

# PAS 1192-3:2014

*Incorporating Corrigendum No. 1*

## Specification for information management for the operational phase of assets using building information modelling



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# Foreword

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Acknowledgement is given to the following organizations that were involved in the development of this PAS as members of the steering group:

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Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

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## 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.

It is a companion document of, and refers heavily to PAS 1192-2:2013, *Specification for information management for the capital/delivery phase of construction projects using building information modelling*.

It also refers heavily to the BS ISO 55000 series, *Asset management*, PAS 55:2008, *Asset management*, and to existing facilities management standards BS 8210:2012 and BS 8587:2012. BS 8536:2010 and BS 8572:2011 have also been useful source documents in relation to facilities management.

## 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.

## 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 the wedge element of Figure 3. Copyright holders are Mark Bew and Mervyn Richards.

Copyright is also claimed on Figure 2, which has been repurposed for this publication from Figure 14 in PAS 1192-2:2013. The copyright holder is Mervyn Richards.



## Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in italic type, and does not constitute a normative element. The word “should” is used to express recommendations, the word “may” is used to express permissibility and the word “can” is used to express possibility, e.g. a consequence of an action or an event.

Spelling conforms to The Shorter Oxford English Dictionary. If a word has more than one spelling, the first spelling in the dictionary 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 this PAS cannot confer immunity from legal obligations.**

# 0 Introduction

## 0.1 Background and context

The Introduction to this PAS sets the scene for the normative content. Whilst in this sense the introduction is informative, it is recommended that all users of PAS 1192-3 take the time to read and reflect on the topics discussed here since these affect the way that the body of the PAS has been written and the way that its requirements have been expressed.

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”. This is reinforced by the Industrial Strategy Construction 2025<sup>1)</sup>, published in July 2013.

PAS 1192-3 is a companion document to PAS 1192-2, which specified an information management process to support building information modelling (BIM) Level 2 in the capital/delivery phase of projects. In contrast, PAS 1192-3 focuses on the operational phase of assets irrespective of whether these were commissioned through major works, acquired through transfer of ownership or already existed in an asset portfolio. The operational phase of an asset is deemed to commence at handover, but the requirements within PAS 1192-3 may also be helpful during major works.

Like PAS 1192-2, PAS 1192-3 applies to both building and infrastructure assets. In addition, both PAS 1192-2 and PAS 1192-3 assume a certain level of knowledge regarding BIM and BS 1192:2007.

PAS 1192-3 makes extensive reference to the definitions and concepts in PAS 1192-2. All users of PAS 1192-3 are encouraged to obtain a copy of PAS 1192-2, which is summarized on <http://shop.bsigroup.com/Navigate-by/PAS/PAS-1192-22013/> and available as a free download.

The discipline of asset management allows organizations to optimize the whole life cost of managing portfolios of assets which can be complex and varied in nature, distributed over extensive geographical areas and may be subjected to differing demand/utilization requirements. Integrating the management of information across the longer term activity of asset management with the shorter term activity of asset construction for a portfolio of assets should deliver real savings. These come about in a variety of ways, including:

- reduced costs as a result of the automated transfer of accurate, complete and unambiguous information at asset handover and during transfer of operation from one service provider to another;
- better awareness of the operational and maintenance needs of assets;
- better decisions regarding operation and maintenance expenditure based on actual asset performance and status;
- dynamic measurement and condition-sensing enabling poor energy performance, faults and impending failure to be identified;
- better organizational and strategic planning from more complete and accurate asset information, for example in the development of the health and safety file required by the [\[C1\]](#) Construction (Design and Management) Regulations<sup>2)</sup> [\[C1\]](#);
- better information quality as a result of automation enabling an increased amount of verification.

It is up to each organization to decide for itself how and when to apply PAS 1192-3 to existing asset information, especially when a new project delivers a project information model (PIM) as defined in [\[C1\]](#) PAS 1192-2 [\[C1\]](#).

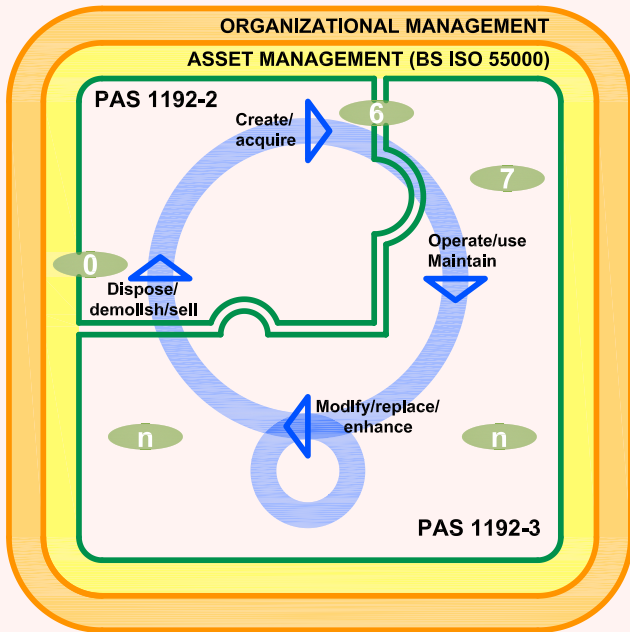
<sup>1)</sup> Available from <https://www.gov.uk>

<sup>2)</sup> Available from <http://www.hse.gov.uk/construction/cdm.htm>

## 0.2 Substantive issues

- a) Despite similarities in the nature of the assets being managed, there are differences in approach between the asset management and facilities management disciplines. Both have generated their own standards or specifications (see Clause 2, Normative references) and both have evolved their own language of preferred and defined terms. In their own ways, facilities management and asset management are concerned with managing the key assets of an organization at optimal whole life cost. These activities extend to the infrastructure and buildings needed by the organization and cover physical-, organizational- and people-related requirements. In facilities management this distinction is often made through the terms “hard FM” and “soft FM”. This PAS concentrates on physical-related requirements and so, for clarity of intent, the terms “asset” and “asset management” are used in this document to reflect this emphasis.
- b) The management of portfolios of assets will typically involve an almost continuous cycle of assets being created, operated, maintained/overhauled and then decommissioned or demolished prior to more asset creation activities. This PAS is fundamentally about the availability, integrity and transfer of data and information during the operational phase of an asset's life. Where assets are subject to a capital/delivery phase this means there is a link with those information management processes defined in PAS 1192-2. There are still instances where organizations treat capital and operational expenditure separately and these practices present challenges to the strategic and holistic management of assets, as existing asset information should inform major works. However, the draft publication of the framework for the digital Plan of Work (available in early 2015) should start to change this custom and practice, as it includes a stage for strategic planning at the property or asset portfolio level and a stage for feedback and learning from a completed project. This mirrors the strategic asset management system and life cycle approach contained within PAS 55-1 and BS ISO 55001. It is important that the handovers between discrete time-limited project work and ongoing management operations, and vice versa, are properly designed and implemented.
- c) PAS 1192-3 cross-references with other existing standards concerned with the management of assets, with the procurement of asset-related services and asset management services, and with the organization of information related to asset management. These standards are listed in the normative references in Clause 2. In particular, this PAS is closely related to the BS ISO 55000 series of standards and their UK antecedents PAS 55-1 and PAS 55-2. These asset management standards provide one overarching framework for the adoption and implementation of PAS 1192-2 and PAS 1192-3. The relationship between these specifications and the concept of asset management is illustrated in Figure 1, with organizational and asset management shown around the interlocking requirements of PAS 1192-2 and PAS 1192-3. As such, PAS 1192-3 should be implemented within a management system that sets out requirements for policy, strategy, planning, implementation, organizational structure, people and IT systems in order to optimize the management of an organization's assets. Although the BS ISO 55000 series has been published, PAS 55 had not been withdrawn at the time of writing. PAS 1192-3 refers to BS ISO 55000 for general issues regarding asset management and to PAS 55 where the additional detail in PAS 55 is relevant.

**Figure 1** – Relationship between asset management, PAS 1192-2 and PAS 1192-3



**NOTE 1** The cycle of activities shown in Figure 1 is based on that given in Asset Management – an anatomy [1] and also includes reference to the life cycle stage numbers shown in Figure 2.

**NOTE 2** The inclusion of the disposal stage of the lifecycle within PAS 1192-2 covers the situation where demolition of an existing asset is part of the construction of a new asset. In other situations, disposal may be within the scope of this PAS or, in the case of very specialist disposal activities, may not be in scope of either PAS.

**NOTE 3** The organization should consider how the land asset remaining after demolition of an asset is treated in relation to PAS 1192-2 and PAS 1192-3.

**NOTE 4** It will also be for the organization to decide whether the modification, replacement or enhancement of an asset falls within the scope of PAS 1192-2 or PAS 1192-3.

d) Where a suitable business case might exist, this PAS provides a mechanism for existing assets to enter the PAS 1192-3 management process without relying on a project information model (PIM) from a capital/delivery project managed using the PAS 1192-2 process.

There are three different entry points to the information management processes set out in PAS 1192-2 and PAS 1192-3, and these are cross-referenced to the stage numbers shown in green ovals in Figures 1 and 2:

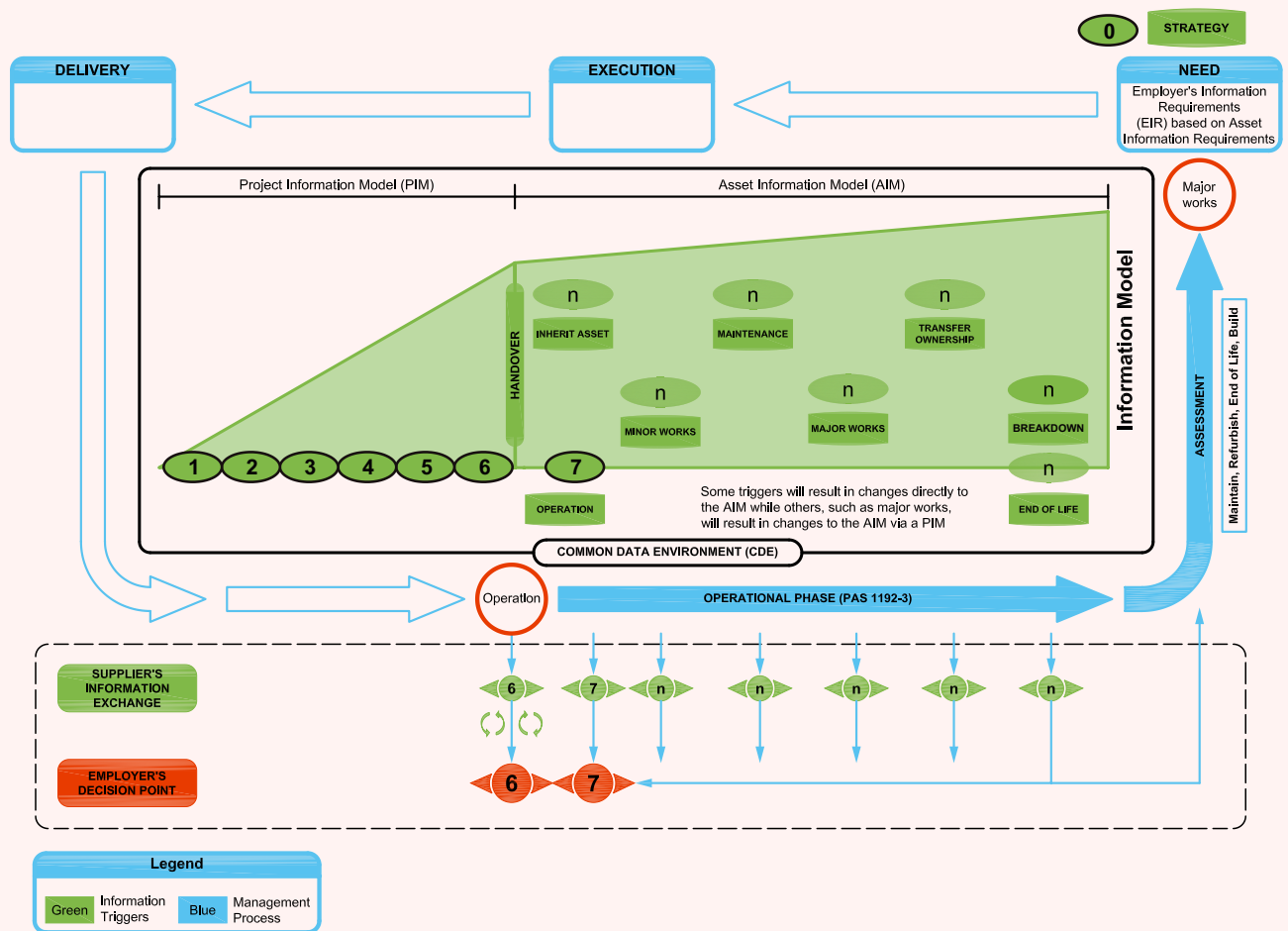
- 1) Stage 7 and n, operation and end of life – PAS 1192-3 information management in response to a trigger-related event (e.g. minor works);
- 2) Stage 6, handover and close-out – PAS 1192-3 information management in response to a capital/delivery project that has followed PAS 1192-2;
- 3) Stage 0, strategy – PAS 1192-2 information management in response to a major works trigger-related event.

**NOTE** Some trigger-related events are listed in A.5.

e) An obvious difference between PAS 1192-2 and this PAS is the more flexible sequence of activities throughout the asset life cycle. Whereas PAS 1192-2 is able to follow a clear and well-understood sequence, commonly defined by project stages, this PAS applies across a mixture of planned and unplanned events in the life of an asset that can happen in any order between the points of asset handover and asset disposal. The information delivery cycle shown in PAS 1192-2:2013, Figure 2, has therefore been adapted to convey these non-sequential triggers, each of which will have their own implications for the information management process, and this is shown in Figure 2.



Figure 2 – PAS 1192-2 information delivery cycle amended for asset management



**NOTE 1** The Execution and Delivery boxes in the outer management process are described in PAS 1192-2.

**NOTE 2** Figure 2 is adapted from the information delivery cycle developed for PAS 1192-2, but operational information may be used to inform the early stages of a project, e.g. plan of work stages 0 to 3.

- f) PAS 1192-2 and PAS 1192-3 both support what has become known as BIM Level 2, in response to the Government's Construction Strategy published in 2011. The wedge diagram in Figure 3 is often used to describe what is meant by the different maturity levels of BIM, from Level 0 to Level 3. The levels were defined in *A report for the Government Construction Client Group – Building Information Modelling (BIM) Working Party Strategy Paper*,<sup>3)</sup> with BIM Level 2 defined as:

*"Managed 3D environment held in separate discipline "BIM" tools with attached data. Commercial data managed by an enterprise resource platform. Integration on the basis of proprietary interfaces or bespoke middleware could be regarded as "pBIM" (proprietary). The approach may utilize 4D programme data and 5D cost elements as well as operational systems."*

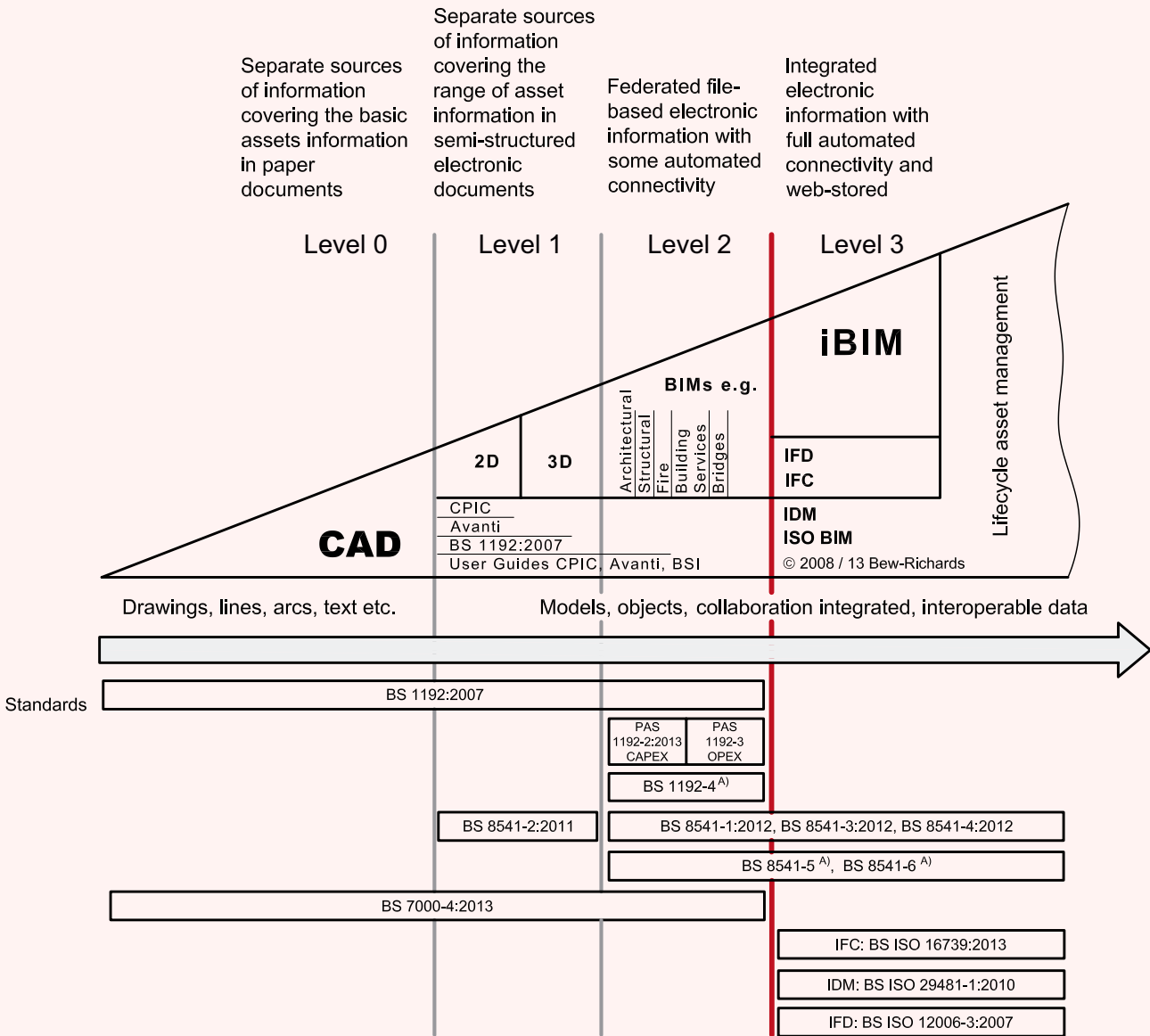
In addition, collaboration at BIM Level 2 is file-based as opposed to paper-based (BIM Level 0) or through integrated web services (envisaged as BIM Level 3 at the time of writing).

**NOTE** Some organizations may not wish to or be able to adopt BIM Level 3 as currently envisaged if the use of a web-based approach conflicts with their own requirements, for example for information security.

However, the wedge diagram in Figure 3 defines the BIM Levels in terms of design and construction terminology, with the acronyms at Level 2 standing for architectural information model, structural information model, building services information model, etc. Figure 3, therefore, shows the original wedge diagram and B/555 BSI technical committee's road-map with additional text appropriate for asset management, to help the user of this PAS understand the definition of BIM Level 2 in terms of asset information management.

<sup>3)</sup> Available from <http://www.bimtaskgroup.org/>

Figure 3 – BIM maturity levels extended to asset information management



**Key**

- <sup>A)</sup> In preparation.
- IDM Information Delivery Manual
- IFC Industry Foundation Classes
- IFD International Framework for Dictionaries

*NOTE 1 Copyright is claimed on the wedge element of Figure 3. Reproduction of this element and making products from it might infringe that copyright. Details of the copyright owners can be found in the Foreword.*

*NOTE 2 More information about BS 1192-4 is given in 7.1.3, Note 2.*

### 0.3 The relationship between project and asset information

PAS 1192-3 extends the information management concepts covered in PAS 1192-2. It sets out the need for information requirements and for an information model that is focused on the operational phase of an asset or portfolio of assets. The relationship between the key requirements of PAS 1192-2 and this PAS is shown in Figure 4.

The purpose of the asset information model (AIM) is to be the single source of approved and validated information related to the asset(s). This includes data and geometry describing the asset(s) and the spaces and items associated with it, data about the performance of the asset(s), supporting information about the asset(s) such as specifications, operation and maintenance manuals, and health and safety information. This PAS is flexible in allowing data and information to be stored within a discrete information model, or to be accessed via links to existing information systems.

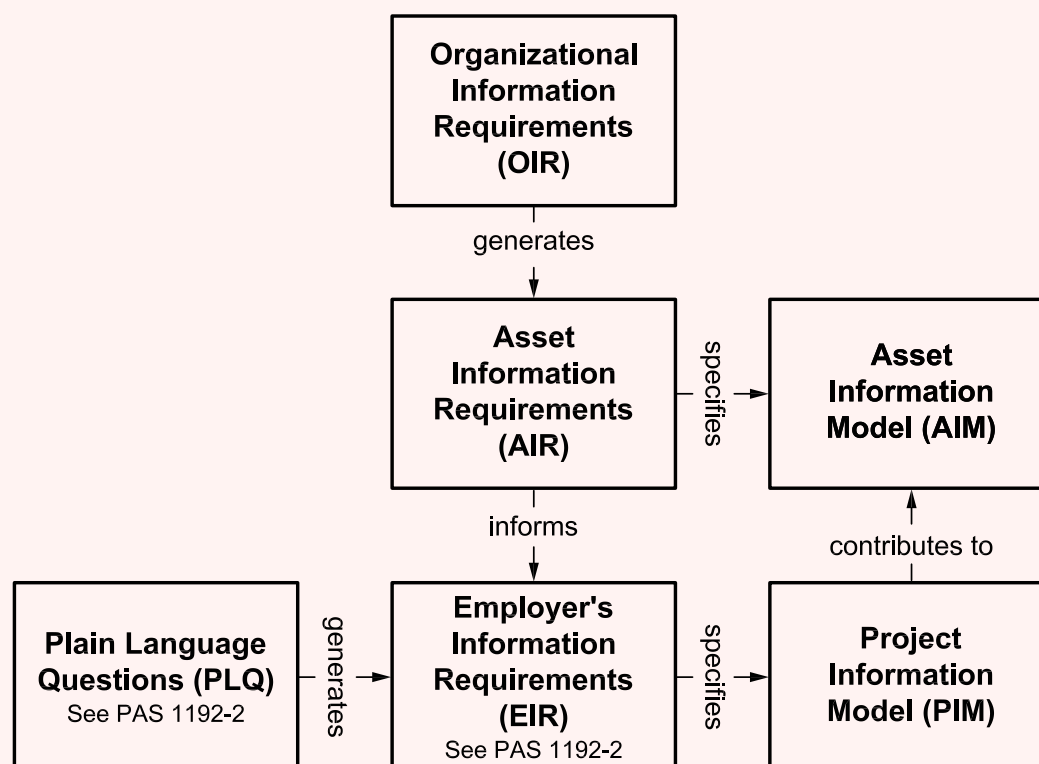
### 0.4 Overarching requirements for BIM Level 2 asset information management

Asset information management should take place within the context of an asset management system, including the preparation of plans, organizational information requirements and plain language questions, see Figure 4.

The following overarching requirements for an asset information management process suitable for Level 2 have been adapted from BS ISO 55001:2014, 7.5:

- The roles and responsibilities for information management have to be considered;
- The processes, procedures and activities for information management have to be considered and specified;
- The risks related to information management have to be considered, including the impact of quality, availability and management of information on organizational decision making;
- The exchange of information with stakeholders has to be considered, including the requirements for information quality, information attributes, method of exchange and the timing of information exchange.

**Figure 4** – Relationship between elements of information management



These principles are reflected in the requirements of this PAS to reinforce the importance of asset information in asset management.

## 0.5 Overview of PAS content

This PAS specifies the information management requirements of the operating phase of assets in four different ways.

- a) It specifies the information management processes by which data and information is specified through organizational and asset information requirements, is put into and retrieved from the AIM, and is passed on to or used with existing enterprise systems, where appropriate, to support the organizational information requirements (OIR). This is described in 4.1 to 4.7.

*NOTE Links and cross-references between the AIM and existing enterprise systems should be used instead of duplicating data or information.*

- b) It specifies a federated model (see 4.6.3) that contains the data and information required by the AIM and explains its relationship to the PIM that is defined in PAS 1192-2. This latter point is described in B.1.
- c) It specifies the nature and types of data and information to be used in information exchange and within the AIM. Wherever possible, this is done through cross-reference to existing standards. Information exchange is described in Clause 7.
- d) It gives two examples of the detailed processes for implementing the BS 1192 common data environment, for different asset-related activities. These are described in Annex B.

In addition, it suggests how high-level responsibilities may be allocated to the various stakeholders participating in the information management processes, while recognizing that these responsibilities will be definitively specified in contracts or works orders.

The way these responsibilities are allocated to individuals or organizations will depend on the complexity of the asset or portfolio and the asset management system of the organization. It is not the intention of this PAS to create new positions in the asset management team. However it may be necessary for organizations to undertake a gap analysis to assess existing skills against the requirements defined within this PAS.

# 1 Scope

This PAS specifies requirements for information management to achieve building information modelling (BIM) Level 2 in relation to the operation and maintenance of assets (buildings and infrastructure).

It covers the data transfer processes to:

- a) create an asset information model (AIM) for an existing asset or portfolio of assets;
- b) exchange asset information with a project information model (PIM);
- c) record information relating to the disposal, decommissioning or demolition of an asset;
- d) use the AIM to support organizational requirements;
- e) revise the AIM as the asset changes; and
- f) hold the AIM as a resource for the organization.

This PAS does not cover data content as this is defined in the organizational information requirements (OIR) and asset information requirements (AIR) but does cross-refer to broad headings and documents which define data content.

This PAS is for use by organizations and individuals responsible for the operation, maintenance and strategic management of assets. It is of use to individuals involved in transferring data from the PIM to an AIM utilized by the organization. In addition, it is of use to individuals involved in exchanging data throughout the life of an asset.

***NOTE** An organization may apply this PAS without necessarily needing to use BIM Level 2. However, an organization required to apply BIM Level 2 to the operational phase of an asset should apply this PAS.*



## 2 Normative references

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

BS ISO 55000, *Asset management – Overview, principles and terminology*

PAS 1192-2:2013, *Specification for information management for the capital/delivery phase of construction projects using building information modelling*

## 3 Terms and definitions

### 3.1 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply in addition to, or in some cases (as stated), replacing the terms and definitions from PAS 1192-2:2013.

#### 3.1.1 alignment

achieving complete agreement between the contents of an information model and the state of a physical asset

#### 3.1.2 asset

item, thing or entity that has potential or actual value to an organization

[BS ISO 55000:2014]

**NOTE 1** *An asset may be fixed, mobile or movable. It may be an individual item of plant, a system of connected equipment, a space within a structure, a piece of land, or an entire piece of infrastructure or an entire building or portfolio of assets.*

**NOTE 2** *Value can be tangible, intangible, financial or non-financial, but in the context of this PAS assets are predominantly physical entities such as systems, equipment, inventory or properties.*

**NOTE 3** *The value of an asset might vary throughout its life and an asset might still have value at the end of its life.*

**NOTE 4** *This definition is different from that used in PAS 55-1:2008.*

#### 3.1.3 asset information management

discipline of managing asset-related organizational data and information to a sufficient quality to support organizational objectives and outcomes

#### 3.1.4 asset information model (AIM)

data and information that relates to assets to a level required to support an organization's asset management system

**NOTE 1** *An AIM can relate to a single asset, a system of assets or the entire asset portfolio of an organization*

**NOTE 2** *This definition is different from that used in PAS 1192-2:2013 to reflect developments since that PAS was drafted.*

**NOTE 3** *The AIM consists of graphical, non-graphical and documentation components as well as metadata.*

**NOTE 4** *The AIM is the product of the common data environment (CDE, see 3.1.10) process and comprises the PUBLISHED part of the CDE.*

#### 3.1.5 asset information requirements (AIR)

data and information requirements of the organization in relation to the asset(s) it is responsible for

**NOTE 1** *The organization should have processes in place to respond to any changes in the AIR while a project using PAS 1192-2 is underway.*

**NOTE 2** *When the asset management process gives rise to a new project that will apply PAS 1192-2, then the appropriate AIR becomes or forms part of the employer's information requirements (EIR) as defined in PAS 1192-2:2013.*

#### 3.1.6 asset management

coordinated activity of an organization to realize value from assets

[BS ISO 55000:2014]

**NOTE 1** *The term "activity" has a broad meaning and can include, for example, the approach, the planning, the plans and their implementation.*

**NOTE 2** *In this PAS this includes realizing value from networks and systems of assets.*

#### 3.1.7 asset management system

management system for asset management whose function is to establish the asset management policy and asset management objective

[BS ISO 55000:2014]

### 3.1.8 capital/delivery phase

major works where information is managed using PAS 1192-2:2013 and an asset is designed, procured and delivered

**NOTE** See also 3.1.21.

### 3.1.9 COBie (Construction Operation Building information exchange)

structured asset information for the commissioning, operation and maintenance of an asset often in a neutral spreadsheet format that will be used to supply data to the organization to populate decision-making tools and asset management systems

[adapted from PAS 1192-2:2013 to refer to an asset rather than a project]

### 3.1.10 common data environment (CDE)

single source of information for any given project or asset, used to collect, manage and disseminate all relevant approved files, documents and data for multi-disciplinary teams in a managed process

[adapted from PAS 1192-2:2013 to refer to an asset rather than a facility]

**NOTE** The explanatory notes to PAS 1192-2, A.30 gives supporting commentary on the CDE.

### 3.1.11 data

observations that in context yield information

[Skyrme and Amidon, *Knowledge management*, 1997 [2]]

**NOTE 1** See also 3.1.17.

**NOTE 2** Data may be quantitative or qualitative.

### 3.1.12 data manager

organizational representative responsible for establishing governance and assuring data and information flow to and from the AIM

**NOTE** See also Clause 6, Note 2.

### 3.1.13 data store

repository for data within the AIM

**NOTE** For BIM Level 2 the data store could be a database. See also 3.1.15.

### 3.1.14 employer

individual or organization named in an appointment or building contract as the employer [PAS 1192-2:2013]

### 3.1.15 file store

repository for information within the asset information model

**NOTE** For BIM Level 2 the file store should be an electronic document management system (EDMS). See also 3.1.13.

### 3.1.16 handover

the stage of a capital/delivery project where the asset is made available for use or occupation

**NOTE** This is one of the starting points of the PAS 1192-3 information management process and is designated "6" in Figures 1 and 2.

### 3.1.17 information

data arranged and processed into meaningful patterns, put into context

[Skyrme and Amidon, *Knowledge management*, 1997 [2]]

**NOTE** See also 3.1.11.

### 3.1.18 information management process (IMP)

process to manage information related to the operational phase of an asset

### 3.1.19 maintainer

individual, department or organization engaged by either the owner or operator of an asset to carry out maintenance on or in connection with that asset

**NOTE** Where the maintainer is a department within the owner's organization, there may not be a formal contract between maintainer and organization.

### 3.1.20 maintenance

combination of all technical and associated administrative actions to retain or restore an asset to a state in which it can perform its required function

[adapted from BS ISO 15686-1:2011, BS ISO 6707-1:2004]

**NOTE 1** Maintenance includes, but is not limited to, cleaning, servicing, repairing and replacing parts of the asset.

**NOTE 2** This is one of the starting points of the PAS 1192-3 information management process and is designated "n" in Figures 1 and 2.

**3.1.21 major works**

works where information is managed using PAS 1192-2:2013

**NOTE 1** See also 3.1.23.

**NOTE 2** Major works may include large-scale or complex demolition, refurbishment or repair, new construction. A possible division between major and minor works is whether or not they need to be notified to the HSE or equivalent regulator, but the organization should define its own differentiation between major and minor works.

**NOTE 3** This is one of the starting points of the PAS 1192-2 information management process and is designated "0" in Figures 1 and 2.

**3.1.22 management of assets**

operational activities carried out on assets in support of those assets meeting their requirements

**3.1.23 minor works**

works carried out on an asset where information is managed using this PAS

**NOTE 1** See also 3.1.21.

**NOTE 2** Minor works include maintenance. A possible division between major and minor works is whether or not they need to be notified to the Health and Safety Executive or equivalent regulator but the organization should define its own differentiation between major and minor works.

**NOTE 3** This is one of the starting points of the PAS 1192-2 information management process and is designated "n" in Figures 1 and 2.

**3.1.24 operator**

organization that uses an asset to create value but does not own the asset

**3.1.25 organization**

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

[BS ISO 55000:2014]

**NOTE** In the context of this PAS, the organization may also be known as the owner (such as the government department, agency, private firm or individual owning a piece of infrastructure or the freeholder of a building), the operator (such as the leaseholder of a building or the concession-holder of a piece of infrastructure), or maintainer (such as a contracted provider of maintenance services, or an in-house maintenance department or team). See 3.1.27, 3.1.24 and 3.1.19 respectively.

**3.1.26 organizational information requirements (OIR)**

data and information required to achieve the organization's objectives

**NOTE** The management activities leading to OIR are the equivalent of the employer key decision points in PAS 1192-2.

**3.1.27 owner**

organization that owns an asset and uses the asset either directly or indirectly to create value

**3.1.28 plain language questions**

questions asked of the supply chain by the employer to inform decision-making at key stages of an asset life cycle or project

**NOTE** Plain language questions are referred to in PAS 1192-2:2013. The equivalent term in asset management is organizational information requirements.

**3.1.29 project information model (PIM)**

information model (see PAS 1192-2:2013, 3.27) developed during the design and construction phase of a project

[PAS 1192-2:2013]

**3.1.30 RAG report**

performance report summarizing a series of assessments as red (does not meet requirement), amber (does not meet requirement but plan in place to bring up to standard), or green (meets requirement)

**NOTE** A RAG report may be generated in relation to any information or process, for example data quality, data completeness, performance indicators, timeliness of deliverables, etc.

**3.1.31 supervisory control and data acquisition (SCADA)**

systems that collect operational data from assets to support supervisory and other managerial activities

**NOTE** Examples of SCADA systems include building management systems, pipeline flow management systems, traffic flow measurement systems.

**3.1.32 trigger**

planned or unplanned event that changes an asset or its status

**NOTE** The realignment between the asset information and a series of unrecorded changes may constitute a trigger. This may be termed an update trigger.

### 3.1.33 trigger-related event

response to a trigger and the reflection of the altered state of the asset in the AIM

## 3.2 Acronyms

AIM – asset information model

AIR – asset information requirements

BIM – building information modelling

BMS – building management system

BS – British Standard

CAFM – computer-aided facility management

CDE – common data environment

CMMS – computerized maintenance management system

COBie – construction operation building information exchange

EAM – enterprise asset management

EDMS – electronic document management system

EIR – employer's information requirements

FM – facilities management

GIS – geographic information systems

(G)SL – (government) soft landings

IFC – industry foundation classes

IMP – information management process

ISO – International Standards Organization

O&M – operation and maintenance

OIR – organizational information requirements

PAS – publicly available specification

PIM – project information model

POE – post occupancy evaluation

RACI – responsible, authorizing, contributing, informed

RAG – red amber green

SCADA – supervisory control and data acquisition

XML – extensible mark-up language



## 4 Asset information management process

### 4.1 General

The requirements of this PAS shall apply to the organization responsible for managing an asset.

The requirements of this PAS shall be achieved through the organization's direct actions or through delegated or sub-contracted authority. However, ultimate responsibility shall remain with the organization unless provided for differently by a legal or regulatory requirement.

The organization shall establish, document, implement and maintain an information management process (IMP) in accordance with the requirements of this PAS.

**NOTE 1** *Asset information should be controlled by a management system incorporating the requirements, processes and governance, suitable for the organization's needs and/or for the needs of its stakeholders.*

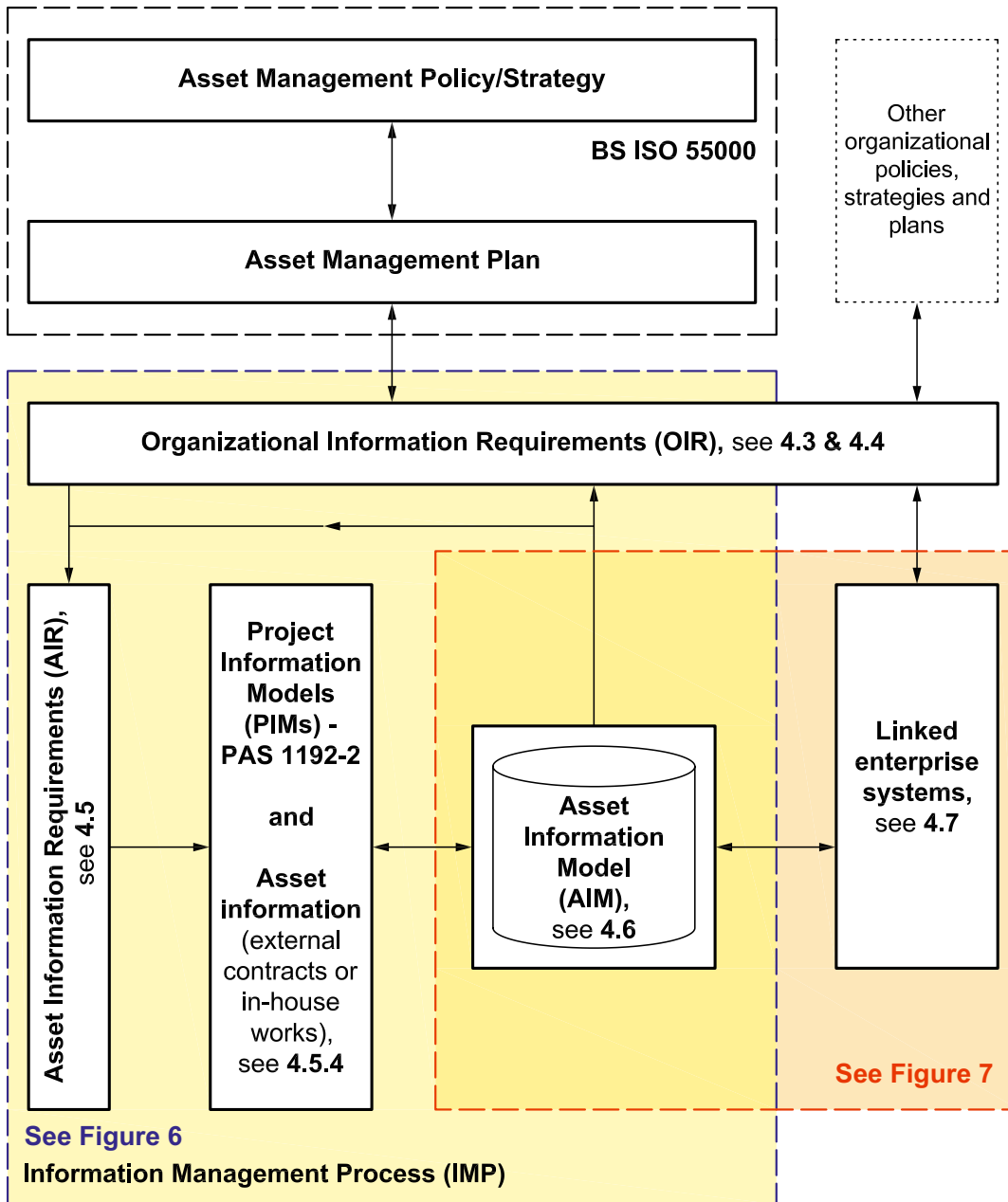
The IMP shall cover the operational lifecycle of the asset including, but not limited to, handover from design and construction, day-to-day operation of the asset, planned and reactive maintenance, minor works, major works, decommissioning, and dismantling or demolition.

The IMP shall operate within or link with such enterprise systems or organizational functions as necessary to optimize the capture, processing, storage and analysis of the data and information specified in the asset information requirements (AIR) for the purposes of satisfying the organizational information requirements (OIR).

**NOTE 2** *The boundary between asset information and other organizational information is not necessarily rigid. Effective organizational management may mean that asset management requires sources of information beyond the IMP or that other organizational management activities require asset information.*

**NOTE 3** *A high-level asset information process-map is shown in Figure 5. More detailed representations of parts of the process map are shown in subsequent Figures, and a detailed process map is shown in Figure 10.*

Figure 5 – High-level asset information process map



**NOTE 1** The asset management policy, strategy and plan should comply with the requirements of BS ISO 55000.

**NOTE 2** Asset information might be generated by a wide range of systems, including CAFM, CMMS, EAM, IT systems and helpdesk systems.

**NOTE 3** Activities such as governance, data quality, monitoring of provision and usage of asset information are implied in Figure 5 but not shown in detail.

**NOTE 4** Where the asset management plan results in a new project within the scope of PAS 1192-2 then the relevant AIR shown here inform the employer's information requirements (EIR) for that project.

## 4.2 Purpose of the information management process

The information management process shall maintain the integrity of asset information to support the following activities related to asset management:

- a) defining asset management strategies and plans;
- b) implementing asset management plans;
- c) managing the asset lifecycle;
- d) acquiring and managing asset knowledge;
- e) managing the organization and its human resources;
- f) managing and reviewing risk.

*NOTE Limited guidance on the nature of these activities is given in Annex A.*

## 4.3 Steps in the asset information management process

The asset information management process shall comprise the following steps.

- a) Establish information governance processes to direct, control and assure that asset information is managed effectively as an organizational resource, with reference to any asset management strategies and plans.
- b) Establish the OIR based on the asset management activities identified in the policy, strategy and plan, which may be developed through BS ISO 55000 – see 4.4.
- c) Define the AIR that shall be met, in order that the OIR can be satisfied, and the information exchanges by which data and information is transferred to and from the asset information model (AIM), see 4.5.

*NOTE The AIR may start as descriptive text, but should then be developed into a digital plan of deliverables. The effort to complete this should not be underestimated.*

- d) Define the mechanisms for the creation, receiving, validating/verifying, storing, sharing, archiving, analyzing and reporting on the information and data to be held in the AIM.

*NOTE 1 See 4.6 and Annex B for example sets of procedures for asset-related events.*

*NOTE 2 The CDE examples in Annex B show validation through the use of RAG reports, although other validation methods may be suitable.*

- e) Define the interfaces for exchange of data and information between the AIM and other information systems used by the organization, see 4.7.

- f) Define the mechanisms for maintaining the AIM and for monitoring the quality, including referential integrity, of data and information within the AIM through use of the CDE.

*NOTE Where appropriate, ISO/TS 8000-150 should be used to establish data quality.*

The steps in the information management process shall be triggered by each asset-related event or the planning for such an event.

*NOTE A set of envisaged asset-related events are given in A.5. Other events not explicitly covered in A.5 can occur and the information management process (IMP) should also be applied in these cases.*

## 4.4 Organizational information requirements (OIR)

The organization shall determine, catalogue and maintain its requirements for information to meet the needs of its asset management system and other organizational functions.

*NOTE 1 Limited guidance on the nature of the activities to support this requirement is given in A.2.*

*NOTE 2 Where the asset management plan results in a new project within the scope of PAS 1192-2 then the relevant OIR will inform the plain language questions referenced in PAS 1192-2.*

## 4.5 Asset information requirements (AIR)

### 4.5.1 General

Based on the OIR, specific AIR shall be specified as part of a contract or as an instruction to in-house teams and may use data and information from the AIM relating to the asset management activities being carried out. The AIR shall also specify data and information to be captured and fed into the AIM. Where the activities relate to major works covered by PAS 1192-2, then the AIR will inform the EIR.

*NOTE See A.3 for a list of data and information types related to assets and asset management.*

### 4.5.2 Classification

The AIR shall require the organization to classify the data and information being put into the AIM according to an agreed classification system or through the structures of the data store and/or file store.

*NOTE 1 Classification is necessary to enable stored data and information to be searched and retrieved.*

*NOTE 2 A number of classification systems are available. The choice of classification system should follow industry standards where possible, but should take account of the organization's specific needs.*

#### 4.5.3 Linkages between OIR, AIR and AIM

The information requirements at an organizational level, the OIR, shall be conveyed to external contractors or in-house works teams through task- or project-specific AIR. These AIR shall form part of the specification for each asset-related contract or works. Where these contracts are managed in accordance with PAS 1192-2 then the AIR shall inform the development of the PAS 1192-2 EIR.

The information required by the organization at each decision point shall be drawn from the AIM.

If the information held within the AIM is not sufficient or suitable to satisfy the OIR then the organization shall amend the relevant AIR to acquire the necessary data and information.

#### 4.5.4 Exchange of data and information with the AIM

The exchange of data and information with the AIM shall be file-based and implemented through information exchanges between the information provider and the organization responsible for maintaining the AIM, as indicated by the green circles in Figure 6.

**NOTE 1** *The content of the information exchanges should be sufficient to satisfy the requirements of 4.6.3, allowing for data and information that is already contained in the linked enterprise systems.*

The requirement for the process for data and information exchange to comply with ISO/IEC 27001 shall be considered by the organization defining the OIR and the AIR.

The frequency and scope of each information exchange shall be defined in relation to each asset management event.

The format of each information exchange shall be defined by the organization that has defined the OIR and the AIR.

**NOTE 2** *Where COBie is used for information exchange then the content of the COBie files should be determined by the AIR.*

**NOTE 3** *Where appropriate, information received by a contractor or works team from the AIM may originate from the external enterprise systems to which the AIM is linked.*

**NOTE 4** *See also Clause 7.*

## 4.6 Asset information model (AIM)

### 4.6.1 Creation of the AIM

The AIM shall be created in accordance with the organization's requirements. This shall be achieved through a variety of management activities, including some or all of the following:

- a) transfer of information and data from existing organizational systems into the AIM;
- b) recognizing or relabeling an existing data and information store as part of the AIM;
- c) collection of new or updated information and data from surveys of the physical asset;
- d) exchange of information and data with project information model(s) generated as a result of BIM Level 2 capital/delivery projects as specified by PAS 1192-2.

Asset information shall not be considered as the AIM under this PAS until it has been authorized and accepted according to the information management process and flagged or transferred to the Published part of the common data environment (CDE) process.

**NOTE** *It might not be appropriate, cost-effective or possible to create the AIM through a single activity or programme of activities. The AIM may be progressively developed and enhanced as a phased and prioritized programme of activities in line with the OIR.*

### 4.6.2 Data and information definitions

The data and information definitions within the AIM shall enable the organization to meet its OIR.

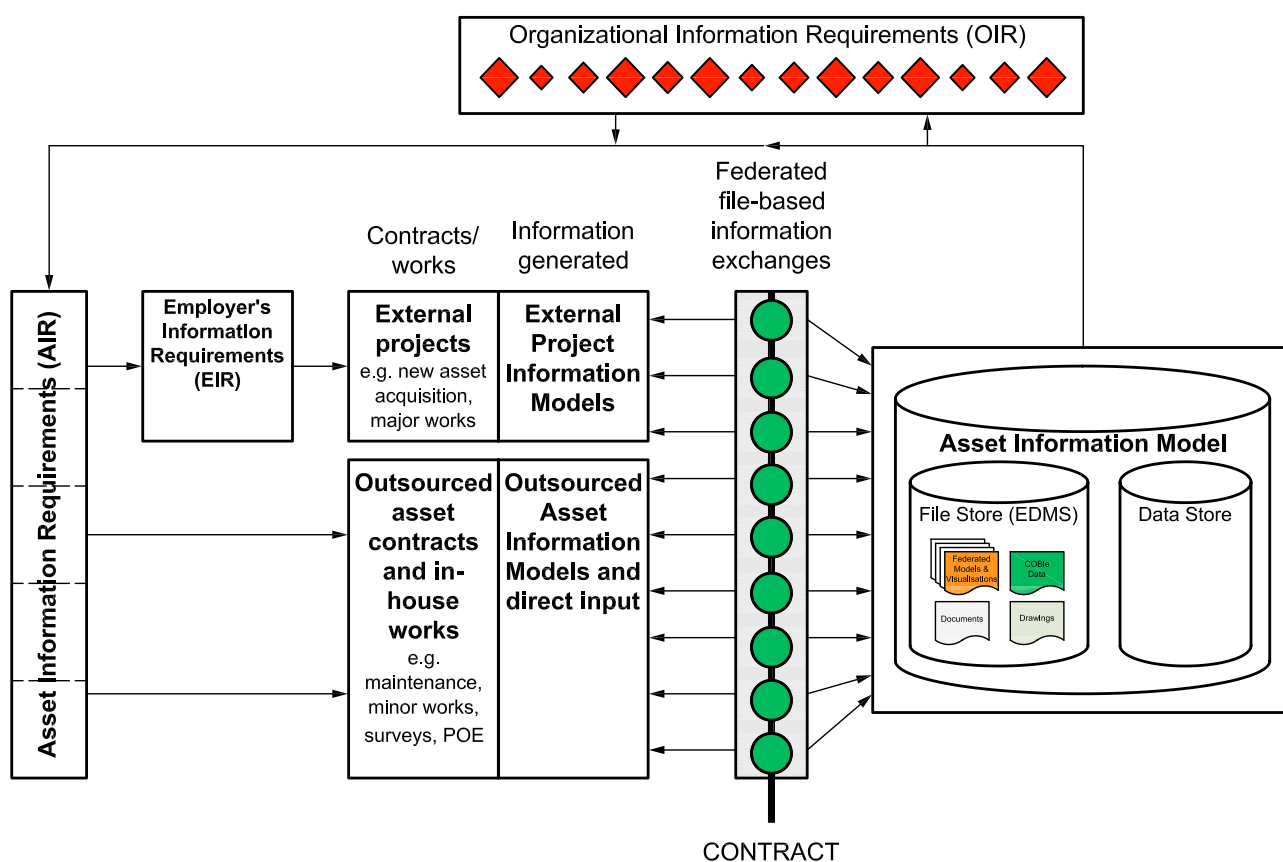
**NOTE 1** *The data and information definitions should also be consistent with those identified in BS 8210:2012 Clause 9, BS 8587:2012, Clause 5 and PAS 55-2:2008, 4.3.3.*

The AIM shall also contain such data and information as shall be specified by the organization such as those headings listed in Annex A.

The data and information definitions shall enable assets with multiple occupants and/or multiple uses to be recorded and analyzed. They shall also enable users of the AIM to understand the engineering, commercial or other reasons for the specification or installation of each significant asset.

**NOTE 2** *Example processes to accept, verify, validate and authorize data and information are described in detail in Annex B.*

Figure 6 – Exchange of data and information with the AIM



#### 4.6.3 Data and information content

All data and information related to or required for the operational phase of an asset shall be contained in or linked to the AIM. At BIM Level 2, the AIM shall be a federated model consisting of a number of discrete parts. The extent and nature of these parts shall be related to the complexity, purpose and scale of the asset.

**NOTE 1** The AIM should contain the following parts:

- information concerning the original brief, specification, design intent and analysis relating to the original installation of the asset and any subsequent changes;
- 3d object-based model(s) of the environment and location of the asset;
- information, or links to information, concerning the ownership of the asset and any rights or covenants associated with the asset;
- information, or links to information, concerning and data obtained from the maintenance, survey or other work carried out on the asset during its lifetime;

- information, or links to information, concerning and data obtained from monitoring the operation and condition of the asset, for example through a SCADA.

**NOTE 2** Information about an asset might not be available depending on its age, ownership history or other factors. Unavailable or incomplete information might concern the original installation or all the maintenance or other work carried out on an asset.

**NOTE 3** The organization should define the extent of the AIM, for example whether each asset has its own AIM or whether multiple assets are grouped into a single AIM.

Within the AIM, data and information shall be stored in a data store and a file store respectively.

The asset-related AIR shall be stored within the CDE.



#### 4.6.4 Processes for maintaining the AIM

The organization shall establish processes and procedures to cover the following aspects of maintaining the AIM:

- a) allocation of roles, responsibilities and authorities for the origination, generation, capture, maintenance, retention, transmission, access to, assurance and archiving of information and data;
- b) definition of the content, meaning, formats and medium for the representation, retention, transmission and retrieval for all information and data;
- c) requirements for information and data maintenance, including version control, integrity checks, validation against the AIR and other assurance activities;
- d) measuring, monitoring, reporting and continually improving the quality of information and data to support organizational needs;
- e) requirements for the generation, capture or importing of the identified items of information and data;
- f) requirements for the storage of information and data according to integrity, security and confidentiality requirements;
- g) requirements for disaster recovery, including the recovery point and the recovery time;
- h) retrieval, distribution and availability of information and data to designated parties as required by agreed schedules or defined circumstances;
- i) requirements for the archival of designated information and data, for example for the purpose of retaining audit records and knowledge preservation;
- j) requirements for the disposal of obsolete, unreliable or unwanted information and data in accordance with the organization's requirements and security and privacy requirements.

**NOTE 1** *The detailed process for maintaining the AIM is illustrated through the CDE examples in Annex B.*

**NOTE 2** *The processes to accept, authorize and verify information within the CDE should occur every time information and data is received through an information exchange.*

**NOTE 3** *When information and data has passed the verification and validation process and has been accepted to be stored in the AIM, then the file store and data store should be updated accordingly. However, if verification and validation is not achieved then the information and data should be rejected, passed to the Archive area of the CDE for record purposes, and returned to the originator for resubmission.*

**NOTE 4** *The decision to dispose of data or information should be exercised with great care so that all foreseeable uses of the data or information have been considered, including by stakeholders outside the organization.*

Data and information shall be stored in a safe place, readily retrievable and protected from deterioration. Critical asset management records shall be protected from possible fire and other damage or loss as appropriate. The organization shall consider issues surrounding the holding and use of electronic records, e.g. legal constraints, storage media obsolescence, access controls.

**NOTE 5** *Responsibility for managing and maintaining the AIM should be in accordance with ISO/TS 8000-150 Annex B, which describes the roles of data manager, data administrator and data technician.*

The information management process shall either:

- a) ensure that between the completion of a trigger-related event and the next trigger the information held in the AIM gives a true picture of the state of the asset. A trigger-related event shall not be completed until the AIM has been updated to bring the relevant asset data and information back into alignment with the, now altered, state of the asset; or
- b) define the extent to which the asset information may be out of alignment with the state of the asset, particularly with reference to available resources for updating the AIM.

While a trigger-related event is underway, the information management process shall ensure that asset information unrelated to the event remains in alignment with the state of the asset.

## 4.7 Links to existing enterprise systems

### 4.7.1 General

The information management process shall enable the AIM to link to existing enterprise systems.

**NOTE 1** See A.4 for a list of example enterprise systems. Some organizations may consider these or other existing enterprise systems to be part of the AIM, depending on the context and the requirements of their organization.

**NOTE 2** The purpose of links between the AIM and existing enterprise systems is to enable the organization to meet the OIR.

### 4.7.2 Interface between AIM and existing enterprise systems

The interface between the AIM and the existing enterprise systems shall be implemented through two-way connectivity, see Figure 7.

The interface shall push authorized data and information from the AIM to the appropriate enterprise systems as determined by the organizational requirements.

The interface shall pull data and information from the appropriate enterprise systems into the AIM, whence it shall be available to external contractors or in-house works teams in support of the AIR for their contracts or works.

**NOTE 1** The IMP may allow external contractors or in-house works teams to use a combination of data and information from the AIM and the enterprise systems.

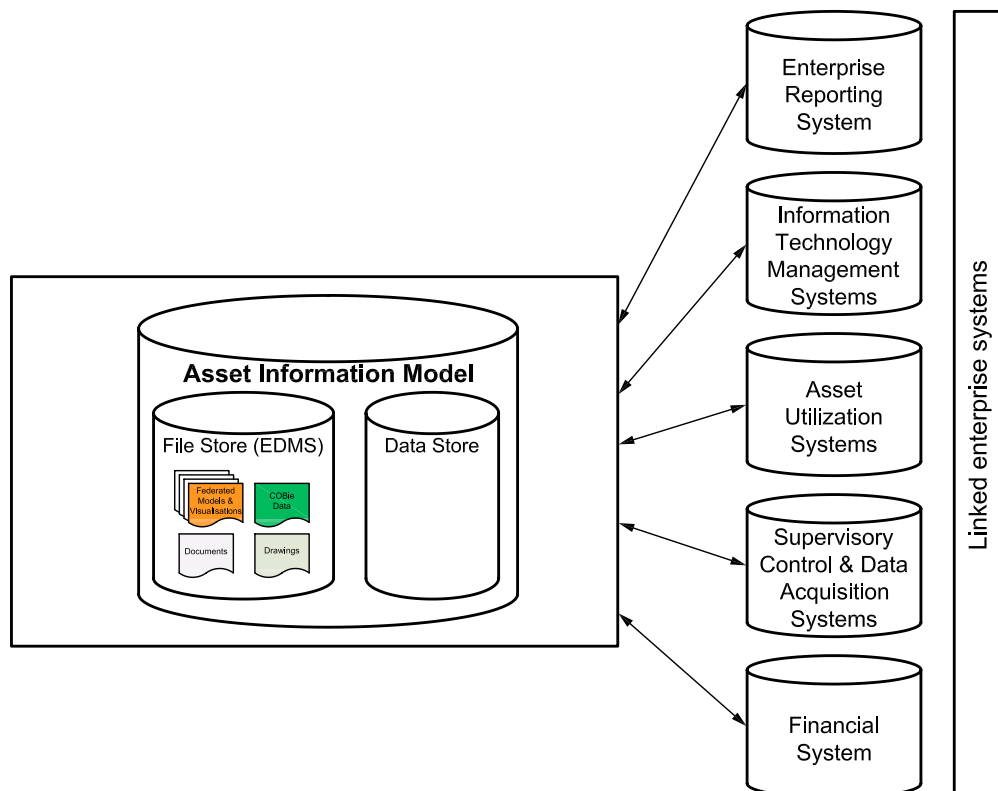
**NOTE 2** The organization may implement the interface as remote calls to either the AIM or the enterprise systems. However, it is essential that data and information ownership and validation are assured. The organization should consider whether replication or transaction-based strategies are needed and implement appropriate validation and roll-back procedures as necessary. See also Figure 8, NOTE 4.

## 4.8 Asset management triggers

The IMP shall be implemented in response to a set of triggers, which may occur at any time throughout the life of the asset, defined by the organization.

**NOTE** See A.5 for a list of example triggers.

**Figure 7** – Interface between the AIM and the existing enterprise systems



## 5 CDE and AIM

### 5.1 Processes to implement the CDE

The organization shall implement processes to provide the CDE as shown in Figure 8 (which has been developed from Figure 9) in order to maintain integrity and control of the data and information throughout the supply chain.

**NOTE 1** The CDE provides a collaborative environment where the whole team can share work and forms the basis here for the information management process. The CDE could consist of more than one system configured to meet the requirements as defined in BS 1192:2007. BS 1192:2007 introduces the managed process within the CDE necessary for enabling the delivery of defined data sets for major works. This general process is reproduced here as Figure 9 for information. **B.1** develops the CDE principles to show an example of the process of incorporating data and information in an AIM – in this case as a result of a new major works project that concludes with a PIM. **B.2** shows an example of transferring an external contract from one provider to another.

**NOTE 2** For the purposes of this PAS, the information management process deals with information as well as data. During the operational phase of an asset, the information management process can start at two points – from a new asset via capital expenditure, or from an asset forming part of an existing portfolio or estate.

**NOTE 3** Annex B contains examples of the process for two specific triggers.

**NOTE 4** In the operational phase of the asset, the process within the CDE will vary depending on which trigger has occurred.

### 5.2 Use of the AIM

An existing AIM shall be identified, or a new AIM shall be created, at the inception of a trigger-related event and shall be used:

- a) as a repository for all information about the event works;
- b) as a means to access links to the information about the event works, e.g. to/from linked enterprise systems;
- c) as the means to receive information from other parties throughout the project stages, up to acceptance of the “as-built” PIM (as specified in PAS 1192-2).

**NOTE 1** A detailed information management process map is shown in Figure 10. This brings together the elements illustrated in Figures 5, 6, 7 and 8.

**NOTE 2** From the earliest stage of a project or event works, information relevant to it should be sourced from existing assets in the case of a current portfolio or asset base, or created afresh in the case of a completely new project. This should start before a PIM has been created and so a repository is required to capture this early input. Typical examples may be business case reports carried out during the digital plan of work stage 0 in order to understand the need for the new asset and then to inform the project brief.

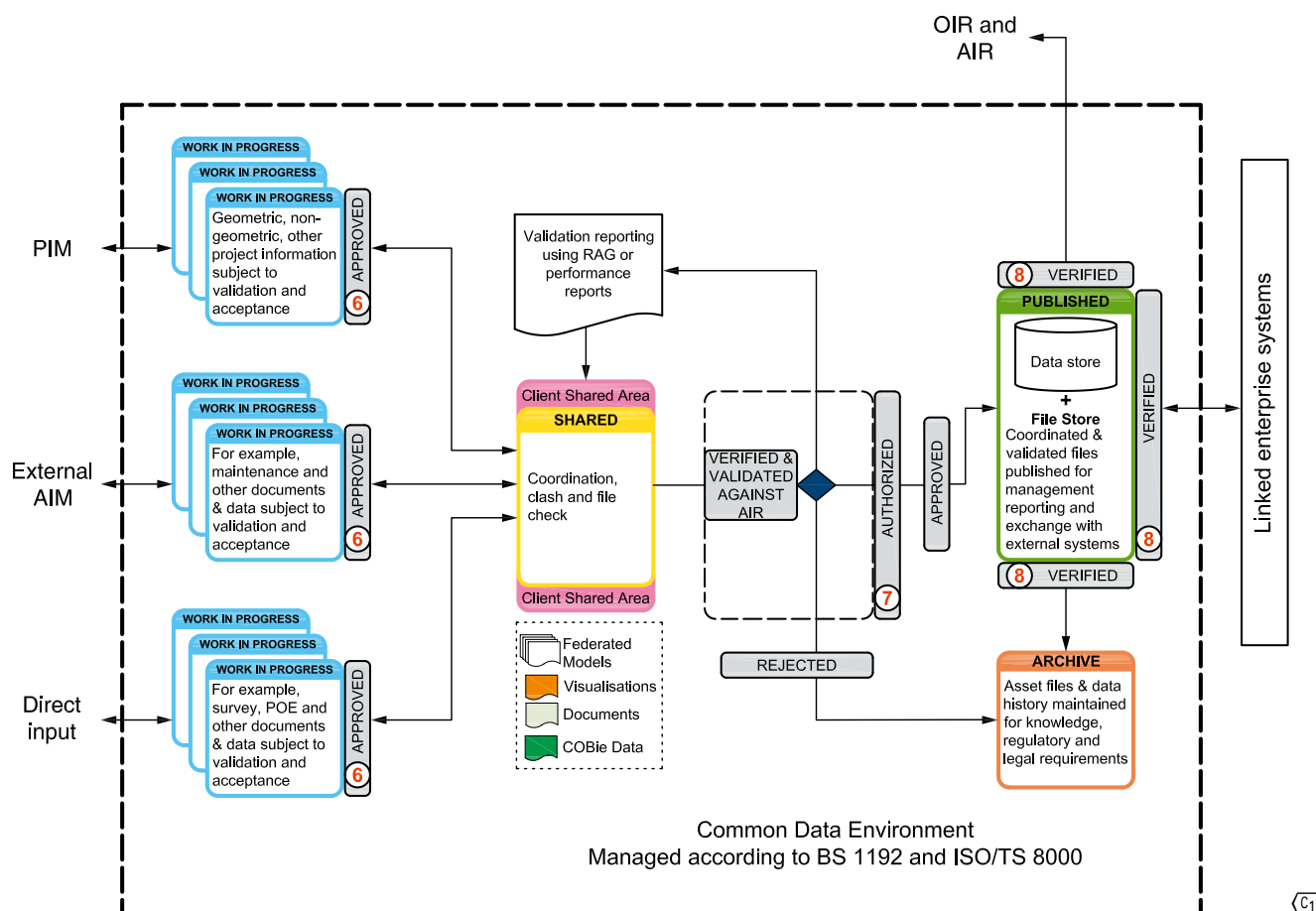
Similarly, information can be captured from the operational side in order to help inform this process – information such as previous history of the asset, site surveys and studies, utilities and services infrastructure, etc. In many cases the project might relate to existing assets and so a subset of the existing AIM should initially populate the project PIM. The project work might therefore require the existing AIM to be updated to reflect the status of the new project, clearly indicating the status of each asset, i.e. those to be constructed and those existing assets which will be modified/enhanced/replaced. However, it is important that the current status of the asset is clear at all times.

**NOTE 3** Once a project has commenced, there are points at which the delivery team are required to exchange information with the employer (or owner), and a method should be in place for the employer/owner to be able to receive this information, and to check and validate that information as described in 5.1. This situation would occur at PAS 1192-2 at the Decision Points 1, 2, 3, 6 and 7 in the case of the UK Government Client.

**NOTE 4** To provide a repository for project information, the AIM should be created at the inception of the project, before any other parties are involved. This can then be operated alongside the PIM and used by the client/owner to process information received throughout the project. This could be the area represented in Figure 10 by the client shared area. Using the AIM in this way provides the benefits of ensuring a “single truth”, where all information is in one place.

**NOTE 5** The AIM can act as an information source for purposes other than construction works.

**Figure 8** – Process map within the CDE



**NOTE 1** In some cases the shared and client shared areas may be the same, depending on the practices of the organisation.

**NOTE 2** Gates are numbered to follow on from those described in PAS 1192-2.

**NOTE 3** The external AIM shown on the left of Figure 8 is any AIM acting as a source or a recipient of data or information which is being managed within the CDE.

**NOTE 4** The two-way connection between external enterprise systems and the CDE verified gate (gate 8) assumes that the external systems have equivalent approval, authorization and verification processes to that shown in the CDE. If this is not the case then information received from external enterprise systems should be routed to the client shared area, from where it can be verified and validated against the AIR and authorized through gate 7.

**NOTE 5** The shared area is a sub-set of the client shared area. The shared area is accessible to the information providers. The client shared area is also accessible to the owner or operator.

**NOTE 6** The published area in Figure 8 represents the AIM.

Figure 9 – The common data environment extracted from PAS 1192-2

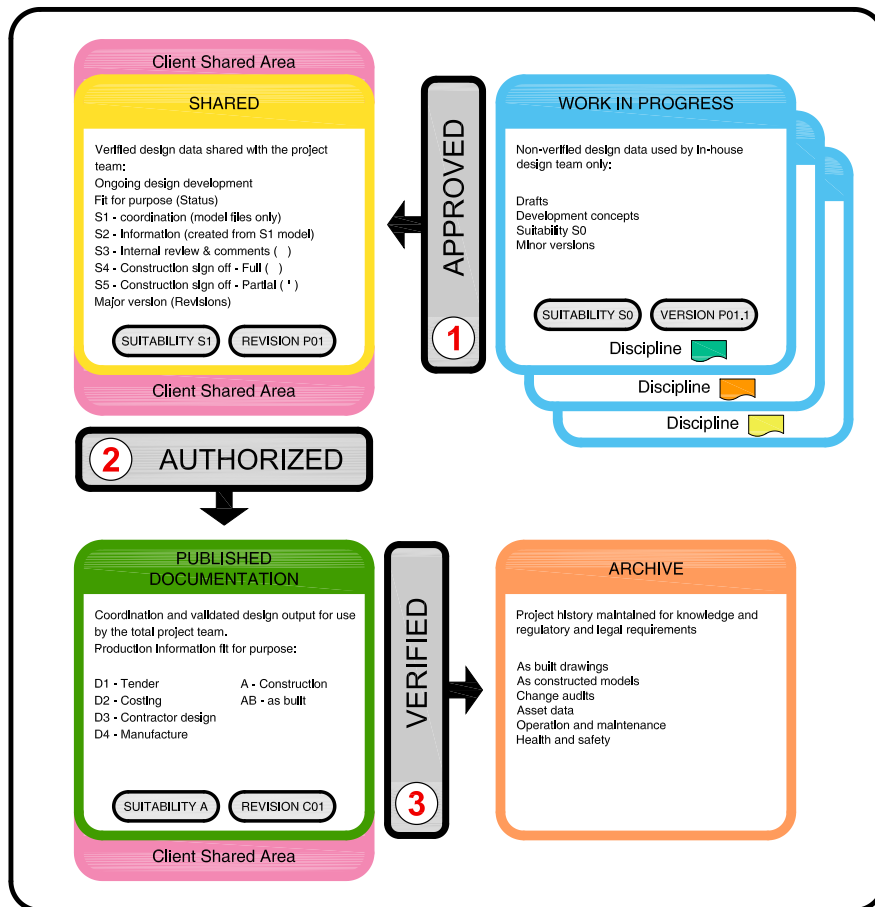
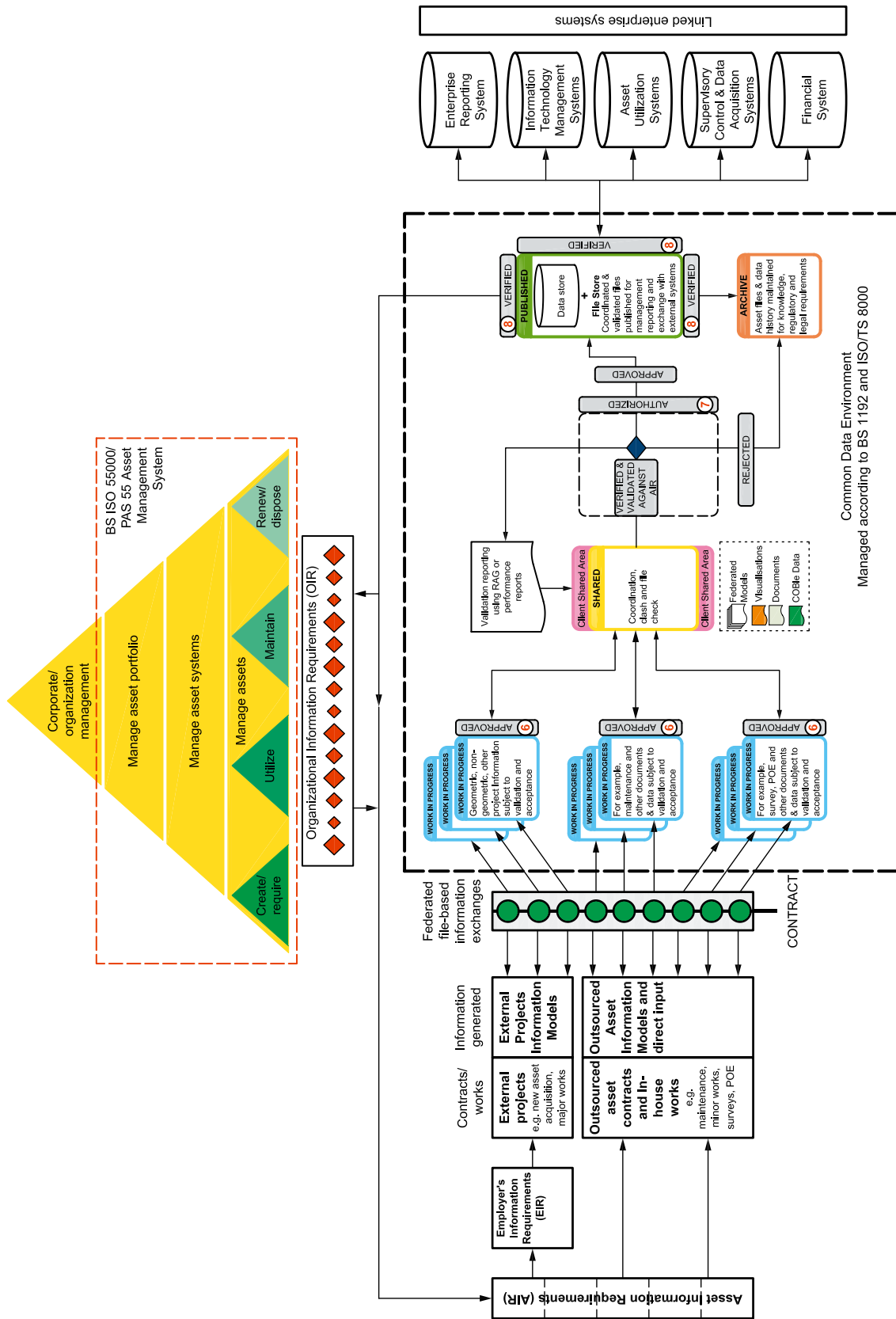


Figure 10 – Ensuring data and information governance and assurance



NOTE The PUBLISHED area in Figure 10 represents the AIM.

## 6 Roles and responsibilities

Roles and responsibilities for information management as defined in this PAS shall be set out in the contract(s) between the owner or operator and the maintainer(s).

**NOTE 1** *Examples of different contractual arrangements are shown in Annex C and examples of roles for different organizations in response to different triggers or trigger-related events are shown in Annex D.*

**NOTE 2** *In accordance with ISO/TS 8000-150, a data manager should have the responsibility for accepting information into the shared area of the CDE and for authorizing it for the published area. The role of the data manager shall be filled at all times by one person, or more than one person in succession, from either the owner or from the operator. For large or complex assets there is likely to be more than one data manager due to the volume or nature of data tasks. However, there will ultimately need to be one point of responsibility for this role for the whole of the IMP. An equivalent role in managing asset information may be the asset information manager.*

**NOTE 3** *In many organizations the roles of data manager and asset information manager may be executed by the same individual and may include information management as defined in PAS 1192-2.*

**NOTE 4** *One method for clarifying roles and responsibilities is to use the RACI indicators ("R" to identify the responsible party, "A" the authorizing party, "C" the contributing parties and "I" the parties to be kept informed).*



## 7 Information exchange

### 7.1 Information exchange processes and content

**7.1.1** Information exchanges shall be carried out in accordance with the requirements of the AIR. The AIR shall define the structure, process and content of information to be exchanged.

***NOTE 1** The preparation of the AIR needs to consider the operations of the organization, including the activities it carries out and the tools and systems used to manage those activities, and the organization as a whole. Information exchanges should be arranged to provide information for key decision making points.*

***NOTE 2** See also 4.5.4.*

**7.1.2** The information identified by the organization shall be of a quality appropriate to the asset management decisions and activities it supports, and appropriate to the operation, maintenance and management of the asset.

***NOTE 1** The type of information required at each information exchange will be different depending on the nature and practices of the organization. These should be clearly understood, and should be defined at the strategy stage of any new works. A key part of this will be appreciating which information the operational team need to carry out their activities, and also the format it needs to be in.*

***NOTE 2** Each information exchange will be specified by the outsourced contract/in-house works which will be set up to satisfy the particular AIRs. All AIRs taken together will express the whole requirement at any one time.*

**7.1.3** The method of information exchange shall be compatible with the systems and processes operated by the organization in order to ensure that the material can be checked, validated and then be made use of in the day to day operations.

***NOTE 1** COBie is the method of information exchange to be used on UK Government mandated projects. However, for other applications any procedure may be adopted which allows for the effective capture and transfer of the information required at each exchange point, as well as facilitating its checking and validation.*

***NOTE 2** A definition of the information requirements leading up to handover and post-occupancy evaluation of a capital/delivery project is in preparation as BS 1192-4, Collaborative production of architectural, engineering and construction information – Client information requirements. This should be published in summer 2014. This standard will specify mandatory requirements and recommend best practice for BIM Levels 1, 2 and 3. BS 1192-4 will support the implementation of COBie and will also reference to IFC and IFC XML.*

## Annex A (informative) Guidance related to the information management process

### A.1 General

This Annex contains guidance to amplify the requirements contained in Clause 4, to give those implementing this PAS some idea of what those requirements are intended to cover. Much of the detail is adapted from PAS 55-2.

*NOTE Although PAS 55 has been superseded by the BS ISO 55000 series, PAS 55 had not been withdrawn at the time of writing and much of the content remains valid.*

### A.2 Specific asset management activities

The following activities support the high-level activities contained in 4.4:

- asset accounting, activity costing, forecasting;
- planning and budgeting;
- demand management and customer expectation policy;
- capital investment and life cycle costing;
- innovation and change management;
- interfacing with regulatory bodies;
- asset operation or utilization;
- asset modifications, refurbishment, replacement, re-use/redeployment, disposal, recycling;
- spares, materials and purchasing;
- data, information and knowledge management;
- contractor and supplier management;
- human resources, skills development and competencies;
- maintenance, inspection, condition and performance monitoring;
- contingency planning and emergencies;
- energy efficiency and environmental aspects, e.g. renewable resources, recycling, waste management, air purity, hygiene;
- risk assessment and management;
- safety, health and environmental management.

*NOTE 1 The asset management activities above are adapted from PAS 55-2:2008 4.4.5j).*

The following activities may assist in the definition of the OIR from 4.4:

- optimizing the asset management strategy and optimizing/prioritizing its asset management plan(s);
- assessing the financial benefits of planned improvement activities;
- modelling the asset to support operational decision making;
- determining the operational and financial impact of asset unavailability or failure;
- making life cycle cost comparisons of alternative capital investments;
- identifying expiry of warranty periods;
- determining the end of an asset's economic life, e.g. when the asset related expenditure exceeds the associated income;
- determining the cost of specific activities (activity based costing), e.g. the total cost of maintaining a specific asset(s)/asset system;
- obtaining/calculating asset replacement values;
- undertaking financial analysis of planned income and expenditure;
- obtaining/calculating the financial and resource impact of deviating from plans that might result in a change in asset availability or performance (e.g. what is the financial impact of deferring the maintenance of a specific generator by six months?);
- assessing its overall financial performance;
- undertaking the on-going identification, assessment and control of asset related risks.

*NOTE 2 The OIR above are taken from PAS 55-2:2008, 4.4.6a).*

*NOTE 3 Some of these OIR might not be applicable to all organizations.*

### A.3 Specific asset information requirements

Example asset information requirements combining BS 8587 and PAS 55-2 are listed as follows:

#### a) Legal information:

- details of ownership and maintenance demarcation where assets interface across a system or network of assets;
- work instructions together with diagrams and reporting requirements, legal obligations such as health and safety file information, and safety/environmental considerations;
- asset related contractual information;
- task risk assessments and control measures.

#### b) Commercial information:

- descriptions of assets and the asset systems they serve;
- functions of assets, including any interdependencies to the activities that require them;
- vendor data (details of the organization that supplied the asset) including asset lead time;
- the condition and duty of assets including intensity of use;
- key performance indicators;
- condition and performance targets or standards;
- criteria of non-conformance and the actions to be taken;
- the criticality of assets and spaces to the organization;
- identities and levels of spares held, inter-changeability, specifications and storage locations.

#### c) Financial information:

- financial data including, where available, whole life costs of asset deployment including cost of historical and planned maintenance tasks, operating costs, downtime impact, current asset replacement value, original purchase/leasing cost.

#### d) Technical information:

- engineering data and design parameters;
- details of asset dependencies and interdependencies;
- commissioning dates and data;
- operational data including performance characteristics and design limits.

#### e) Managerial information:

- unique asset identification numbers;
- locations of the assets, possibly using spatial referencing or geographical information systems;
- spatial data relating to assets, for example pavement areas, room sizes;
- warranties and guarantee periods;
- access planning and work schedules;

- when assets were last maintained/inspected and when these tasks are next due;
- list of overdue/outstanding tasks;
- historical record of planned and unplanned maintenance tasks performed,
- details of the tasks to be carried out;
- asset related standards, process(es) and procedure(s);
- the presence of any hazardous contents or waste;
- details of asset destination at end of current life;
- details of emergency plans including responsibilities and contact details;
- details of historical asset failures, causes and consequences (if known).

*NOTE These AIR are adapted from PAS 55-2:2008, 4.4.6b) and BS 8587:2012, Clause 5 and are indicative only.*

### A.4 Example enterprise systems that may be linked to the AIM

The nature and extent of existing systems that the organization may link to the AIM may vary. Example enterprise systems are listed as follows:

- document management systems;
- work/programme planning and scheduling systems;
- materials management and spares inventory systems;
- purchasing systems;
- accounting and financial planning systems;
- asset utilization systems;
- property systems;
- engineering design and modelling systems;
- performance reporting systems;
- condition monitoring systems;
- geographical information systems (GIS) and spatial analysis toolkits (for the analysis of GIS data);
- asset possession/shutdown/outage planning systems;
- SCADA;
- knowledge management systems;
- staff location, scheduling and despatch systems.

*NOTE These existing enterprise systems are adapted from PAS 55-2:2008, 4.4.6b).*

## A.5 Example triggers

The types of triggers for which the information management process should be operated will be defined by the organization. Example triggers are listed as follows:

- The organization's receipt of information provided at information exchanges during major works, including the capital/delivery phase of a project delivering a new asset;
- The organization's decision to manage information relating to an existing asset according to PAS 1192-3;
- Performance evaluation of an asset, including failure trends from similar components used elsewhere and experience-based learning and feedback from asset performance;
- Maintenance work on an asset, whether planned or reactive;
- Minor works on an asset, such as minor repairs, component replacements or minor upgrades;
- Major works on an asset such as major repairs, refurbishments or major upgrades;
- Asset replacement;
- End-of-life works, such as decommissioning, demolition or moth-balling;
- Planning for and, where appropriate, implementing an emergency response;
- Risk assessment of an asset;
- Change in value of an asset;
- Change in regulations applying to an asset;
- Change in organizational requirements relating to the asset;
- Change in ownership of an asset;
- Change in operator of an asset;
- Change in maintainer of an asset.

***NOTE** The specific information management processes for the first and last of the listed triggers are described in Annex B. Similar processes should be defined by the organization to apply the same principles to the other triggers that are appropriate for them.*

## Annex B (informative) Examples of the CDE in use

### B.1 Example 1, transferring a PIM into the AIM

**NOTE** This example demonstrates the process for taking a PIM into the operational CDE as the basis of the AIM, and is reflected in Figure 8. The example is more specific about the nature of the organization and hence uses the terms owner and operator.

#### B.1.1 WORK IN PROGRESS

**B.1.1.1** The work in progress (WIP) area of the CDE should be used to hold unapproved information for each organizational role.

**NOTE 1** The WIP area represents information generated from a number of parties, all involved in a particular project or activity. For example, this can be survey reports, site investigations, digital scanning surveys or any other source information which might be used to contribute to a wider activity. These parties may be external consultants or contractors, or people from within the client's own organization.

**NOTE 2** AIMs for existing assets may be received from other organizations as a result of transfer of assets.

**NOTE 3** The WIP area concludes with the Approval Gate ("6" in Figure 8) which represents the transition to SHARED, where the information is checked, reviewed and approved by the person in charge of that particular activity. This responsibility should be made clear within each of the individual organizations/client departments.

**B.1.1.2** The PIM used as the basis for the AIM should include only the objects or elements representing what has actually been constructed, which shall replace those objects or elements representing design intent.

**NOTE 1** The PIM will typically be a subset of the AIM, where a project covers only part of an organization's asset portfolio.

**NOTE 2** The PIM will represent what has actually been installed and not what the designers intended. Therefore the party responsible for delivering the PIM should ensure that the PIM includes information such as model, performance, supplier/manufacturer rather than the generic information provided originally by the designers. Changes between the design intent and the installed arrangement may include re-routing of services due to physical site constraints, an alternative design solution due to value engineering, to reflect design errors, etc.

#### B.1.2 SHARED and CLIENT SHARED

**NOTE** "SHARED" may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.

**B.1.2.1** To pass through the Approved Gate (Gate 6) a check, review and approval process should be carried out before information is issued to the SHARED area. The checks should include:

- a) model suitability check;
- b) technical content check;
- c) information exchange;
- d) drawings extract checks along with any additional documentation that is shared as a co-ordinated package of information.

**NOTE** The checks for a particular project or activity can change depending on the nature of the information exchanged. The checks for each exchange should be clearly identified in the AIR.

**B.1.2.2** The SHARED area of the CDE should be used to hold information which has been approved for sharing with other organizations/parties to use as reference material for their own activity development. When all activities, including co-ordination and clash checking on the 3D models, have been completed, the information should be placed in the CLIENT SHARED area.

**B.1.2.3** To pass through the Authorized Gate (Gate 7) the information in the CLIENT SHARED area should be authorized by the owner or the operator.

**NOTE** Published documentation includes specifications, reports, O&M manuals, visualizations, 3D models, maintenance schedules, etc. This represents the transition to PUBLISHED.

**B.1.2.4** Checks for authorization should include validation and verification for compliance with the AIR deliverables and completion of the Plain Language Questions (where applicable). Accepted information and data should be transferred to the PUBLISHED area.

**NOTE** Some information may be commercially sensitive, or have security implications, and as such access to this might need to be controlled. Therefore, it might be necessary to provide separate areas within the AIM Published area which are capable of restricting access to certain data or information.

**B.1.2.5** Information rejected at this stage should be transferred to the ARCHIVE area in order to contribute to the full project/asset information history.

**B.1.2.6** As part of this process a RAG validation report should be produced and passed to the CLIENT SHARED area. Details of information or data rejected at this stage should be passed back to the contractor or works team.

**B.1.2.7** The Authorized Gate (Gate 7) should be used for information to be validated when it is delivered as an AIM for use in operation of the asset.

**B.1.2.8** The Authorized Gate (Gate 7) should represent validated information for delivery to an AIM for use in operation of the asset.

*NOTE 1 This process will be iterative if the sign-off process finds that the requirements for the information exchange have not been met.*

*NOTE 2 Information to be validated will often not be the entire AIM as the project may have been dealing with a subset of the whole asset inventory.*

### **B.1.3 PUBLISHED**

*NOTE "PUBLISHED" may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.*

**B.1.3.1** The PUBLISHED area of the CDE should be used to hold the published information. Information in the PUBLISHED area that is superseded by new information should be moved to the ARCHIVE area.

*NOTE The published area concludes with the Verified Gate (Gate 8).*

**B.1.3.2** The verified information from the PUBLISHED area should be available to support the AIR, and the OIR as well as the linked enterprise systems.

*NOTE 1 The verified information from the PUBLISHED area can be used for meeting the AIR in the Client Shared Area.*

*NOTE 2 The verified data from the PUBLISHED area can be used to populate the AIM database, used as the repository for supporting the day-to-day asset management activities.*

*NOTE 3 The verified information from the PUBLISHED area can be used for informing the linked enterprise systems and also the OIR, related to other organizational operations and activities. In the case of the linked enterprise systems, this may be a two way process, assuming that the information in the linked enterprise systems has undergone a similar control process.*

**B.1.3.3** The PUBLISHED area should be maintained in two parts: File Store to hold all PUBLISHED Level 2 files such as documents, geographic models and non-geographic structured data files, and the Data Store to hold all non-geographic structured data as a data model, such as a relational object database. The two parts should be referentially and relationally maintained so an object in the Data Store can reference a model or document in the File Store. The references in the Data Store can also be external.

### **B.1.4 ARCHIVE**

*NOTE "ARCHIVE" may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.*

**B.1.4.1** The ARCHIVE area of the CDE is for inactive or superseded material and should be used to record all progress through each information exchange and should hold a record of all transactions and change orders and may provide an audit trail in the event of a dispute.

**B.1.4.2** In addition, checked and verified as-constructed information in the PUBLISHED area should be passed to the ARCHIVE area once it has been superseded.

**B.1.4.3** The ARCHIVE area within the AIM should include all information from the PIM archive area.

*NOTE It is important that all information produced throughout the briefing, design and construction phases of an asset are captured and made available to the asset operators. Information used as the basis for design decisions might not be required for the daily operation of the asset, but might be needed for future remodelling or if performance issues are experienced with the asset. However, the archive needs to be actively managed, aligned with the asset information management requirement.*

**B.1.4.4** The ARCHIVE should be maintained in two parts: File Store to hold all ARCHIVE Level 2 files such as documents, geographic models and non-geographic structured data files, and the Data Store to hold all non-geographic structured data objects, each maintaining the record of instance of the move to the ARCHIVE area to deliver a full file and data object history archive.



## B.2 Example 2, transferring the AIM from one service provider to another

**NOTE 1** This example represents the process for taking an AIM used for a particular operations contract (contract AIM) into the operational CDE at the end of the contract, such as when the service provider is to change. Terms and Gate references used here relate to those shown in Figure 8. The example is more specific about the nature of the organization and hence uses the terms owner and operator.

**NOTE 2** As the contract AIM exists and forms a record data set, it will not pass through the 'Work in progress area and Gate 6. Therefore, it will be passed directly into the CLIENT SHARED area to undergo the authorized/verified process.

### B.2.1 CLIENT SHARED

**NOTE** "CLIENT SHARED" may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.

**B.2.1.1** The contract AIM being passed to the CLIENT SHARED area should represent the status of the relevant asset at that point in time.

**NOTE 1** The contract AIM will typically form a subset of the organization's AIM, where a project covers only part of an organization's asset portfolio.

**NOTE 2** The contract AIM will represent what actually exists within the asset as opposed to what existed when the contract started. Therefore, the service provider should ensure that the contract AIM accurately reflects all applicable works which have been carried out during the life of the contract.

**B.2.1.2** To pass through the Authorized Gate (Gate 7) the information in the CLIENT SHARED area should be authorized by the owner or the operator.

**NOTE** Published documentation includes specifications, reports, O&M manuals, visualizations, 3D models, maintenance schedules, etc. This represents the transition to PUBLISHED.

**B.2.1.3** Checks for authorization should include validation and verification for compliance with the AIR and OIR deliverables. Accepted information should be transferred to the PUBLISHED area. Accepted data should be transferred to the AIM database.

**NOTE** Some information might be commercially sensitive, or have security implications, and as such access to this may need to be controlled. Therefore, it may be necessary to provide separate areas within the AIM Published area and database which are capable of restricting access to certain data or information.

**B.2.1.4** Information rejected at this stage should be transferred to the ARCHIVE area in order to contribute to the full project/asset information history.

**B.2.1.5** As part of this process a RAG validation report should be produced and passed to the CLIENT SHARED area. Details of information or data rejected at this stage should be passed back to the contractor or works team.

**B.2.1.6** The Authorized Gate (Gate 7) should be used for information to be validated when it is delivered as an AIM for use in operation of the asset.

**NOTE 1** This process will be iterative if the sign-off process finds that the requirements for the information exchange have not been met.

**NOTE 2** It will often not be the entire AIM as the project may have been dealing with a subset of the whole asset inventory.

### B.2.2 PUBLISHED

**NOTE** "PUBLISHED" may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.

**B.2.2.1** The PUBLISHED area of the CDE should be used to hold the published information. Information in the PUBLISHED area that is superseded by new information should be moved to the ARCHIVE area.

**NOTE** The published area concludes with the Verified Gate (Gate 8).



**B.2.2.2** The verified information from the PUBLISHED area should be available to support the AIR, the OIR and the linked enterprise systems.

**NOTE 1** *The verified information from the PUBLISHED area can be used for meeting AIR in the CLIENT SHARED area.*

**NOTE 2** *The verified data from the PUBLISHED area can be used to populate the AIM database, used as the repository for supporting the day-to-day asset management activities.*

**NOTE 3** *The verified information from the PUBLISHED area can be used for informing the linked enterprise and also the OIRs, related to other organizational operations and activities. In the case of the linked enterprise systems, this might be a two way process, assuming that the information in the linked enterprise systems has undergone a similar control process.*

**NOTE 4** *The verified information from the PUBLISHED area can be used as the AIM for the incoming service provider.*

### **B.2.3 ARCHIVE**

**NOTE** *“ARCHIVE” may be interpreted as being the status of the file rather than being moved across the system. This will prevent multiple copies of files and allow archiving of data with subsequent revisions/versions.*

**B.2.3.1** The ARCHIVE area of the CDE is for inactive or superseded material and should be used to record all progress through each information exchange and should hold a record of all transactions and change orders and should provide an audit trail in the event of a dispute.

**B.2.3.2** In addition, checked and verified as-constructed information in the PUBLISHED area should be passed to the ARCHIVE area once it has been superseded.

**B.2.3.3** The ARCHIVE area within the AIM shall include all information from the PIM archive area.

**NOTE** *It is important that all information produced throughout the briefing, design and construction phases of an asset are captured and made available to the asset operators. Information used as the basis for design decisions might not be required for the daily operation of the asset, but might be needed for future remodelling or if performance issues are experienced with the asset. However, the archive should be actively managed and aligned with the asset information management requirements.*

## Annex C (informative) Contractual scenarios

### C.1 Background

Examples are included here for common contractual scenarios related to the management of assets. These have been shown in two distinct groups (C.1 buildings and C.2 infrastructure) in order to reflect the practices in the two asset areas.

The purpose of these scenarios is to explain where the organization (to which this PAS is directed) could be in the supply chain.

Each of the contractual scenarios described should be arranged so as to make the provision of PIMs/AIMs possible throughout the life of the asset, passing from one organization to the next in order to provide and maintain a full asset information data set.

### C.2 Contractual scenarios related to management of buildings

#### C.2.1 General

There are a variety of contractual arrangements between parties involved in asset delivery projects, and some of these are described in this clause. These arrangements will ultimately determine the way the operations teams are appointed/engaged.

Contractual arrangements need to be carefully considered for each of these scenarios, and care should be taken to ensure duplication of responsibility is avoided whilst making sure that all relevant issues and duties are covered. These scenarios illustrate how responsibility for different parts of the asset information management system may change under different contractual conditions.

For each of these scenarios there is an equivalent situation where the asset is already owned, and the project is to redevelop it.

#### C.2.2 Develop, own, operate scenario

The first scenario described is where an owner will retain control of an asset once it has been constructed.

The owner engages a supply chain to deliver an asset construction project. The delivery supply chain task team undertake to provide the asset to the owner via a contract between the two parties.

The owner then engages an operator supply chain to manage the asset once it has been completed and successfully handed over. The operator supply chain is engaged via a contract with the employer.

#### C.2.3 Develop, own, let scenario

In the second scenario, here the owner will let out the asset to a tenant once it has been completed, becoming a landlord.

As in the first scenario the owner has engaged the supply chain to provide the asset. Once the asset has been handed over, the employer lets the asset to tenants. This arrangement results in the possibility of split responsibilities for the operation of the asset, the landlord will retain responsibility for the operation and maintenance of the common areas whereas the various tenants will be responsible for their own particular areas. In this case there may be a number of contracts for maintenance or operation awarded on the same asset.

#### C.2.4 Develop, own, sell scenario

In this case the developer sells off the asset to an owner or landlord after completion.

The owner may choose to use the asset himself, or may choose to let it to tenants. This may also result in split responsibilities for the operation and maintenance of the asset, with the landlord and tenants each making arrangements with operator supply chains.

### C.3 Contractual scenarios related to management of infrastructure

#### C.3.1 Background

As with the contractual scenarios described in C.1, there are a range of scenarios which relate to the management of infrastructure. Also as described in C.1, these arrangements will determine the way the operations teams are appointed/engaged.

#### C.3.2 Own, change, own scenario

This is where an asset owner identifies the need for works to be carried out to an existing asset.

An example may be where the owner of an existing asset – in this case a bridge – identifies that the deck needs to be replaced. The owner arranges for a contracted party to replace the deck part of the bridge system, and the bridge is then handed back to the operational part of the organization on completion.

#### **C.3.3 Develop, transfer, own scenario**

In this case a developer builds an asset in support of a wider project, transfers the operation of the asset to a third party which takes on ownership of the asset.

The example used here is where a construction company builds a sewerage network to support a new housing development. On completion the network is transferred to the local water supply authority which takes on the ownership and its operational responsibilities.

It is also common practice for the ownership of roads within housing estates to be transferred from the developer to the local authority on completion, with the local authority taking on the maintenance obligations.

#### **C.3.4 Own, enhance, own scenario**

Here an asset owner wants to enhance an existing asset which it will retain ownership of.

In this example, the owner of an existing motorway needs to increase the capacity and opts to widen it. The owner contracts an external organization to carry out the widening works and then takes back the motorway on completion.

#### **C.3.5 Own, transfer, operate/maintain, transfer, own (DBFO) scenario**

This deals with a situation whereby an asset is transferred to an operator for a set period and then handed back to the owner at the end.

An example may be where an existing road network is transferred to a maintainer under a franchise agreement. The maintainer will be responsible for bringing the network up to a good standard, carry out ongoing maintenance for the period of the franchise, and then ownership of the network will revert to the original owner at the end of the franchise period. This scenario is also called DBFO (design, build, finance, operate).

## Annex D (informative) Responsibilities for information management processes

### D.1 General

An example of organizational responsibilities for information management in connection with different triggers or trigger-related events is shown in Table D.1.

**Table D.1** – Summary of stakeholder roles and responsibilities

Trigger or related event	Owner	Operator	Maintainer	Other (specified)
Undertaking a project operating to PAS 1192-2	Update AIM from information received from the major works design and contractor leads Make AIM available to the Operator	Receive access to AIM from the Owner Make AIM available to the Maintainer	Receive access to AIM from the Operator	Major works design and contractor leads: Supply information to the Owner
Developing an AIM for an existing asset	Create or commission the creation of the AIM Make AIM available to the Operator	Receive access to AIM from the Owner Make AIM available to the Maintainer	Receive access to AIM from the Operator	
Day-to-day operation of an asset	Update the AIM with operational data and information	Update the AIM with operational data and information	Supply information to the Operator or Owner for updating	
Planned and reactive maintenance of an asset	Update the AIM with data and information provided by the Maintainer (for assets managed by the Owner)	Update the AIM with data and information provided by the Maintainer (for assets managed by the Operator)	Provide data and information related to maintenance activities to the Owner or Operator as appropriate	
Carrying out minor works on an asset	Update the AIM with data and information provided by the works contractor (for assets managed by the Owner)	Update the AIM with data and information provided by the works contractor (for assets managed by the Operator)		Works contractor: Provide data and information for the AIM to the Owner or Operator as appropriate
Carrying out major works on an asset	Update the AIM with information provided by the design lead and/or contractor lead for the works (for assets managed by the Owner)	Update the AIM with information provided by the design lead and/or contractor lead for the works (for assets managed by the Operator)		Design lead and/or contractor lead: Provide data and information from the works
End-of-life of an asset	Update the AIM with data and information related to the end-of-life Make AIM available to the Operator if the Operator still has an interest in the asset portfolio	Receive access to updated AIM if the Operator still has interest in the asset portfolio		End-of-life contractor: Provide data and information to the Owner
Realigning the AIM	Update the AIM with information related to all events since the last alignment	Update the AIM with information related to all events since the last alignment		

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**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 joint industry-Government Industrial Strategy for Construction, Construction 2025, an enabler of our ambition to achieve significant improvements in cost, value and carbon performance during construction and operation. 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.

PAS 1192-2:2013 looks at the capital delivery phase and builds on the collaborative processes of BS 1192:2007.

This document PAS 1192-3:2014 is a companion to PAS 1192-2 and reminds us that we design and construct to enable the successful operation of assets that support society in a way that is economically and environmentally sustainable. I believe that to achieve that aim requires operational data that is drawn from all relevant sources, stored in an accessible location and is correct, up to date, and can be processed quickly to answer the strategic questions of the organisation.

PAS 1192-3 provides a framework upon which to build a digital asset information model to support the operational information management process.

I believe that collaborative BIM working processes and the data rich technologies that support them 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, operate, maintain and de-commission our built environment.



**Mark Bew**  
Chair of the  
HM Government  
BIM Task Group

Standards play an important role in enabling 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 reduce cost significantly and enable future industry growth.

PAS 1192-3:2014 plays an integral role in the adoption of digital techniques in the asset management and facility management communities which represent such a large and important part of the built environment sector.

The Industrial Strategy – Construction 2025 calls for future whole life cost savings of up to 33% and the application of digital capabilities such as those described in PAS 1192-3 is a part of achieving that target.

Please refer to [www.bimtaskgroup.org](http://www.bimtaskgroup.org) for updates and other documents. The site also provides help such as lessons learned and access to the BIM4 communities.

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