue the information and model(s) to the PUBLISHED part of the CDE.

9.5.3 Information shall be issued according to the process above in a digital format. This will be defined in the EIR (5.3).

NOTE The issue should normally take the form of four data sets, including: native BIM files, clash rendition (for an agreed model viewer), documents and 2D drawings as PDFs, and COBie data.

9.5.4 The clash renditions, drawings and COBie data shall be created from the native files to ensure consistency.

NOTE The information should be checked for completion and issued to recipients using a collaboration system to ensure security and integrity. Tools to help automate the checking process are continually being added to the Task Group website <http://www.bimtaskgroup.org>.

9.6 Design for bespoke manufacture

9.6.1 When the design requires manufacturing of bespoke products, a placeholder shall be used in the model such that the volume allocation is adequate for final installation, including necessary connections (interfaces) and access for installation, maintenance and replacement.

NOTE 1 This follows a "process engineering" workflow and procedure.

NOTE 2 Use of placeholders for bespoke products within the allocated volume allows the design team and the manufacturer to work in parallel and avoid unnecessary updates to the spatially co-ordinated model.

NOTE 3 It is not necessary for the virtual construction model to contain the level of detail required in the manufacturing process of a bespoke product where each and every component making up that product may need to be modelled for manufacturing purposes.

9.7 Using assemblies and library information

9.7.1 General

NOTE 1 The use of Library systems to store, manage and share pre-defined assemblies or sub-assemblies is a key productivity enhancing feature of most BIM tools. They are also a useful location to store lessons learnt for future projects

Libraries may be managed by the employer or their agent with specific controls which will be documented or referenced by the EIR.

If assemblies are used from Public Libraries, due attention should be made to quality and commercial

checks especially licences to use and reuse information. Under the CIC BIM Protocol (2013), originators provide assurance that all assemblies within a model are licensed for use in connection with the project

NOTE 2 The use of library systems to store, manage and share pre-defined assemblies or sub-assemblies is a key productivity enhancing feature of most BIM tools. They are also a useful location to store lessons learnt for future projects.

Libraries may be managed by the employer or their representative with specific controls which will be documented or referenced by the EIR.

NOTE 3 The creation and management of assemblies, components and materials are documented elsewhere, including at <http://www.bimtaskgroup.org>.

9.8 Levels of model definition

9.8.1 The minimum level of detail needed by the team or the employer for each model's purpose shall be defined.

NOTE 1 Key to the success of information management is clear definition of requirements as defined by the information exchanges and including COBie and geometry.

NOTE 2 It is wasteful for the supply chain to deliver a greater level of detail than is needed which may also overload the IT systems and networks available.

9.8.2 The level of model definition required in a model at an information exchange shall be defined in the EIR and the CIC BIM Protocol (2013). The level of graphical information and data to be delivered at each information exchange will be defined with reference to industry standards.

9.8.3 The levels of model definition shall be articulated in the BEP and need to be fully understood by all relevant members of the project team.

9.8.4 Levels of model definition shall conform to:

- a) the EIR;
- b) the scope of work set out by the CIC Scope of Services, for example, related to the project stages; and
- c) the Uniclass classification tables regarding the relationship of systems, products and elements with the specification and the cost plan.

NOTE The Uniclass classification tables shall define the progressive maturity of the model from outline, spaces and volumes, to design elements and finally to products. See Table 3 (9.2.3) for cross-reference of CIC stages and Uniclass classification tables.

9.9 Levels of model detail and model information

NOTE The levels of model detail and model information shown in Figure 20 (9.9.7) are derived from the BIM Task Group website: <http://www.bimtaskgroup.org>.

9.9.1 Brief

NOTE At briefing stage, the graphical model will either not exist or will inherit information from the AIM (for work on existing buildings and structures).

9.9.2 Concept

NOTE At concept design stage the graphical design may only show a massing diagram or specify a symbol in 2D to represent a generic element. See BS 8541-2.

9.9.3 Design

At design stage the objects shall be represented in 3D with the specification attached.

NOTE 1 See BS 8541-1, BS 8541-3 and BS 8541-4.

NOTE 2 The level of detail should as a minimum represent the space allocation for the product's access space for maintenance, installation and replacement space in addition to its operational space. For example, the space required to turn on or turn off valves.

9.9.4 Definition

At definition stage the object shall be based on a generic representation of the element.

NOTE The specification properties and attributes from design allow selection of a manufacturer's product, unless the product is nominated, free issue or already selected.

9.9.5 Build and commission

At build and commission stage any generic object shall be replaced with the object procured from the manufacturer. Any essential information to be retained shall be reattached or relinked to the replacement object.

NOTE 1 Inheritance of information is a complex issue and should be well understood and the solution tested at mobilization.

NOTE 2 The selection of the product should give further detail about flanges and connections so that final positioning of pipework and ductwork can be defined.

NOTE 3 Although minimum levels of graphical detail can be specified at each design stage, care should be taken that adequate detail is provided to convey design intent and installation requirements. See Design Framework for Building Services, Churcher, 2012,

NOTE 4 *for an example of the full process relating to building services.*

9.9.6 Handover and close-out

At the handover and close-out stage all necessary information about the product shall be included in the handover document and attached to the commissioning and handover documentation. The as-constructed model shall represent the as-constructed project in content and dimensional accuracy.

NOTE *In addition is all the manufacturer's maintenance and operation documentation, commissioning records, health and safety requirements, the final COBie information exchange, as-built models in native format and all relevant documentation.*

9.9.7 Operation and in-use

At the operation stage, the performance of the project shall be verified against the EIR and the brief. If the specification is not met and changes are necessary then objects that have been changed or replaced with different equipment shall be updated accordingly.

At the in-use stage, the object's information shall be updated with any supplementary information such as maintenance records or replacement dates, and objects that have been changed or replaced with different equipment shall be updated accordingly.

Figure 20 – Levels of model definition for building and infrastructure projects

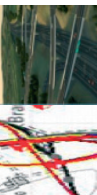
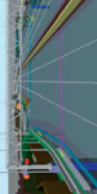
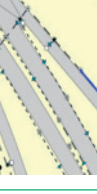
Stage number	Model name	1	2	3	4	5	6	7
Model name	Systems to be covered	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
		N/A	All	All	All	All	All	All
Graphical illustration (building project)								
Graphical illustration (infrastructure project)								
What the model can be relied upon for	Model information communicating the brief, performance benchmarks and site constraints	Models which communicate the initial response to the brief, aesthetic intent and outline performance requirements. The model can be used for early design development, analysis and co-ordination. Model content is not fixed and may be subject to further design development. The model can be used for co-ordination, sequencing and estimating purposes	A dimensionally correct and co-ordinated model which communicates the response to the brief, aesthetic intent and some performance information that can be used for analysis, design development and early contractor engagement. The model can be used for co-ordination, sequencing and estimating purposes including the agreement of a first stage target price	A dimensionally correct and co-ordinated model that can be used to verify compliance with regulatory requirements. The model can be used as the start point for the incorporation of specialist contractor design models and can include information that can be used for fabrication, co-ordination, sequencing and estimating purposes, including the agreement of a target price/maximum price	An accurate model of the asset before and during construction incorporating co-ordinated specialist sub-contract design models and associated model attributes. The model can be used for sequencing of installation and capture of as-installed information	An accurate record of the asset as a constructed at handover, including all information required for operation and maintenance	An updated record of the asset at a fixed point in time incorporating any major changes made since handover, including performance and condition data and all information required for operation and maintenance	The full content will be available in the PAS 1192-3

Figure 20 – Levels of model definition for building and infrastructure projects (*continued*)

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Output	Project brief and procurement strategy	Refined project brief and concept approval	Approval of co-ordinated developed design	Integrated production information	Integrated production information. Complete fabrication and manufacturing details, system and element verification, operation and maintenance information. Modify to represent as installed model with all associated data references	As constructed systems, operation and maintenance information. Agreed Final Account. Building Log Book. Information gathered as key elements are completed to feed installation information for the later packages	Agreed final account. In use performance compared against Project Brief. Project process feedback: risk, procurement, information management, Soft Landings

Figure 20 – Levels of model definition for building and infrastructure projects (*continued*)

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Parametric information	Project needs updated: definition of function(s), operation, quality and time. Benchmarking updated: capital cost, maintenance cost, time, health & safety, risk procurement contract Performance requirements: Priorities and aspirations for: function, mix of uses, scale, location, quality, performance in use, cost (Capex & Opex), value, time, health & safety, embodied carbon, energy and resource needs, standard designs Site constraints: geo-spatial, available site information	Sufficient data to estimate per square metre rates and other similar metrics. Wireframe or surfaces/ solids Concepts, site context placeholder/ volumes/ package routings, site selection, datum points & levels Integrated concept for the project setting scope, scale, form and primary design criteria: architectural form and spatial arrangements, structural/civil philosophy and spatial arrangements, services philosophy and special arrangements preliminary assessment of energy use and embodied/ in-use carbon, incorporation of standard systems	Co-ordinated Developed Design for the project setting: generic systems, objects, or assemblies represented with, detailed form, function, cost, defining all components in terms of overall size, typical detail, performance and outline specification, primary geometry frozen, integration of standard designs and systems, builder's work strategy for significant interfaces, energy use, embodied use, and in use carbon Maintenance plan Detailed design and construction programme	Production information for the project: Specific systems, objects and assemblies accurate in terms of specification, size, form, function and location Critical interfaces flagged Fixing methodology Confirmed clash free detailed production programme sequence. Updated: energy use and embodied in use carbon, detailed design and construction programme	Production record for the project: Specific systems, objects and assemblies accurate in terms of specification, size, form, function and location with detailing, fabrication, assembly, and installation information Detailed routing of systems Fixings and interfaces details to be used Updated: energy use and embodied in use carbon, detailed design and construction programme	Updated: Geometry and installed product information, "as constructed" Accuracy/ resolution of information. Commissioned performance for: Opex, energy, and carbon Detailed maintenance methodology Snagging actions status	Revisions for modifications to the facility during its life

Figure 20 – Levels of model definition for building and infrastructure projects (*continued*)

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Employer activities							
Critical interfaces and logic	N/A	Environmental control philosophy and special allocations for ventilation; Availability of the site and outline construction methodology assumptions; Services capacity for the site Permitted working hours on site	Assumed procurement package performance and spatial boundaries; Other relationships between procurement packages; Assumed design codes regarding dimensional tolerances of related systems; Foundation tolerances for use of off-site modular systems; Assessment of predicted movements (thermal, loading, creep, shrinkage etc.)	Allocated procurement package relationships, performance and special boundaries; Actual dimensional interface requirements; Records of any derogations approved; Actual on-site to off-site interface specifications	Progressive capture of actual dimensional data for critical interface dimensions. Progressive capture of information for calculating material requirements for follow on packages. Capture of object status for progress reporting and collaborative planning	As constructed 3D scan Element performance test results System commissioning status	As modified survey data

Figure 20 – Levels of model definition for building and infrastructure projects (*continued*)

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Construction requirements (examples)	N/A	Crane use zones; Traffic diversions	Confirmed crane (or other lifting system) zones Formwork details. Traffic diversion details	Actual crane (or other lifting system) zones and movement sequences Construction methodology, sequence and movements, critical to how the production design is developed	Status of construction requirements. Safety briefing information. Construction methodology, sequence and movements, critical to installation. Formwork details including install and removal sequence. Actual traffic diversion details.	Confirmed status that the construction aids have been removed	Design of any construction requirements, EG: temporary safety supports or restraint systems if structural defects have been discovered
Project costs	Initial project budget Order of cost estimate	Feasibility cost plan Feasibility whole life cost plan	Commitment Cost Plan Contractor's first stage bid submission Detailed whole life cost plan	Contract Sum/ Target Price/ Agreed Maximum Price Pre-construction whole life cost plan	Contract Sum/ Target Price/ Agreed Maximum Price Pre-construction whole life cost plan	Final account	Actual in-use costs Asset replacement sinking fund
Project logistics and off-site activities (examples)	Client requirements, EG to avoid impact on other operations	Assumed access and egress points; Potential delivery and lay down zones	A feasible logistics sequence for the construction sequence; Confirmed modular strategy (volumetric, panelized, hybrid or other)	Finalized logistics sequences. Details of actual off-site system to be used	Object status progress recording to initiate demand pull signals for deliveries	Remote monitoring systems status	Remote monitoring systems status

Figure 20 – Levels of model definition for building and infrastructure projects (continued)

Stage number	1	2	3	4	5	6	7
Model name	Brief	Concept	Definition	Design	Build and commission	Handover and closeout	Operation
Project facilities (welfare, IT infrastructure, security etc.), on site and off-site (examples)	Collaboration tools; Data standards	Assumed access and welfare zones; Design team collocation	Confirmed access zones and design team collocation	Finalized, costed plan. Critical lead times confirmed. Off-site manufacturing capacity reserved	Recording status of security critical areas (EG unchecked, sweep in progress, screened and secured)	Security system operational, potentially using model information for lines of sight from cameras, PAVA zone controls, etc.	Security system operational. Facilities management systems running on model generated information Geometry for letting activities accessed from "as constructed" model
Notes and associated project documents, based on model information	Management systems for information and decision making Approval policies	Technical strategy studies Commissioning philosophy NRM1 capital cost plan NRM3 maintenance cost plan	Provides the basis for Integrated Production Information to be produced on a package basis with limited risk of changes to primary coordination Room Information sheets, Detailed construction methodology NRM2 and NRM3 cost plans Health and safety risk management Risk management plan	Updated: maintenance plan, risk management plan, detailed construction methodology, NRM2 procurement pricing schedule, NRM3 maintenance cost plan, health and safety risk management plan, risk management plan	Detailed construction methodology, Updated health and safety risk management plan NRM3 maintenance cost plan	Approximate final account Maintenance procurement pricing Remedial works, handover and maintenance programme	N/A (project closed)

NOTE 1 A lack of alignment between different members of the supply chain regarding progress through the stages can introduce risks to the project. If this is likely it is important to effectively manage the programme and deliverables' schedules to ensure continuity of data and deliverables.

NOTE 2 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.



9.10 Classification

Models, documents, project information, cost information and specifications shall all be organized using a classification system to allow external processes such as cost planning to take place.

NOTE 1 This should not be confused with an object naming convention that may contain the classification code.

NOTE 2 A classification system provides a common terminology and structure to which all project documents and information can be related. The use of classification is required in information exchange and in the COBie-UK-2012 templates.

NOTE 3 Table 4 shows how different classification systems, or parts thereof, may be used to classify different types of information.

NOTE 4 As the project progresses the specification and design information required for the project increases in detail. This information is classified according to different tables in Uniclass.

NOTE 5 The cost plan and specification required at appraisal is progressively defined throughout the lifecycle.

NOTE 6 The classification system aids the co-ordination of the levels of elemental cost and the levels of specification to be managed.

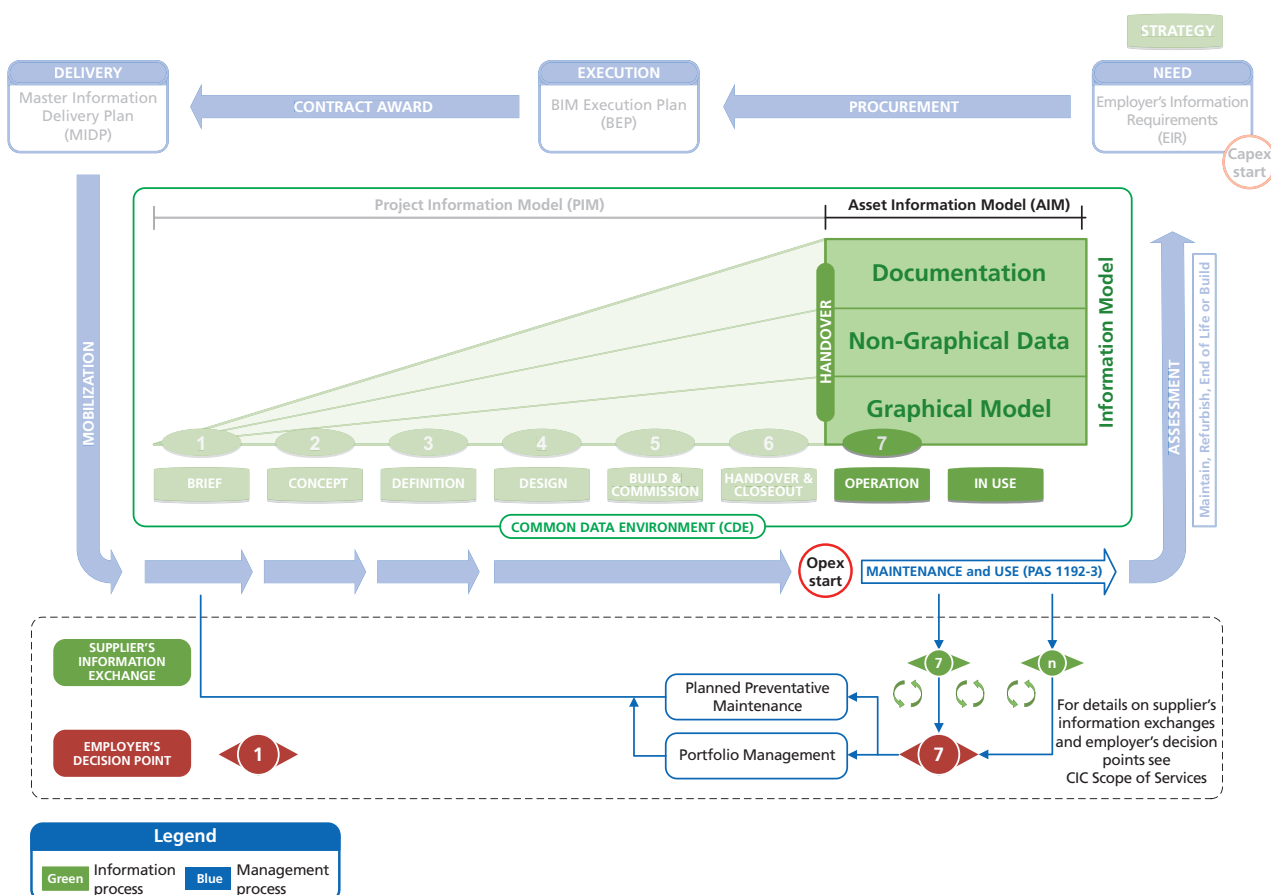
NOTE 7 For more information about Uniclass, see the CPI website (<http://www.cpic.org.uk>). For more information about NRM, see the RICS website (<http://www.rics.org/nrm>). For more information about CESMM see the ICE website (<http://www.ice.org.uk>).

Table 4 – Application of different classification systems

Information	Classification system/part
Concept cost information	NRM1, CESMM
Detailed cost information	NRM2, CESMM
Concept design information	Uniclass/Entities, Spaces, Elements tables
Developed design information	Uniclass/Elements, Systems tables
Production information	Uniclass/Systems, Work results, Products tables
Installation information	Uniclass/Products tables
As constructed information	Uniclass/Systems, Products tables
In-use design information	Uniclass/Systems, Work results, Products tables
Maintenance cost information	NRM3

10 Information delivery – Asset information model (AIM maintenance)

Figure 21 – Information delivery – AIM maintenance



10.1 General – Information delivery – Asset information model (AIM) maintenance

NOTE 1 Guidance on the use and maintenance of the AIM is to be documented in PAS 1192-3.

NOTE 2 Figure 21 shows how this part of the information delivery cycle fits into the overall process.

NOTE 3 It is expected that the data generated during the delivery phase's described above together with the commissioning information will form the majority of the information to be handed over at completion. COBie-UK-2012 is the recommended format for information exchange. If extra information such as proprietary geometric models (2D or 3D) or extra data attributes are required employers and project delivery teams should document these alternative formats in the EIR at project commencement.

NOTE 4 COBie-UK-2012 is a data schema for holding and transmitting data to support the delivery and operation of a facility. It is formally defined as a subset of the Industry Foundation Classes, but can also be conveyed using worksheets or relational databases.

NOTE 5 During traditional projects, most of the data required by COBie-UK-2012 is already delivered in unstructured form. COBie-UK-2012 gives the opportunity to input critical data just once, allowing it to be re-used in many outputs, be tested in many ways and be delivered to many applications including facility management and asset management systems.

NOTE 6 For a detailed definition of the COBie-UK-2012 schema, see the BIM Task Group website <http://www.bimtaskgroup.org>.

NOTE 7 Copyright is claimed in this illustration. Reproduction of this illustration and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.

10.2 Handover process between CAPEX and OPEX

10.2.1 The effective transfer of structured information between the asset lifecycle stages delivers significant value. To effectively enable this, formal handover processes shall be documented in the EIR. The document shall define the structure, process and content of information to be exchanged. This document shall form the basis for the operational contract documentation.

In addition, appropriate surveys such as point cloud or LiDAR shall be provided to verify the completeness of the as-constructed model.

NOTE 1 A number of formal processes exist such as *Soft Landings* (see <http://www.bsria.co.uk/services/design/soft-landings>) or in the case of the public sector “Government Soft Landings” (GSL) (see <http://www.bimtaskgroup.org/gsl>).

NOTE 2 The handover process and detailed operational processes are documented in PAS 55; the data requirements for these and associated activities are to be documented in PAS 1192-3.

NOTE 3 Evaluation of the operational performance of the asset is to be documented in PAS 1192-3.

Annex A (informative) Terms, definitions and abbreviations for BIM documentation

A.1 2D

Two-dimensional.

A.2 2D drawing

A 2D drawing contains a view of a model that is referenced into a “drawing sheet template” (blank drawing and title block). Such drawings must always be considered to be static documents, as they are drawing renditions or snapshots of the design’s model files. Such renditions are generated each time the drawing is prepared for “sharing” at regular milestones.

A.3 2D model

A model with entities having two-dimensional properties. Such models are always to be considered to be dynamic, as they will be made up of “model files” that are “x-ref” or “reference” files.

A.4 3D

Three-dimensional.

A.5 3D model

A model with objects having three-dimensional properties. Such models are always to be considered to be dynamic, as they will be made up of “model files” that are “x-ref” or “reference” files.

A.6 3D visualization

3D images from the 3D CAD model, or a virtual representation of the building or facility to be constructed; used for visualizing the project.

A.7 archive

Component of the common data environment (CDE).

NOTE *The archive section of the CDE is for inactive or superseded information. Such information will provide a history of the project information transfers, sharing, change orders and knowledge retention, and can be used for other contractual purposes or “discovery”.*

A.8 as-built or as-constructed

A model consisting of documentation, non- graphical information and graphical information defining the delivered project.

“As-built” is defined as the record drawings and documentation defining deviation to the designed information occurring during construction at the end of the project.

“As-constructed” defines the defect and deviation to the designed model occurring during construction. The “as-constructed” model and its appended documentation are continually updated through re-measurement as construction progresses. This allows for deviation to be reviewed with respect to the following packages and making knowledgeable assessment of impact and resolution.

A.9 assembly

Group of components or types to enable the reuse of standardized design or specification elements improving productivity of design and delivery as well as providing a location to hold specifications and lessons learnt in a simple and useable way. They may hold benchmark data for cost and carbon impacts.

The contents of assemblies may themselves have attributes and classifications. These properties may include key data which is attached (to the object) for use once it is placed into a model and may include cost, CO₂, programme, maintenance and other key information.

A.10 attribute

Piece of data forming a partial description of an object or entity.

A.11 author

Originator of model files, drawings or documents.

A.12 AIM/Asset Information Model

Maintained information model used to manage, maintain and operate the asset.

A.13 BEP/BIM Execution Plan

Plan prepared by the suppliers to explain how the information modelling aspects of a project will be carried out.

A.14 BIM

Building information modelling.

A.15 BIM(M)

Sometimes Building Information Management but as BIM(M) Building Information and Management.

A.16 BIM Viewer

Software used to view 3D rendition without requiring the user to have the software that produced the model (Navisworks, Navigator, Solibris, etc.; also eDrawing to view both 2D and 3D rendition).

A.17 CAD

Computer aided design.

A.18 CAD standard

Standard used to produce CAD models that will include origins, units, layering conventions, line specifications, file-naming conventions, drawing numbering, etc.

A.19 CAD viewer

Software used to view rendition print files without requiring the user to have the software that produced the model. (Adobe PDF, DWF, etc.)

A.20 CADD

Computer aided design and draughting.

***NOTE** A computer-aided design software application with additional features such as the ability to output drawings from the software.*

A.21 CAWS

Common Arrangement of Work Sections, published by CPIC for use in specifications and bills of quantities.

A.22 CDM

Construction (Design and Management) regulations.

A.23 CIAT

Chartered Institute of Architectural Technologists.

A.24 CIBSE

Chartered Institution of Building Services Engineers.

A.25 CIC Scope of Services

Multi-disciplinary scope of services published by the Construction Industry Council (CIC) for use by members of the project team on major projects.

A.26 CI/SfB

The UK version of the Construction Indexing Classification System for Construction products and elements – a version of the SfB classification system originating from Sweden.

A.27 clash rendition (CR)

Rendition of the native format model file to be used specifically for spatial coordination processes. To achieve clash avoidance or to be used for clash detection.

A.28 classification

Systematic arrangement of headings and sub-headings for aspects of construction work including the nature of assets, construction elements, systems and products.

A.29 client

Individual or organization commissioning a built asset.

***NOTE** The client may be different from the employer.*

A.30 common data environment (CDE)

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.

NOTE 1 A CDE may use a project server, an extranet, a file-based retrieval system or other suitable toolset.

NOTE 2 Note CDE as defined in the BS 1192:2007.

NOTE 3 The fundamental requirement for producing information through a collaborative activity is to share information early, and to trust the information that is being shared as well as the originator of that information. What is needed is a disciplined auditable process that is transparent and controllable.

The method for managing a project through a common data environment (CDE) is applicable to all sizes of practice, and in particular it prepares that office to be able to work collaboratively. As a standard that is adopted by all, it will help to remove the problem of having to constantly retrain on each and every project when client standards are to be applied. If the clients accept the procedures and make them contractual, then these problems disappear.

The CDE is a means of allowing information to be shared efficiently and accurately between all members of the project team – whether that information is in 2D or 3D, or indeed textual or numeric. The CDE enables multi-disciplinary design teams to collaborate in a managed environment, where the build-up and development of information follows the design, manufacturing and construction sequence. See BS 1192:2007 or Building Information Modelling – A Standard Framework and Guide to BS 1192, Richards, 2010.

The CDE process also ensures that information is only generated once and is then reused as necessary by all members of the supply chain. It also ensures that the information is constantly updated and enriched for final delivery as part of the Facilities Management (FM) document.

A.31 component

Synonym for “occurrence”.

A.32 concession

Permission to use or release a product that does not conform to specific requirements

[BS ISO 10007:2003]

or a concession against a contract requirement (gain permission for non-conformance).

A.33 concurrent engineering

Systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support (based on IDA definition). In a construction context it incorporates both early contractor and owner/operator involvement.

A.34 configuration

Interrelated functional and physical characteristics of a product defined in product configuration information.

[BS ISO 10007:2003]

A.35 configuration item

Entity within a configuration that satisfies an end use function.

[BS ISO 10007:2003]

A.36 configuration management

Co-ordinated activities to direct and control configuration.

[BS ISO 10007:2003]

A.37 configuration status accounting

Formalized recording and reporting of product configuration information, the status of proposed changes and the status of the implementation of approved changes.

[BS ISO 10007:2003]

A.38 CPI

Construction project information.

A.39 CPIc

Construction Project Information Committee.

A.40 CPIx

Construction Project Information Xchange.

A.41 CSG

Constructive solid geometry representation. A CSG object is composed from standard primitives using regularised Boolean operations and rigid motions.

A.42 COBie-UK-2012

Structured facility information for the commissioning, operation and maintenance of a project often in a neutral spreadsheet format that will be used to supply data to the employer or operator to populate decision-making tools, FM and asset management systems.

NOTE Templates for the preparation of COBie information exchange files can be downloaded from the BIM Task Group website: <http://www.bimtaskgroup.org>.

A.43 data

Information stored but not yet interpreted or analyzed.

A.44 design intent model

Initial version of the Project Information Model developed by the design suppliers.

A.45 DGN

File extension for Bentley Systems' MicroStation and Intergraph's Interactive Graphics Design System CAD programs.

A.46 dispositioning authority

Person or a group of persons assigned responsibility and authority to make decisions on the configuration.

[BS ISO 10007:2003]

A.47 DMS

Document management system.

A.48 document

Information for use in the briefing, design, construction, operation, maintenance or decommissioning of a construction project, including but not limited to correspondence, drawings, schedules, specifications, calculations, spreadsheets.

NOTE Documents must either be immutable or incorporate a means of controlling changes.

A.49 document repository

Entity including an electronic data management (EDM) system, project extranet or folder hierarchy on a Windows file server.

A.50 drawing

Static, printed, graphical representation of part or all of a project or asset.

A.51 drawing title block

Framework – often containing the project team's logos – to show the drawing title, number, purpose of issue, status and revision information.

A.52 DWF

Design web format. An open, secure file format developed by Autodesk for the distribution and communication of design data to view, review, or print design files.

A.53 DWG

Proprietary AutoCAD file format.

NOTE DWG (drawing) is a binary file format used for storing two and three dimensional design data and metadata. It is the native format for several CAD packages including AutoCAD and is supported by many other CAD applications.

A.54 DXF

File format used mainly for importing and exporting CAD data between AutoCAD and other CAD-related programs.

A.55 earned value analysis (EVA)

A method of project performance measurement that integrates cost, time and scope.

A.56 electronic document management system (EDMS)

System for storing, retrieving, sharing and otherwise managing electronic documents.

NOTE An EDMS provides more control and better management of computer-generated files. It adds enhanced file security, revision control, file descriptions, extended file names and user access privileges to the basic file directory management features of the computer operating system.

A.57 employer

Individual or organization for whom the contract is executed and delivered.

A.58 employer's Information Requirements (EIR)

Document setting out the information to be delivered by the supplier as part of the project delivery process to the employer.

A.59 entity

Synonym for "object".

A.60 FM

Facilities management.

A.61 gate/stage

Division of a standardized process map for the acquisition of a facility, at some of which the requirements can be delivered.

NOTE The stages at which information exchanges are required should be specified in the EIR by reference to the agreed stage and gate names. See the CIC Scope of Services.

A.62 graphical data

Data conveyed using shape and arrangement in space.

A.63 graphic file

File format designed specifically for representing graphical images.

A.64 IAI

International Alliance for Interoperability. Now known as Building Smart.

A.65 iBIM

Integrated Building Information Model.

A.66 ICE

Institution of Civil Engineers.

A.67 ICT

Information and communications technology.

A.68 IFC2x

Industry Foundation Class version 2x.

A.69 information

Representation of data in a formal manner suitable for communication, interpretation or processing by human beings or computer applications.

A.70 information exchange

Structured collection of information at one of a number of pre-defined stages of a project with defined format and fidelity.

A.71 Information management

Tasks and procedures applied to inputting, processing and generation activities to ensure accuracy and integrity of information.

A.72 information model

The information model comprises three constituent parts: documentation, non-graphical information and graphical information.

NOTE The model is conveyed using PDF, COBie and native model files.

A.73 information modelling

Use of data to provide information through better understanding, by applying logic or mathematical functions to derive new data.

A.74 layer

Attribute given to entities within CAD files enabling their visibility to be controlled. Further values may be assigned to the attribute to enable control whether it can be edited or deleted.

A.75 lean

Production focused on delivering value for the employer and eliminating all non-value-adding activities using an efficient workflow.

A.76 lean principles

Understanding value from a client's perspective, identifying the value stream, establish a balanced flow of work, in which the demand for product is pulled from the next customer, with a constant drive for continuous improvement and perfection (Based on "Lean Thinking", Womack & Jones, 2003 edition).

A.77 levels of model detail (LOD)

Description of graphical content of models at each of the stages defined for example in the CIC Scope of Services.

A.78 levels of model information (LOI)

Description of non-graphical content of models at each of the stages defined for example in the CIC Scope of Services.

A.79 master information document index (MIDI)

Index specifying a detailed list of the deliverables for a project; for model, sub models, documents and data also allocating responsibility to deliver and the programme for delivery of a project supply chain.

A.80 manageable assets

Those aspects of the facility that may be managed during the facility life-cycle include both physical and spatial objects, and their functional groupings.

NOTE 1 An asset is a uniquely identifiable element which has a financial value and against which maintenance actions are recorded.

NOTE 2 Some aspects, such as the structural frame, or individual pipe and duct segments, fixings and secondary elements may be excluded from scope by the employer.

A.81 marked-up drawing

Paper or electronic drawing that has been marked up with comments from other disciplines or the client.

A.82 master information delivery plan (MIDP)

Primary plan for when project information is to be prepared, by whom and using what protocols and procedures, incorporating all relevant TIDPs.

A.83 metrics

The acceptability of the deliverable may be assessed against the requirements shown in the examples and/or against indicative ratios and counts based on the information provided.

A.84 model file

Native, proprietary format, CAD file that can be a 2D or 3D model.

A.85 non-graphical data

Data conveyed using alphanumeric characters.

A.86 NRM

RICS New Rules of Measurement (NRM) for Building Works: a suite of documents issued by the RICS Quantity Surveying and Construction Professional Group.

A.87 NRM1

Order of Cost Estimating and Cost Planning for Capital Building Works.

A.88 NRM2

Detailed measurement for building works, provides detailed rules for the measurement and description of building works for the purpose of obtaining tender prices.

A.89 NRM3

Order of cost estimating and cost planning for building maintenance works is currently in development and is expected to launch in 2013.

A.90 object

Item having state, behaviour and unique identity – for example, a wall object.

NOTE Wiki: object as anything that we can think or talk about. In a general sense it is any entity.

A.91 origin

As the setting out point for a project or programme using co-ordinate geometry or related to the OS or geospatial reference.

A.92 originator

Author of models, drawings and documents.

A.93 OS

Ordnance Survey.

A.94 PDF

Portable Document Format. A standard document format from Adobe Systems for transfer between different computer systems.

A.95 placeholder

Simplified or generic representation of a 3D object.

A.96 project delivery team

Group of organizations or individuals contracted either directly or indirectly to deliver services or products to the project.

A.97 project information model (PIM)

Information model developed during the design and production and construction phase of a project, consisting of documentation, non- graphical information and graphical information defining the delivered project.

NOTE The PIM is developed firstly as a design intent model, showing the architectural and engineering intentions of the design suppliers. Then the PIM is developed into a virtual construction model containing all the objects to be manufactured, installed or constructed. It becomes the basis of the Asset Information Model once handed over.

A.98 project implementation plan (PIP)

Statement relating to the suppliers' IT and human resources capability to deliver the EIR.

NOTE Also contains standard method and procedure.

A.99 published/documentation

Component of the CDE for drawing renditions that have been approved as suitable for a specific purpose – for example, suitable for construction.

NOTE The published documentation section of the CDE contains drawings – and, if agreed by the project teams, the native model files and renditioned– which are snapshots of the shared information taken at a specific time. They are compiled by referencing the relevant approved model files into a coordinated model file and cutting the views and sections from the models.

A.100 purpose of issue

States the purpose for issuing the document.

A.101 purposes

Those aspects of the Facility that are intended to be managed by the facility owner.

NOTE Some purposes, such as supporting the business case, may be common with the briefing and design processes.

A.102 RACI indicator

Abbreviation used to identify which of a group of participants or stakeholders are responsible for ("R"), authorize ("A"), contribute to ("C") or are to be kept informed about ("I") a project activity

A.103 reference file

CAD model file associated or linked with another CAD model file. Also referred to as an “X-ref”.

A.104 rendition

Documentation in a form enabling the information to be viewed, printed and marked up. For example, PDF and DWF files are documentation consisting of snapshots of

A.105 requirements

Requirements are the documented expectations of facility owners/commissioners for sharable structured information. These are also referred to as the Employers Information Requirements (EIR) (alternatively, the Clients Information Requirements).

***NOTE** Detailed requirements are scheduled in the examples.*

A.106 revision

Used to identify revisions of documents, drawing and model files.

A.107 RIBA

Royal Institute of British Architects.

A.108 RICS

Royal Institution of Chartered Surveyors.

A.109 shared

Component of the CDE. The shared section of the CDE is where information can be made available to others in a “safe” environment. The early release of information assists in the rapid development of the design solution. To allow this to be achieved, the concept of information “status/suitability” has been adopted.

A.110 SI system

Le Système International d’Unités. International system of units.

A.111 SMP

Standard Method and Procedure. Set of standard methods and procedures covering the way information is named, expressed and referenced.

A.112 soft landings

Graduated handover of a built asset from the design and construction team to the operation and maintenance team to allow structured familiarisation of systems and components and fine tuning of controls and other building management systems.

A.113 standard font

Agreed set of font types and sizes to be used for the project.

A.114 standard layering convention

Single layering convention used by the project team.

[BS 1192:2007]

A.115 status

Defines the “suitability” of information in a model, drawing or document. Not to be confused with the status in architectural documentation as “new build”, “retain” or “demolish”.

A.116 supplier

Provider of services or goods either directly to the employer or to another supplier in a supply chain.

A.117 supplier information modelling assessment form

The form conveying the capability and experience of a supplier to carry out information modelling in a collaborative environment.

A.118 supplier information technology assessment form

The form conveying the capability and IT resources of a supplier for exchanging information in a collaborative environment.

A.119 supply chain capability assessment form

Form summarizing the human resource and IT capability of each organization in a supply chain.

A.120 system

Group of components that work together to provide a specific building service such as envelope, ventilation or fire protection.

A.121 system (IFC)

Organized combination of related parts, composed for a common purpose or function or to provide a service. System is essentially a functionally related aggregation of products.

A.122 systems engineering

Interdisciplinary approach enabling the realization of successful systems.

[SOURCE: International Council on Systems Engineering]

A.123 task information delivery plan (TIDP)

Federated lists of information deliverables by each task, including format, date and responsibilities.

A.124 TBM

Tunnel boring machine.

A.125 third party capability assessment form

form conveying the information management and IT capabilities of non-design, non-construction organizations in a supply chain.

A.126 Uniclass

Unified classifications for the construction industry sponsored by CC, RICS, RIBA and CIBSE. The classification system is based on CI/SfB, CAWS and other relevant documents. Complying with BS ISO 12006-2.

A.127 user

Individual occupying or using a built asset for its designed purpose.

A.128 virtual construction model

Subsequent version of the Project Information Model developed from the design intent model by the construction supplier and their supply chain.

A.129 volume

Manageable spatial subdivision of a project, defined by the "project team" as a subdivision of the overall project that allows more than one person to work on the project models simultaneously and consistent with the analysis and design process.

NOTE 1 Analogous to the volume strategy defined by the lead designer to allocate volumes within the project to different disciplines into which they carry out their system models (walls, structure, pipework, ductwork, electrical, etc).

Also achieves spatial co-ordination prior to detail design.

Each volume or subdivision is a reference file. When one or more referenced files is viewed, the full or partial project may be represented.

This subdivision also becomes important when using extranets, as it allows the files to be kept to a manageable file size.

NOTE 2 This term is defined as "zone" in BS 1192:2007.

A.130 version

Sub-indexing to revision as used in the common data environment to show the development of information and information models, e.g. if a version is named P1.1, P1 is the revision number and .1 is the version to that revision.

A.131 VPN

Virtual private network.

A.132 work in progress (WIP)

Component of the CDE.

A.133 x-ref

CAD model file associated or linked with another CAD model file. Also referred to as a "reference file".

Bibliography

Standards publications

For dated references, only the edition cited applied. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7000-4:1996, *Design management systems – Part 4: Guide to managing design in construction* (currently under review)

BS 8541-1:2011, *Library objects for architecture, engineering and construction – Part 1: Identification and classification – Code of practice*

BS 8541-2:2011, *Library objects for architecture, engineering and construction – Part 2: Recommended 2D symbols of building elements for use in building information modelling*

BS 8541-3:2012, *Library objects for architecture, engineering and construction – Part 3: Shape and measurement – Code of practice*

BS 8541-4:2012, *Library objects for architecture, engineering and construction – Part 4: Attributes for specification and assessment – Code of practice*

BS 11000-1:2010, *Collaborative business relationships – Part 1: A framework specification*

BS 11000-2:2010, *Collaborative business relationships – Part 2: Guide to implementing BS 11000-1*

PAS 55:2008 (all parts), *Asset management – Specification for the optimized management of physical assets*

PAS 91:2010, *Construction related procurement – Prequalification questionnaires*

Other publications

Building Information Modelling (BIM) Working Group Strategy Paper (March 2011)

Construction Industry Council (CIC) Scope of Services (revised consultation draft) (2012)

CPlx Protocol. Construction Project Information Committee (CPIC), 2012

CHURCHER, D. *Design Framework for Building Services*. Third Edition. Bracknell, UK: BSRIA, 2012

Government Construction Strategy (May 2011)

Websites

Building Information Modelling (BIM) Task Group
<http://www.bimtaskgroup.org>

COBie-UK-2012, Reference documentation
<http://www.bimtaskgroup.org/COBie-UK-2012>

Construction Industry Council (CIC)
<http://www.cic.org.uk>

Construction Project Information Committee (CPIC)
<http://www.cpic.org.uk>

Further reading

BS 8534:2011, *Construction procurement policies, strategies and procedures – Code of practice*

BS EN ISO 9001:2008, *Quality management systems – Requirements*

BS ISO 10007:2003, *Quality management systems – Guidelines for configuration management*

BS ISO/IEC 27001:2005, *Information technology – Security techniques – Information security management systems – Requirements*

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services. It presents the UK view on standards in Europe and at the international level.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

Revisions

British Standards and PASs are periodically updated by amendment or revision. Users of British Standards and PASs should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using British Standards would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Similarly for PASs, please notify BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers BSI Subscribing Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of British Standards and PASs.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001
Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website **www.bsigroup.com/shop**. In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

In response to orders for international standards, BSI will supply the British Standard implementation of the relevant international standard, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005
Email: knowledgecentre@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards and PASs via British Standards Online can be found at **<http://shop.bsigroup.com/bsol>**

Further information about British Standards is available on the BSI website at **www.bsigroup.com/standards**

Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained. Details and advice can be obtained from the Copyright & Licensing Department.

Tel: +44 (0)20 8996 7070
Email: copyright@bsigroup.com



Peter Hansford
Chief Construction
Advisor

The HM Government's Building Information Modelling (BIM) Programme – which has a target to have all centrally-procured Government projects adopt BIM Level 2 by 2016 – has been called one of the most ambitious and advanced policy-driven programmes in the world. It is one in which the UK can take on a global leadership role in BIM exploitation.

The BIM Programme is also an integral part of the Government Construction Strategy, an enabler of our ambition to achieve significant improvements in cost, value and carbon performance. By working in a collaborative, digitally-enabled environment, we can remove waste and help achieve better asset outcomes throughout all stages of the asset life-cycle.

It is therefore essential that this programme is underpinned with a proven process that supports our Level 2 BIM needs, and brings together the basic requirements to create a collaborative project. This PAS builds on the collaborative processes of BS 1192:2007 which is the only BIM modelling and management process and procedure that has been published anywhere in the world. Along with our common data set (COBie-UK) and the CIC BIM Protocol, we are creating the tool-sets to ensure that Level 2 BIM can be adopted successfully.

I believe that collaborative BIM working processes and the data rich technologies that support it, are fundamental for economic growth in both our domestic and international construction markets. It is therefore essential that we are adequately equipped to ensure the UK is at the frontline of this global shift in how we create and maintain our built environment.



Mark Bew MBE
Chair of the
HM Government
BIM Task Group

Standards play an important role in ensuring the wider adoption of BIM technologies, processes and collaboration by ensuring that the same accurate data can be accessed throughout the supply chain. The standardization of Level 2 BIM will help HM Government and industry alike save significant sums and enable significant future industry growth.

PAS 1192-2:2013 plays an integral role in the adoption of digital techniques in the construction industry, but needs to be used in conjunction with your Plan of Works, Scope of Services and normal contract documentation. For updates to all of these documents be sure to regularly visit <http://www.bimtaskgroup.org>.



BSI, 389 Chiswick High Road
London W4 4AL
United Kingdom
www.bsigroup.com



www.bimtaskgroup.org

ISBN 978-0-580-82666-5



9 780580 826665