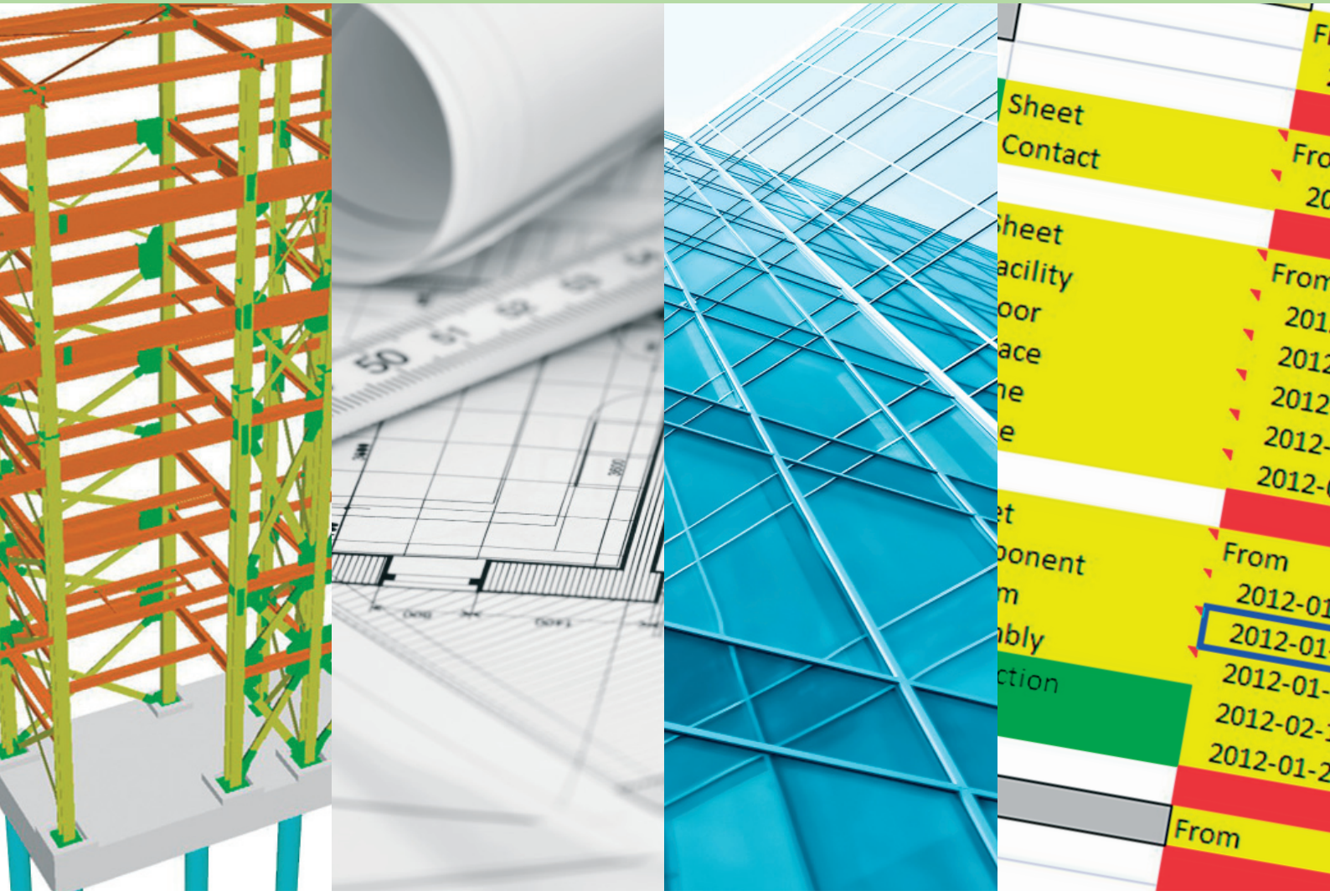
PAS 1192-2:2013

Incorporating Corrigendum No. 1

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



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Contents

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:

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- West One Management Consulting

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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

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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.

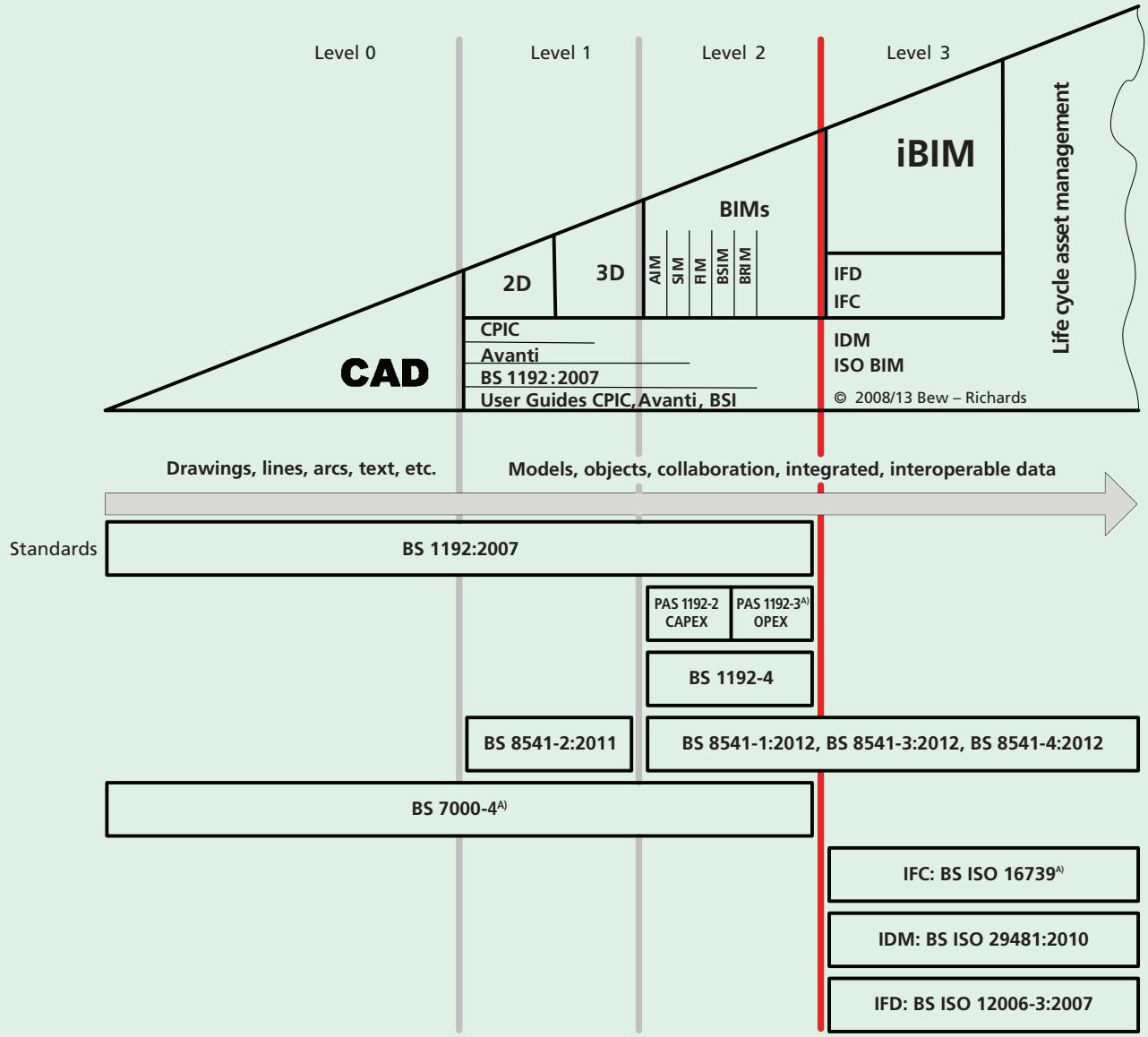
The GREEN elements of the diagrams represent the information delivery process known as the common data environment (CDE).

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.

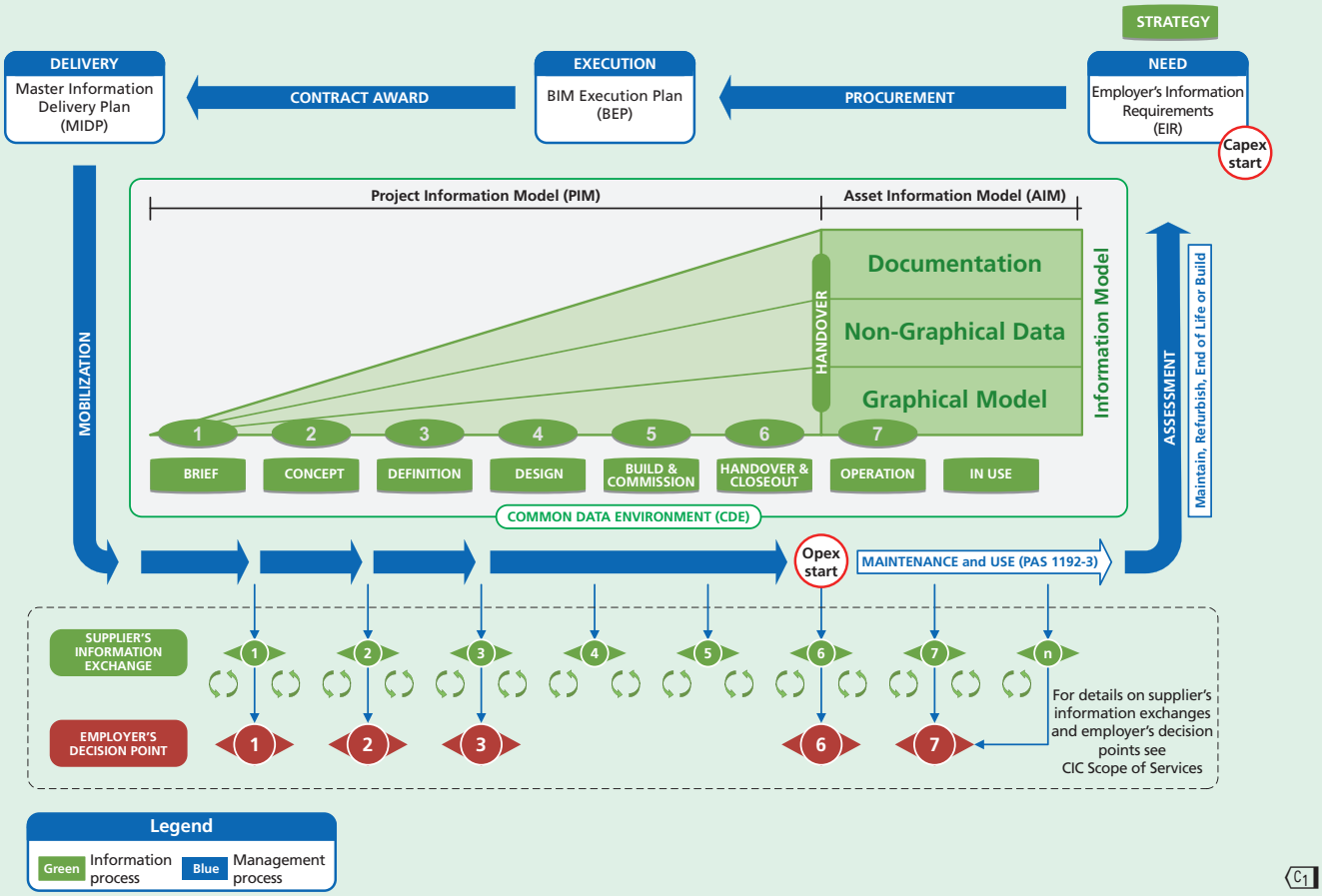
PAS 1192-2 provides specific guidance for the information management requirements associated with projects delivered using BIM. Not all information on a project will be originated, exchanged or managed in a BIM format. This information will also need to be managed in a consistent and structured way to 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



A) In preparation.

C1 **Figure 2** – The information delivery cycle



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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****).*

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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: • CPIx 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 Publically 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.