

BS 8536-1:2015



BSI Standards Publication

Briefing for design and construction –

Part 1: Code of practice for facilities management (Buildings infrastructure)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 88, an inside back cover and a back cover.

Foreword

Publishing information

This Part of BS 8536 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 July 2015. It was prepared by Technical Committee FMW/1, *Facilities management*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This Part of BS 8536 supersedes BS 8536:2010, which is withdrawn.

Relationship with other publications

BS 8536, *Briefing for design and construction*, will eventually comprise two parts:

- *Part 1: Code of practice for facilities management (Buildings infrastructure); and*
- *Part 2: Code of practice for asset management (Linear and geographical infrastructure).*

Information about this document

The initial drafting of this British Standard was produced in association with BIS as part of their ongoing programme of support for standardization.

Briefing for design and construction focuses on those aspects of design, construction, testing and commissioning, handover and start-up of operations that are concerned with achieving the required operational performance of a new or refurbished asset/facility. These include, but are not limited to, overall concept, context, uses, access, visual form, environmental impact, space, internal environment, durability, adaptability, usability and engineering performance.

This revision introduces the following principal changes:

- broadening of the scope of the standard to take account of operational requirements during design, construction, testing and commissioning, handover, start-up of operations and during defined periods of aftercare;
- the incorporation of the principles of soft landings (3.1.51);
- integration of comprehensive information management with the requirements for post-occupancy evaluation (POE) to strengthen the link between asset/facility owners, operators, operations teams and facility managers, as appropriate, and the design and construction team to assure performance of the design and the operational asset/facility;
- cross-referencing of information requirements associated with “Level 2 BIM” in accordance with PAS 1192-2, PAS 1192-3 and BS 1192-4; and
- updating the retained content to align with current industry best practices in briefing.

The aim is three-fold: to improve the focus of the supply chain on performance in use; to extend supply chain involvement through to operations and defined periods of aftercare; and to involve the operator, operations team or facility manager, as appropriate, from the outset.

Whilst this standard assumes the use of “Level 2 BIM” for projects, the adoption of soft landings (see 3.1.51) is not precluded where “Level 2 BIM” cannot be achieved across the project.

This standard forms part of an existing set of standards connected with facilities management.

This standard broadly aligns with the principles of *The soft landings framework* published by UBT and BSRIA [1] and the principles identified in *Government Soft Landings* [2]. Soft landings (3.1.51) is concerned with the smooth transition from design and construction into operation and use of an asset/facility. It advocates close collaboration during briefing, design, construction and handover between the design and construction team and the operator, operations team or facilities manager, as appropriate, in matters affecting operations and end-users, in order to maintain focus on the required outcomes.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

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

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the Clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

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

Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction

This British Standard considers matters relating to projects for the delivery of assets/facilities according to defined operational requirements, including maintenance, and expected performance outcomes. For the purpose of this British Standard, the term “design and construction team” covers the collective efforts of designers, constructors, subcontractors, operators, operations teams, facility managers and other specialists, representing the disciplines and skill-sets engaged in the delivery of a new asset/facility or the refurbishment of one existing. An integrated design and construction team offers benefits in terms of coordinated design and problem solving, as well as consideration of buildability and operational impacts. This British Standard emphasizes the importance of adopting a whole-life view of an asset/facility; not solely its design and construction or refurbishment. In this regard, it is important to recognize that a vast amount of information and data about an asset/facility is generated and exchanged during its lifetime and that a security-minded approach to the handling of such information and data will need to be adopted.

The principle of buildability is widely applied in design. However, the principle of operability has not historically been considered to the same extent. Design decisions have to be based upon accurate and relevant information and data, and their impact on operational needs has to be understood before they are committed to construction work and/or installation. The most effective time to comment on the suitability or effectiveness of design is before it is finalized. Testing assumptions during design is necessary to understand how the asset/facility will perform in operation. Whilst it is too late to comment on the design of the asset/facility once it is operational, systematic measurement, analysis, comparison and feedback can be useful in informing the design of future assets/facilities.

This British Standard is intended to complement and strengthen briefing practices and procedures by:

- a) promoting the early involvement of the operator, operations team or facility manager, as appropriate; and
- b) extending the commitment on the part of the design and construction team to aftercare post-handover of the asset/facility and its correct, safe, secure and efficient operation in line with environmental, social, security and economic performance targets.

The requirements of inclusive design and of managing design in construction have been incorporated to anticipate the implications for managing assets/facilities and their environments effectively and inclusively when they become operational. This British Standard outlines the primary activities, information, questions and deliverables to be addressed by the designers, constructors, subcontractors and other specialists to support their work and so ensure that the asset/facility owner and the operator, operations team and facility manager, as appropriate, are provided with as much certainty as possible in regard to the required operational performance of the asset/facility.

This British Standard broadly aligns with the principles of *The soft landings framework* published by UBT and BSRIA [1] and the principles identified in *Government Soft Landings* [2].

1 Scope

This Part of BS 8536 gives recommendations for briefing for design and construction to ensure that the design takes account of the expected performance of the asset/facility in use over its planned operational life. It is applicable to the provision of documentation supporting this purpose during design, construction, testing and commissioning, handover, start-up of operations and defined periods of aftercare.

This British Standard is not intended to provide detailed guidance on design or construction, but is concerned with information and data that are needed in order that due consideration can be given to operability and performance requirements for the new or refurbished asset/facility. It does not cover decommissioning or other end of life activities.

This British Standard is intended for use by individuals and organizations preparing or contributing to design, construction and operations, in both the public and private sectors, including owners refurbishing an existing asset/facility, organizations procuring a new asset/facility, and the designers, constructors, subcontractors, operators, operations teams, facility managers and other specialists engaged in such activities.

2 Normative references

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

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

BS 1192-4, *Collaborative production of information – Part 4: Fulfilling employer's information exchange requirements using COBie – Code of practice*¹⁾

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

PAS 1192-3, *Specification for information management for the operational phase of assets using building information modelling*³⁾

PAS 1192-5, *Specification for security-minded building information modelling, digital built environments and smart asset management*

¹⁾ This standard also gives an informative reference to BS 1192-4:2014.

²⁾ This standard also gives an informative reference to PAS 1192-2:2013.

³⁾ This standard also gives an informative reference to PAS 1192-3:2014.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purpose of this British Standard the following terms and definitions apply.

3.1.1 access

ability of reaching and using a service or facility
[SOURCE: BS ISO 16439:2014, 3.2]

3.1.2 accessibility

ease of reaching and using a service or facility
[SOURCE: BS ISO 11620:2014, 2.2]

3.1.3 activity

task that is needed to produce a deliverable

3.1.4 adaptability

possibility of changing characteristics such as volume, function or space in order to meet new demands or needs

3.1.5 aftercare

defined period post-handover of an asset/facility in which the design and construction team passes on information and knowledge to the operator, operations team or facility manager, responds to queries and problems, and monitors and reviews the asset's/facility's performance.

3.1.6 as-constructed information

expression of the design, its working detail, construction work and/or installations, functions and operation and maintenance needs of an asset/facility in a form suitable for use in managing that asset/facility

3.1.7 asset

item, thing or entity that has potential or actual value to an organization
[SOURCE: BS ISO 55000:2014, 3.2.1]

3.1.8 asset information model (AIM)

data and information that relate to assets to a level required to support an organization's asset management system
[SOURCE: PAS 1192-3:2014, 3.1.4, modified]

3.1.9 asset information requirements (AIR)

data and information requirements of the organization in relation to the asset(s) for which it is responsible
[SOURCE: PAS 1192-3:2014, 3.1.5, modified]

3.1.10 asset management

coordinated activity of an organization to realize value from assets
[SOURCE: BS ISO 55000:2014, 3.3.1]

3.1.11 basis for design

information and data concerning the required function, form, layout, specification and operation of an asset/facility amongst other matters

3.1.12 brief

working document which specifies at any point in time the relevant needs and aims, resources of the client and user, the context of the project and any appropriate design requirements within which all subsequent briefing (when needed) and designing can take place

[SOURCE: BS 7832:1995, ISO 9699:1994, 2.1]

NOTE Annex A offers an example of a "Brief checklist".

3.1.13 briefing

process of identifying and analysing the needs, aims and constraints (the resources and the context) of the client and the relevant parties, and of formulating any resulting problems that the designer is required to solve

[SOURCE: BS 7832:1995, ISO 9699:1994, 2.2]

3.1.14 buildability

degree to which the design of a planned asset/facility assists its construction and utilization

3.1.15 building information modelling (BIM)

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

[SOURCE: PAS 1192-2:2013, 3.7]

3.1.16 carbon emissions

polluting carbon substances released into the atmosphere

3.1.17 carbon metric

measure of the weight of carbon dioxide equivalent (CO₂-eq) emitted per square metre per annum (based on greenhouse gas emissions over a 100-year period), expressed as kgCO₂-eq/m²/annum per building type

3.1.18 commissioning

process by which equipment, a system, a facility or a plant that is installed, is completed or near completion is tested to verify if it functions according to its design specification and intended application

[SOURCE: BS ISO 50004:2014, 3.1.1]

3.1.19 common data environment (CDE)

single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multidisciplinary teams in a managed process

[SOURCE: PAS 1192-2:2013, A.30]

3.1.20 deliverable

product or service as an outcome of a process

3.1.21 design review protocol

procedure for ensuring a structured and systematic review of a design at defined points in the project life cycle

3.1.22 digital plan of work (dPoW)

generic schedule of phases, roles, responsibilities, assets and attributes, made available in a computable form

[SOURCE: BS 1192-4:2014, 3.3]

- 3.1.23 employer's information requirements (EIR)**
pre-tender document setting out the information to be delivered, and the standards and processes to be adopted by the supplier as part of the project delivery process
[SOURCE: PAS 1192-2:2013, 3.21]
- 3.1.24 end-user**
person receiving asset/facility-related services
[SOURCE: BS EN 15221-1:2006, 2.4, modified]
- 3.1.25 external envelope**
roof and facade including openings
- 3.1.26 facilities management**
integration of processes within an organization to maintain and develop the agreed services that support and improve the effectiveness of its primary processes and activities
[SOURCE: BS EN 15221-1:2006, 2.5]
- 3.1.27 facility**
tangible asset that supports an organization
[SOURCE: BS EN 15221-1:2006, 2.6]
- 3.1.28 facility handbook**
organized collection of documentation covering the operation of an asset/facility
- 3.1.29 facility-related service**
support provision to the primary processes and activities of an organization, delivered by an internal or external provider
- 3.1.30 flawless start-up**
fault-free commencement of operations
[SOURCE: BS 8587:2012, 3.1.15]
- 3.1.31 handover**
act of passing responsibility for, and control over, an asset/facility to the owner or operator following testing and commissioning
- 3.1.32 impact**
any change that might be adverse or beneficial
[SOURCE: BS ISO 15392:2008, 3.13]
- 3.1.33 inclusive design**
design that seeks to include everyone irrespective of needs, circumstances or identity
- 3.1.34 information exchange**
structured collection of information at one of a number of predefined stages of a project
[SOURCE: PAS 1192-2:2013, 3.25, modified]
- 3.1.35 key performance indicator (KPI)**
measure that provides essential information about the performance of asset/facility-related services delivery
[SOURCE: BS EN 15221-1:2006, 2.13, modified]
- 3.1.36 occupant**
user who spends a significant proportion of their time in or about a facility

- 3.1.37 operability**
capable of being put into use as intended
- 3.1.38 operational strategy**
overall approach to managing the production or use of an asset/facility
- 3.1.39 operations team**
functional group responsible for the day-to-day running and maintenance of an asset/facility
- 3.1.40 operator**
organization responsible for the day-to-day operation of an asset/facility
- 3.1.41 organizational information requirements (OIR)**
data and information required to achieve the organization's objectives
[SOURCE: PAS 1192-3:2014, 3.1.26]
NOTE The management activities leading to OIR are the equivalent of the employer's key decision points in PAS 1192-2.
- 3.1.42 owner**
individual or organization owning or procuring an asset/facility
NOTE This can refer to both existing and prospective owners.
- 3.1.43 performance**
ability to fulfil required functions under intended use conditions or behaviour when in use
[SOURCE: BS ISO 15392:2008, 3.16]
- 3.1.44 plain language question**
request for information that is expressed in simple, easy-to-understand terms
- 3.1.45 post-occupancy evaluation (POE)**
process of evaluating an asset/facility after it has been completed and is in use to understand its actual performance against that required and to capture lessons learned
- 3.1.46 project information model (PIM)**
information model developed during the design and construction phase of a project
[SOURCE: PAS 1192-2:2013, 3.35]
- 3.1.47 project execution strategy**
high-level statement of the intentions and arrangements for a project
- 3.1.48 quality**
degree to which a set of inherent characteristics fulfils requirements
[SOURCE: BS ISO 9000:2005, 3.1.1]
- 3.1.49 scope of work**
design, construction work and/or installation, testing and commissioning, handover and start-up activities necessary to deliver an operational asset/facility
- 3.1.50 service level**
complete description of requirements of a product, process or system, with their characteristics
[SOURCE: BS EN 15221-3:2011, 3.1.11]

- 3.1.51 soft landings**
process for the graduated handover of a new or refurbished asset/facility, where a defined period of aftercare by the design and construction team is an owner's requirement that is planned and developed from the outset of the project
- 3.1.52 stage**
division of a standardized process map for the acquisition of a facility, at some of which the requirements can be delivered
[SOURCE: PAS 1192-2:2013, 3.22]
- 3.1.53 stakeholder**
person, group or organization that has interests in, or can affect, be affected by or perceive itself to be affected by, any aspect of the project
[SOURCE: BS ISO 21500:2012, 2.14]
- 3.1.54 stakeholder impact analysis**
method for evaluating the influence that stakeholders possess in regard to an organization, asset/facility or project
- 3.1.55 statement of needs**
expression of the objectives and needs of an individual or organization and the extent to which they are likely to be satisfied by an asset/facility
- 3.1.56 steady state**
stable operation and use
- 3.1.57 value improving practice**
practice with a demonstrated, statistically-reliable connection between its use and a better outcome

3.2 Abbreviations

AIM	Asset Information Model
AIR	Asset Information Requirements
BIM	Building Information Modelling
BREEAM	Building Research Establishment Environmental Assessment Method
BUS	Building Use Studies
CAFM	Computer-aided Facilities Management
CDE	Common Data Environment
COBie	Construction Operations Building information exchange
DQI	Design Quality Indicator
EIR	Employer's Information Requirements
ERP	Enterprise Resource Planning
HSSE	Health, Safety, Security and Environment
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
OIR	Organizational Information Requirements
PIM	Project Information Model
POE	Post-occupancy Evaluation
RASCI	Responsible, Accountable, Support, Consulted and Informed

4 Design and construction for operability

4.1 Key principles and requirements

COMMENTARY ON 4.1

Design and construction for operability takes into consideration the needs of the owner, operator, end-users and other key stakeholders of the new or refurbished asset/facility. An asset/facility is likely to hold its value or benefit for the owner if it is efficient, trouble free and represents best value in terms of operation.

This standard broadly aligns with the principles of The soft landings framework published by UBT and BSRIA [1] and the principles identified in Government Soft Landings [2].

The overarching principles are that the project should take account of the operational requirements and expected performance outcomes for the new or refurbished asset/facility from the outset, through all work stages (see 4.5) and into operation. Design and construction should be guided by these requirements and be followed by defined periods of aftercare to ensure that the owner, operator and/or end-users are able to derive the expected benefits from the asset/facility.

NOTE 1 Projects are set up for success from the outset. Otherwise, they are unlikely to achieve their expected objectives or match the operational performance required by the owner, operator and end-users where these are known. This implies an emphasis at the front end of the project, where the ability to influence changes in design is relatively high and the cost of making those changes is relatively low. It involves developing sufficient strategic definition through which the owner can articulate requirements and address risk and uncertainty then make the decision to commit resources to the project in a controlled manner.

These principles should be supported by the following.

- a) The owner should be capable of articulating the business case for the project, its objectives and the required performance of the asset/facility (see 5.1.1). The owner should seek appropriate professional advice where any aspect cannot be adequately defined.
- b) The owner should be capable of expressing the security needs for the project and the ongoing operation of the asset/facility. The owner should seek appropriate professional advice where any aspect cannot be adequately defined. Where the project relates to a sensitive asset/facility, the owner should appoint a built asset security manager (see PAS 1192-5).
- c) An evidence-based approach to design and construction should be adopted that is driven by outcomes that are explicit and measurable, wherever possible, and which reflect the requirements of the owner, operator, end-users and other key stakeholders in regard to the operational performance of the asset/facility (see 4.2).
- d) Clear targets should be set for the expected outcomes at the start of the project (see 4.3), which should be aligned with the owner's business objectives, as reflected in the business case (see 5.1.1), and be capable of being cascaded through the supply chain. These targets should be reviewed at defined information exchange points within work stages (see PAS 1192-2, PAS 1192-3, BS 1192-4 and 4.9.4) and, finally, during operation of the asset/facility.
- e) The appointment of the design and construction team (see 4.6.6 and PAS 91) should incorporate a commitment to defined periods of aftercare (see 5.1.5).
- f) Post-occupancy evaluation (POE) and other reviews of performance should be undertaken with the involvement of the design and construction team

during a defined period of extended aftercare and these, together with the lessons learned, should be recorded and stored in an asset information model (AIM) so that they are available to the operator, operations team or facility manager, as appropriate, and other parties determined by the owner (see 5.8.2.3.4).

- g) The transition from design through construction and into operation should include the transfer of project information and data for operational purposes from the project information model (PIM) to the asset information model (AIM) (see PAS 1192-2, PAS 1192-3, PAS 1192-5 and 4.9.4).
- h) The adoption of “Level 2 BIM” should be considered to provide a fully populated asset data set to support asset/facilities management through the use of the owner’s defined enterprise system during the operational life of the asset/facility (see BS 1192:2007, PAS 1192-2, PAS 1192-3, BS 1192-4, PAS 1192-5 and 4.9.4).

NOTE 2 PAS 91 provides detailed guidance on the prequalification of appointees.

NOTE 3 The common data environment (CDE) provides a single source of information for the project (see BS 1192:2007, PAS 1192-2, PAS 1192-3 and 4.9.4).

NOTE 4 “Level 2 BIM” represents federated file-based digital information with some automated connectivity (see PAS 1192-2 and PAS 1192-3).

NOTE 5 The owner might utilize an enterprise system [e.g. enterprise resource planning (ERP) system] to support asset/facilities management. In other cases, a computer-aided facilities management (CAFM) system might be used for this purpose. BS 8587 provides guidance on CAFM systems.

4.2 Evidence-based approach

This standard recommends an evidence-based approach to design and construction, where decisions should be based on the best available information from multiple sources, including but not limited to the owner’s business objectives, current operations, the lessons learned from previous projects, design modelling, and simulation and performance evaluations. This approach should be extended to include the provision of evidence to support proposals and recommendations prepared by the design and construction team for the owner’s approval. Information and data for these purposes should be handled, stored and protected in accordance with the owner’s security requirements (see PAS 1192-5).

NOTE 1 BS 7000-4 provides guidance on the management of design, including a general approach to briefing.

NOTE 2 Evidence-based design and construction can be expected to result in improvements to the project’s outcomes and the achievement of more exacting operational requirements with respect to environmental, social, security and economic performance, including demonstration of the owner’s, operator’s and end-users’ satisfaction with the asset/facility in operation.

NOTE 3 Information and data related to the owner’s current and future business objectives and operations might include sensitive commercial/economic details and intellectual property that need to be afforded appropriate and proportionate protection.

4.3 Outcomes

The following performance outcomes should be set at the Strategy work stage and monitored during each subsequent work stage up to Operation and End of life (see 4.5), with post-occupancy evaluation (POE) during a defined period of extended aftercare (see 5.8.2.3) used as the basis for measuring operational performance:

- a) Environmental – the asset/facility should meet performance targets such as those for energy use, CO₂ emissions, water consumption and waste reduction and/or others defined by the owner and operator [see BS EN 15643-2 and Annex B for an approach and typical measures forming a part of POE].
- b) Social (i.e. functionality and effectiveness) – the asset/facility should be designed and constructed to meet the functional and operational requirements of the owner such as the overall concept, context, uses, access, visual form, space, internal environment, durability and adaptability, and in operation should meet the operator's and end-users' requirements, such as utility, usability, safety, maintainability, security, inclusiveness and comfort [see BS EN 15643-3 and Annex C for an approach and typical measures forming a part of POE].
- c) Security – the asset/facility and the creation, use, storage and disposal of asset/facility-related information and data should meet the security requirements of the owner, operator, operations team or facility manager, as appropriate, and end-users (see PAS 1192-5 for the development of an appropriate security-minded approach).
- d) Economic – the asset/facility should meet performance targets for capital cost and operational cost, which should be considered side-by-side to enable whole-life costs to be calculated [see BS EN 15643-4 and Annex D for an approach and typical measures forming a part of POE].

Performance outcomes and targets should be specific to the project and should be verified in each work stage (see 4.5 and Clause 5). As far as possible, a quantitative approach should be taken to measuring performance.

NOTE A number of methods exist for measuring performance. One example is the Design Quality Indicator (DQI) [3], which is a five-stage method for evaluating the design over the project life cycle against three quality principles: functionality, build quality and impact. In the context of POE, the BUS methodology [4] quantifies occupant satisfaction, reveals features of value or concern in the asset/facility and provides feedback. BREEAM In-Use [5] is a scheme to help the owner, operator, operations team or facility manager, as appropriate, reduce the operational costs and improve the environmental performance of existing assets/facilities.

4.4 Processes

The following processes should be measured principally through key performance indicators (KPIs) to determine their effectiveness.

- a) Design and construction – the asset/facility should be designed and delivered to the required operational requirements to allow it to perform as expected for its planned life subject to an appropriate maintenance regime (see 5.3.2.3 and BS 8210).
- b) Commissioning, training and handover – the commissioning and handover of the asset/facility should be supported by training to meet the needs of the operator, end-users and other key stakeholders (see 5.6 and 5.7).
- c) Asset/facilities management – the strategy for managing the asset/facility should be efficient and cost-effective in terms that are quantifiable.

- d) Information and security management – the management of information and security should be efficient and effective in terms that are quantifiable (see PAS 1192-5).

NOTE KPIs measure progress towards achieving objectives or other factors that are critical to success (see BS EN 15221-1). They represent the significant measures that allow the owner to act quickly and decisively upon any deviation in performance.

4.5 Plan of work

The plan of work is a framework to ensure that the deliverables of all contributors are identified and appropriate to the decisions required at each work stage and should be adopted by the owner as the basis for delivering and operating the asset/facility. This plan should be specific to the project, “digitally checkable” and capable of supporting “Level 2 BIM” (see 4.9.4).

NOTE 1 “Level 2 BIM” represents federated file-based digital information with some automated connectivity. A digital plan of work (dPoW) implies the use of “Level 2 BIM”. The BIM Toolkit [6] (<https://toolkit.thenbs.com/>) [viewed 2015-07-29] has been developed to provide step-by-step help to define, manage and validate responsibility for information development and delivery at each work stage.

The work stages should be based on the following and may be adjusted to suit the owner’s specific needs.

- 0 Strategy – defines the owner’s business case for the project, including required outcomes and other core considerations.
- 1 Brief – develops project objectives, including project outcomes and required performance for the asset/facility.
- 2 Concept – prepares the concept design, including outline proposals for the structural design and building services engineering systems.
- 3 Definition – develops the design, including coordinated and updated proposals for structural design and building services engineering systems.
- 4 Design – prepares technical design, including all architectural, structural and building services engineering information, cost and detailed operational data.
- 5 Build and Commission – plans, organizes and coordinates off-site manufacturing with on-site construction, including assembly, testing and commissioning.
- 6 Handover and Close-out – training of the operations team and selected end-users, handover of the asset/facility to the operator and start-up of operations.
- 7 Operation and End of life – steady-state operation, aftercare, post-occupancy evaluation, fine-tuning (POE), benchmarking and feedback.

NOTE 2 A plan of work outlines the work stages and establishes the level of detail and the level of information that need to be delivered by each contributor to the owner during delivery and operation of the asset/facility. Progression depends on satisfying predefined criteria at decision gates (or points) that include requirements relating to environmental, social, security and economic performance. This recommended plan of work reflects a generic approach derived from various sources including, but not limited to, the Construction Industry Council (working with a number of professional institutions), the BIM Task Group (<http://www.bimtaskgroup.org/>) [viewed 2015-07-29] and the Association for Project Management.

An example plan of work is the RIBA Plan of Work 2013 (<http://www.ribaplanofwork.com/>) [viewed 2015-07-29], which is applicable to a wide variety of project types and contexts and which is customizable. Other plans of work have been developed for particular uses and might be appropriate.

Figure 1 outlines the progression from Strategy through to Operation and End of Life, where the decision to proceed from one work stage to the next depends upon the owner signing-off on key decisions. For this reason, the owner should introduce decision gates (or points) in each work stage relating to the progress achieved in alignment with the project's outcomes and the operational targets for environmental, social, security and economic performance. The timing of decision gates, information exchanges (see PAS 1192-2, PAS 1192-3, BS 1192-4, PAS 1192-5 and 4.9.4) and the criteria that should be satisfied should reflect the adopted procurement method.

Figure 1 **Work Stages**

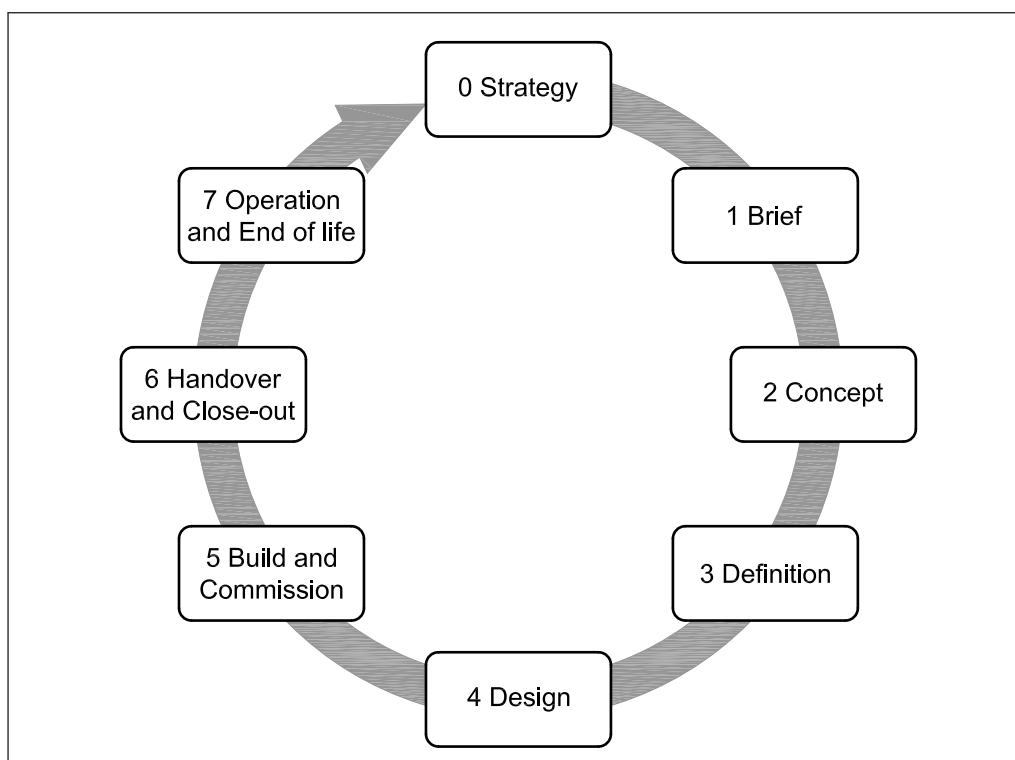
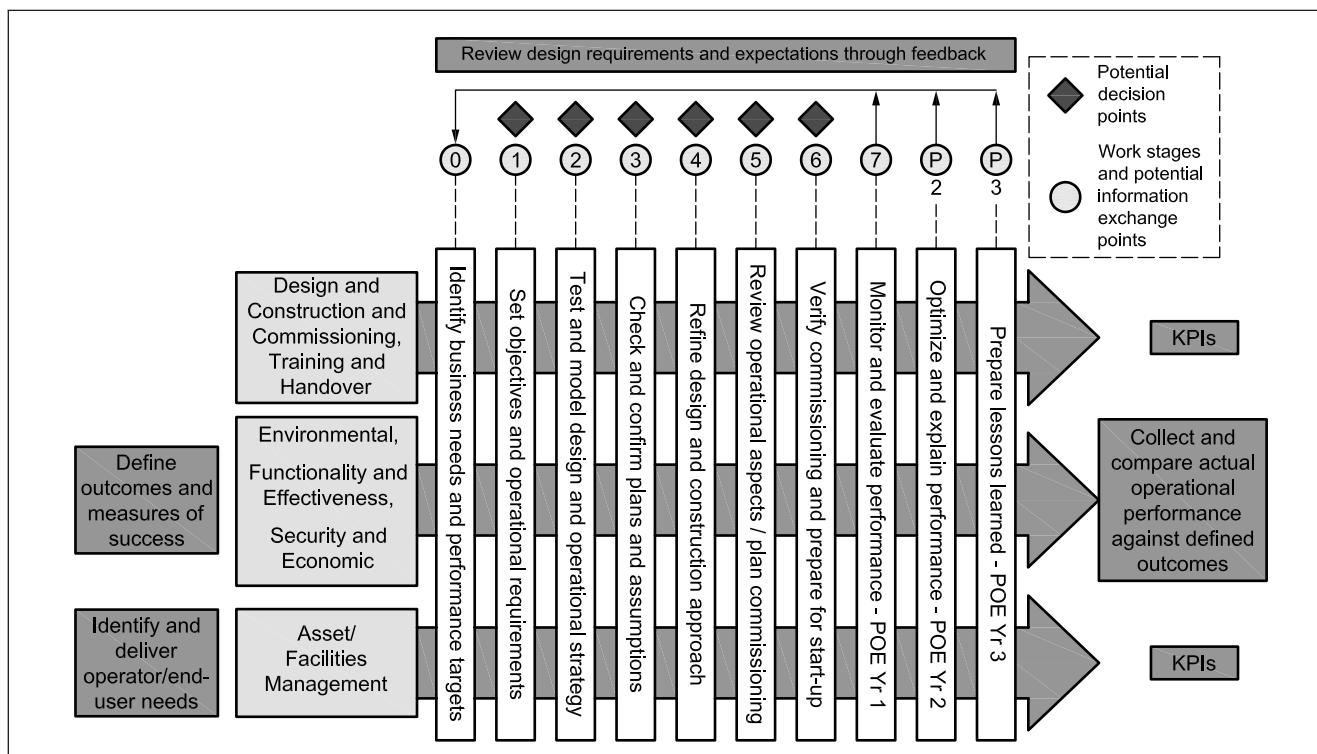


Figure 2 summarizes the overall approach in which design requirements and expectations are reviewed through continual feedback. Progression should be conditional upon satisfying defined criteria relating to operational requirements and the expected environmental, social (i.e. functionality and effectiveness), security and economic performance outcomes for the asset/facility (see 4.3).

Figure 2 Overall approach highlighting the importance of performance reviews and feedback



4.6 Roles and responsibilities

4.6.1 General

The owner should ensure that there is a clear governance structure with defined roles and responsibilities that are resourced by personnel with the appropriate level of competence, skills and experience.

The appointment of the design and construction team and the operator, operations team or facility manager, as appropriate, should be made having regard to the need to establish the clearest possible understanding of the respective parties' duties and obligations from the outset of the project. The incorporation of periods of aftercare within the Operation and End of life work stage will extend the traditional involvement of the design and construction team and so the owner should be explicit about the particular commitments this will entail from all parties affected. The appointment of the operator, operations team or facility manager, as appropriate, should be made before any decision is reached on whether or not to proceed with the project. Where this is impractical, the owner should ensure that expertise on asset/facilities management is available so that operational requirements and the expected performance of the asset/facility form an integral part of the decision making.

NOTE 1 PAS 91 provides detailed guidance on the prequalification of appointees.

There should be, from the outset of the project, an explicit working approach that requires agreement between the various parties on the work activities and their timing, with the associated information requirements and deliverables. The basis upon which decisions will be made should be clearly defined and communicated to all parties from the earliest practicable moment. This task can be greatly assisted if the owner is proactive in ensuring that the roles and responsibilities of the parties are properly defined and communicated.

NOTE 2 Defining and managing the organizational information requirements (OIR), the employer's information requirements (EIR) and the built asset security information requirements (BASIR) are important considerations (see PAS 1192-3, PAS 1192-2 and PAS 1192-5 respectively).

NOTE 3 Agreeing the working approach and the basis of decisions up front is likely to avoid inefficiencies and reduce the potential for conflict between the parties.

Where the asset/facility is sensitive or the owner has decided to implement more than baseline security measures, advice/guidance should be sought from the built asset security manager on all security aspects related to the design, construction and operation of the asset/facility and the protection of asset/facility information and data (see PAS 1192-5).

4.6.2 Owner

COMMENTARY ON 4.6.2

Soft landings [1] and [2] is intended to assist owners and operators in getting the best out of their new or refurbished asset/facility by providing a unified approach for addressing outcomes from an integrated process of briefing, design and delivery of the asset/facility. It aligns with energy performance criteria, building logbooks, building manuals, green leases and social responsibility. The emphasis is upon greater involvement of the design and construction team with the operations team (or with the facility manager) acting on behalf of the owner and/or operator and end-users before, during and after completion of construction, with the aim of improving operational readiness in the expectation of a flawless start-up and sustained operational performance in use. Much of the information required to support soft landings is already collected in the normal course of delivering a project. Where soft landings has been adopted, the owner would be expected to nominate a soft landings champion with responsibility for ensuring that it is developed to suit the project throughout design and construction and into operation of the asset/facility.

The owner should appoint a person whose principal task is to ensure that design and construction is planned and controlled to enable a smooth transition into operation and for the defined periods of aftercare.

NOTE 1 This person might be referred to as the “soft landings champion”, the “owner’s representative” or by some other term at the owner’s discretion. The term “owner’s representative” has been adopted in this standard (see 4.6.3).

The appointed person should be expected to have first-hand working knowledge of the owner’s organization and an understanding of the asset’s/facility’s future. Where an existing asset/facility is to be refurbished, the owner’s representative should have an understanding of its history.

NOTE 2 There is the chance that the owner’s representative might be seen as a project manager. For clarity, a project manager is responsible for delivering the asset/facility to an agreed scope, schedule and cost/budget and, normally, has no involvement or interest once the project has been delivered and the asset/facility is operational. Similarly, a facility manager would likely have little expertise and limited interest in the project’s delivery, other than to ensure that the asset/facility, once delivered, performed as required. There is, therefore, the need for a person who possesses a broader, more integrated understanding of the combined project delivery and asset/facilities management process than either of the aforementioned.

The owner should appoint an integrated design and construction team to ensure there is an emphasis on collaborative working based on shared responsibilities and goals that are aligned with those of the owner and the operator, where the latter is a separate entity (see 4.6.4), and/or the operations team. The owner, or the owner's representative, should determine the composition of the design and construction team. Consideration should be given to the breadth and depth of competences, skills and experience needed in the project through each successive work stage from Strategy through to Operation and End of life, maintaining continuity of purpose in regard to the owner's business objectives throughout (see 5.1.1). The team should be extended by the owner to include personnel from the operations team or, where no such arrangement presently exists, a facility manager should be appointed to ensure that operational requirements and performance outcomes (see 4.3) are taken into account in each work stage.

4.6.3 Owner's representative

The owner's representative should be appointed by the owner for the whole period from the Strategy and into the Operation and End of life work stage to provide continuity of purpose and consistency of approach. The owner's representative should report to the owner and may consult with the representative(s) of end-users or other key stakeholders as determined by the owner.

The role of the owner's representative should be to maintain the focus of all parties on the required project outcomes and operational performance, as well as on an evidence-based approach during all work stages from Strategy through to Operation and End of life. The day-to-day role of the owner's representative should not be delegated to another party.

The role should include regular reference to the schedules or equivalent documentation that identify the work activities of the design and construction team with their associated information requirements and deliverables. The owner's representative should facilitate input from the operator, operations team or facility manager, as appropriate, and end-users to the work of the design and construction team. The owner's representative may communicate directly with the designated manager for the construction work. The owner's representative should liaise with the owner's built asset security manager, where one has been appointed, to ensure that the owner's security requirements are fulfilled.

The owner's representative should ensure that the following are achieved, as a minimum:

- a) establishment of the expected project outcomes and operational performance for the asset/facility and the operational budget (see 4.3);
- b) verification through successive work stages that the expected outcomes and performance will be met (see Clause 5);
- c) plans for commissioning, training and handover of systems and the phasing in of asset/facilities management (see 5.6, 5.7 and 5.8);
- d) post-occupancy evaluation (POE) to establish how the asset/facility is performing as expected (see 5.8.2.3.4), including measurement of actual operational performance against the required performance outcomes and targets from environmental, social, security and economic perspectives (see 4.3) based on information and data taken from reliable sources;

- e) coordination of the preparation of an advisory report during the extended period of aftercare covering the need for any corrective actions, the presentation of benchmarking data and the lessons learned (see 5.2.2.2). The advisory report should be prepared by the operator, operations team or facility manager, as appropriate, with input from the design and construction team where required (see 5.8.5); and
- f) adoption of a security-minded approach by the operator, operations team and facility manager, as appropriate, to the design, implementation and operation of the AIM and the owner's information management system.

4.6.4 Operator, operations team and facility manager

COMMENTARY ON 4.6.4

The owner might be the operator of the asset/facility or another party might fulfil this role. In either case, it is important that the interests of the operator are taken into account from the outset. This interest extends to the needs of the end-users of the asset/facility. In a larger organization, an operations team, facility management team or, perhaps, a facility manager is responsible for the asset/facility on a day-to-day basis, including its maintenance. In a smaller organization, there might not be any equivalent provision. Nonetheless, someone has to provide expertise on operational matters and that might have to fall to a consultant engaged for this purpose. This person is necessary to provide comment and advice on the implications of design and construction proposals from an operational perspective as they are developed from the Strategy through to the Handover and Close-out work stage.

The operator, operations team or facility manager, as appropriate, should be given authority by the owner to contribute information and data concerning the operational strategy and operational requirements, including performance outcomes and targets, operational costs and budgets, and the procurement of facility-related services where appropriate (see BS 8572). The owner might agree that such contributions are channelled through the owner's representative or they might be communicated directly to the design and construction team. In the latter case, the design and construction team should ensure that contributions are duly recorded and made available within the team. A RASCI chart should be used to clarify responsibilities.

NOTE 1 Annex E gives an extract from a RASCI chart.

NOTE 2 PAS 1192-3 contains guidance on the need for the operator, operations team or facility manager, as appropriate, to identify the owner's information requirements, referred to as the employer's information requirements (EIR) in PAS 1192-2 (see 4.9.1).

NOTE 3 PAS 1192-5 contains guidance on the need for a security-minded approach to asset/facilities management and the need for the owner to set out a security strategy and security management plans for the asset/facility.

4.6.5 End-users

COMMENTARY ON 4.6.5

The users of the asset/facility are a key stakeholder group and can include occupants, visitors and external customers among others. They are collectively referred to as "end-users", because they are generally the ultimate beneficiaries of the services provided by the asset/facility in operation.

The owner or the owner's representative should ensure that the interests and needs of the end-users of the asset/facility are taken into account through a process of stakeholder engagement (see 5.1.3). Depending on the number and diversity of end-users, the owner or owner's representative may consider it appropriate to arrange for representation on a group, rather than an individual, basis.

The collection, use and storage of personally-identifiable information and data should be handled in a security-minded manner. The views of end-users should be sought regarding the level of protection required.

NOTE Asset/facilities-related systems might contain a range of information and data about end-users, for example information regarding passes or access tokens and emergency contact details.

4.6.6 Design and construction team

COMMENTARY ON 4.6.6

An integrated, collaborative approach to design and construction is necessary to assure both the buildability of the design and the operational performance of the asset/facility. The term “design and construction team” is used throughout the standard to refer to the combined, collaborative efforts of the many disciplines that can be needed to assist in transforming the owner’s business objectives into an operational asset/facility. An integrated design and construction team reduces the likelihood of “silo working”, reducing the prospect of errors and omissions. Whilst subcontractors and others in the supply chain can be regarded as an integral part of this team, particular requirements in regard to the former warrant additional consideration (see 4.6.7).

The design and construction team should support the role of the owner’s representative in pursuing an operational asset/facility that meets agreed performance outcomes and targets. The design and construction team should nominate a person from within its body to be responsible for coordinating all transition-related activities with the owner’s representative.

The design and construction team should ensure that roles and responsibilities for the project are aligned to defined work activities, with their associated information requirements and deliverables. Responsibility assignment matrices (e.g. RASCI charts) should be prepared for this purpose by the design and construction team and their format should be approved by the owner’s representative. Each RASCI chart should be updated as necessary in each work stage and in readiness for the subsequent work stage (see Clause 5). RASCI charts should be coordinated with an organization chart for the project prepared by the design and construction team to show reporting/communication between all parties within the project delivery organization, with interfaces to external entities and other key stakeholders as appropriate. Design responsibility matrices should complement the use of RASCI charts by providing a focus on assigned design responsibilities, the level of detail and the level of information exchanged (see 4.9.4).

NOTE 1 Annex E gives an example RASCI chart and a design responsibility matrix.

The design and construction team should advise the owner, or the owner’s representative, of the need for any additional competences, skills and experience required in the team as soon as it becomes apparent. Where the building services engineering systems are complex, the owner should consider the appointment of an independent commissioning manager if not already appointed. The commissioning manager should be appointed early in the project’s life. Where there is a known or perceived security threat to the asset/facility, the owner should consider the appointment of a security manager, if not already appointed, at the outset of the project.

NOTE 2 PAS 1192-5 outlines a security triage process which an owner can use to establish the level of security-minded approach required for its asset/facility and associated information and data, and any asset/facility information and data it might hold regarding neighbouring assets/facilities.

4.6.7 Subcontractors, specialist suppliers and manufacturers

COMMENTARY ON 4.6.7

In the course of delivering a new or refurbished asset/facility, much work devolves to subcontractors, specialist suppliers and manufacturers. This standard anticipates such an arrangement. The success of the transition from design through construction and into operation depends on the effective integration of the supply chain covering all of the entities necessary for delivering the operational asset/facility. The management of multiple organizational, technical and contractual interfaces between these entities is part of the task and is a factor in that success. Subcontractors have a pivotal role in the sense of standing between the designers and construction managers and the manufacturers and suppliers of myriad materials, products, components and systems. It is essential that subcontractors are effectively integrated into the approach to be taken, including the work activities, information requirements and deliverables in each work stage.

As far as practicable, subcontractors, suppliers and manufacturers should adopt an approach that supports the key principles (see 4.1) throughout all work stages in which they are involved. Each subcontractor, supplier and manufacturer, where appropriate, should identify its contact person for the purpose of transition and inform the transition coordinator (see 4.6.6) within the design and construction team. The contact person should attend meetings of the design and construction team, when requested, to present proposals concerning the respective parties' work, including details of the operational requirements of systems, equipment, controls and user interfaces, as appropriate.

Subcontractors may be retained to assist the owner and other members of the design and construction team during handover and to monitor performance during start-up and operation of the asset/facility. Subcontractors may be based on site full-time during an initial period of aftercare to assist with end-user queries and to undertake periodic fine-tuning of systems as needed. In this case, the owner, or the owner's representative, should make these requirements clear and ensure that they are embodied in the scope of work and subsequent agreements with these identified subcontractors.

NOTE PAS 91 provides detailed guidance on prequalification for construction tendering.

Subcontractors identified by the owner might be required to provide support for an extended period of aftercare, in which case the roles and responsibilities should follow those required in the Operation and End of life work stage (see 5.8.2.3).

Subcontractors should be required to contribute their specialist information to the common data environment (CDE) (see BS 1192:2007, PAS 1192-2, PAS 1192-3 and PAS 1192-5). Depending on the security requirements of the owner, any subcontractor supplying specialist information relating to sensitive aspects of an asset/facility should follow the owner's security policies, processes and procedures regarding the creation, use, storage and disposal of asset/facility information.

4.7 Collaboration and alignment

COMMENTARY ON 4.7

The purpose of "design and construction for operability" is to align the interests of those who design and construct an asset/facility with those who subsequently operate and use it. Success will be due, in large part, to a collaborative approach between the various parties, but also to monitoring and verifying the alignment of the design and the work of the design and construction team with the project's expected outcomes and the operational performance requirements for the asset/facility.

The owner should ensure that the design and construction team understands the necessity of a collaborative approach to its work and the importance of active engagement with the owner's representative and the operator, operations team or facility manager, as appropriate. The design and construction team should provide evidence of its approach in the form of a schedule of work activities, with their associated information requirements and deliverables, for each work stage (see Clause 5). This should take the form of a responsibility assignment matrix (e.g. a RASCI chart) to cover the work activities with their associated deliverables for each work stage. This should be supplemented by a design responsibility matrix covering assigned design responsibilities, the level of detail and the level of information exchanged (see 4.9.4).

NOTE 1 Annex E gives an example RASCI chart and a design responsibility matrix.

The design and construction team should obtain early input on the operator's, end-users' and other key stakeholders' interests and needs, which should be assisted by the owner's representative who should prepare a plan for stakeholder engagement (see 5.1.3). End-users, or their representative(s), should be allowed to express their views in an environment that is conducive to obtaining an honest and accurate understanding of their needs.

An aim should be to establish clear measures and targets for environmental, social, security and economic outcomes. In the case of social outcomes, these should cover, as a minimum, functionality and effectiveness (e.g. uses, space, internal environment, usability, inclusiveness, durability, adaptability, maintainability and safety) and environmental outcomes should cover energy performance, in particular energy use and CO₂ emissions, water consumption and waste reduction. Security outcomes should focus on the practical steps to be taken to reduce the risk of loss, compromise or disclosure of information and data about sensitive aspects of the design, construction or operation of the asset/facility. Economic outcomes should focus on capital, operational and whole-life costs as early as possible and, thereafter, should focus on ways in which costs might be reduced without suffering a loss of functionality or effectiveness. All performance outcomes and targets should be, as far as practicable, subject to monitoring and verification through all work stages.

NOTE 2 The adoption of value improving practices, if properly controlled, can assist in identifying functions that add cost but no value for the owner and then eliminating them. Value engineering is a common and proven methodology for this purpose. It is important, however, to ensure that value engineering is a genuine attempt to seek value improvement, which implies a relationship between cost and quality, and is not simply a cost-cutting exercise. The adoption of whole-life costing can be similarly regarded as a value improving practice, as can applying lessons learned.

Commissioning, training and handover should be planned jointly by the design and construction team and the operations team, overseen by the owner's representative, to ensure operational readiness, flawless start-up and, subsequently, early optimization of operational performance (see 5.6 and 5.7). End-users, or their representative(s), should be involved in this planning.

The design and construction team should be involved in post-occupancy evaluation (POE) as a process for assessing the performance of the asset/facility over at least the first three years of its operational life to establish actual outcomes and to record and share lessons learned (see 5.8.2.3.4). The POE should extend to measuring the impact of the operator's or operations team's asset/facilities management strategy on the performance of the asset/facility (see 4.4 and 5.7.7).

NOTE 3 The benefits of this approach, including post-occupancy evaluation (POE), are seen in terms of optimized operational performance of the asset/facility within the operational budget as soon as possible and the alignment of operational performance with the required performance outcomes set prior to the start of design and construction. Achievement of the required outcomes could be regarded as an indication of the operator's and end-users' likely satisfaction with the asset/facility and offers some assurance with respect to operational cost.

The owner's representative should ensure that operational input is a continual, but controlled, contribution during design and construction work to ensure that the design of the asset/facility is subject to evaluation from an operational perspective. A design review protocol should be used to support this work together with an information exchange plan (see BS 1192-4). The design and construction team should respond on matters of alignment of the developing design with the expected outcomes, changes to the design that have been necessary and the extent to which performance targets for the operational asset/facility are likely to be met. Confirmation of the associated capital and operational costs should be provided by the design and construction team, with input from the operator, operations team or facility manager, as appropriate, at points defined for each work stage for the purpose of information exchange (see PAS 1192-2, PAS 1192-3, BS 1192-4, PAS 1192-5, 4.9.4 and Clause 5).

4.8 Risks and opportunities

The risks and opportunities that could affect the realization of the value and performance of the asset/facility should be systematically assessed and managed in each work stage. This assessment should be undertaken periodically to identify any condition or event that could impact negatively or positively on the operation of the asset/facility and the actions needed to manage them. The assessment should include identification and analysis of downside risk events and upside opportunities, responses to risk events and the controls to be applied. Account should be taken of the operator's and end-users' interests in the asset/facility when identifying and assessing risk and opportunity. Details of such events and action arising should be recorded in a risk and opportunity register and reflected in the estimates of capital cost and operational cost and the project schedule.

NOTE 1 Downside risks are factors that can have a potentially negative impact on the asset/facility, such as hazards faced in the construction work. Upside risks are factors that can add value to the outcome and are more commonly referred to as "opportunities". The latter might arise from a re-examination of the scope of work against the business and project objectives, e.g. changes to take advantage of more energy-efficient technology.

NOTE 2 PAS 1192-5 includes both a security triage process for assessing the level of security-minded approach required, based on the overall risk, and a risk management process for assessing security risks throughout the asset's/facility's life cycle. These processes support a holistic approach to the production and maintenance of a security risk management strategy. They are not a one-off exercise, but are intended to be repeated at various points through the life cycle and when certain trigger events occur.

A risk and opportunity register should be established and maintained from the outset and is one of the deliverables in the Strategy work stage (see 5.1). It should be used to record any identified downside risks and upside risks (opportunities), an assessment of their potential impact and the likelihood of their occurrence. For downside risks, actions should be explored to reduce or avoid their potential impact. For upside risks, actions should be explored to realize or enhance the improvement. The risk and opportunity register should be kept up to date throughout all work stages so that it reflects the current situation and should be used as part of the process of gathering lessons learned.

NOTE 3 A risk and opportunity register formally records conditions or events, which could threaten or improve outcomes, to be taken into account in risk assessment or risk analysis. The register is not simply a repository, but a tool to help gain a current understanding of conditions or events and the risks and/or opportunities they represent.

NOTE 4 Annex F provides an example of a risk and opportunity assessment.

NOTE 5 The likelihood of cyber attacks occurring and the severity of cyber security threats to the owner's information management systems and the CDE are constantly changing as new vulnerabilities to IT systems and software applications emerge. By maintaining situational awareness of vulnerabilities and potential threats, the owner and operator, operations team or facility manager, as appropriate, can maintain a current understanding of the overall threat environment and the need for any changes to the security-minded approach.

4.9 Information requirements

4.9.1 Employer's information requirements (EIR)

COMMENTARY ON 4.9.1

The employer's information requirements (EIR) set out the information to be delivered, and the standards and processes to be adopted by the design and construction team, including its supply chain, as part of the project delivery process. The information requirements as set out in the EIR are intended to provide enough information to answer the "plain language questions" required at a particular work stage at an appropriate level of detail (see 4.9.3). The EIR would be expected to include the following as a minimum: a) information management; b) commercial management; c) security management (see PAS 1192-5); and d) competence assessment. The EIR would normally exist as a self-standing document, cross-referenced to other documentation used across the work stages. It does not, however, expressly consider the information that the design and construction team or the operator or operations team might need from the owner.

The owner should define its requirements adequately and clearly in terms of the information to be delivered by the design and construction team and its timing, and the standards and processes to be adopted in this regard. The points at which information exchanges are required should be specified in the EIR by reference to the applicable work stage and decision gate (or point) (see 4.5). PAS 1192-2, BS 1192-4 and PAS 1192-5 provide detailed guidance in this regard. The EIR may incorporate a schedule of plain language questions (see 4.9.3).

NOTE 1 PAS 1192-5 provides guidance on the creation of a security management regime and the need to develop security information requirements that inform the development of both the EIR and the asset information requirements (AIR).

NOTE 2 BS 1192-4 provides guidance on a common structure for the exchange of information, i.e. COBie, to ensure that information can be reviewed and validated for compliance, continuity and completeness.

A closely-related document is the brief, which should be used as a basis for developing and, subsequently, for evaluating design and construction proposals (see 5.5.7). The brief should be delivered in a digitally-checkable form supplemented by the EIR.

4.9.2 Asset information requirements (AIR)

The owner should define the asset information requirements (AIR) to be met in order that the organizational information requirements (OIR) can be satisfied, together with the information exchanges by which information and data are transferred to, and from, the asset information model (AIM) (see PAS 1192-3 and PAS 1192-5).

4.9.3 Plain language questions

COMMENTARY ON 4.9.3

The owner requires information from the design and construction team. Similarly, the design and construction team requires information from the owner and the operator, operations team or facility manager, as appropriate, in order to perform its work and to contribute effectively to the outcomes expected by the owner. This communication is best handled through a structured information exchange, where all questions are framed in plain language, with the answers recorded and shared within the design and construction team and with the operator, operations team or facility manager, as appropriate. The efficiency of this process depends to a large extent on the clarity with which questions are put by the owner, or to the owner, how the subsequent answers are interpreted and how the decisions that arise from them are implemented. This often involves confirming understanding then recording details in the owner's information management system, including the relevant parts of the project information model (PIM).

Plain language questions should be drafted for each work stage for the purpose of obtaining information to enable decisions to be taken in a timely and effective manner, including the key question of whether or not to proceed to the next stage. The purposes for which information is required should be stated. The information required to answer questions, and any clarification or confirmation arising, should be delivered at the appropriate information exchange point (see PAS 1192-2, PAS 1192-3 and PAS 1192-5).

NOTE There is a crossover from plain language questions to EIR and vice versa (see 4.9.1). Annex G gives example plain language questions to be asked of the owner by the design and construction team.

4.9.4 Building information modelling (BIM)

The use of building information modelling (BIM) in general and the creation and management of a project-specific building information model in particular should be seen in the wider context of the owner's information management system. The owner should take steps to ensure that there is sufficient information technology in place to support "Level 2 BIM", where this is to be adopted.

The owner, or the owner's representative, should consider the following requirements with respect to BIM:

- a) the common data environment (CDE) to be used – BS 1192:2007, PAS 1192-2, PAS 1192-3 and PAS 1192-5 provide guidance in this regard;
- b) details of information required from the project delivery team to support optimal operational performance of the asset/facility – PAS 1192-3 and PAS 1192-5 provide guidance in this regard;
- c) the format and means for information exchange – COBie may be used for this purpose – BS 1192-4, PAS 1192-2, PAS 1192-3 and PAS 1192-5 provide guidance in this regard;

NOTE 1 COBie provides a common structure for the exchange of information and ensures that information can be reviewed and validated for compliance, continuity and completeness.

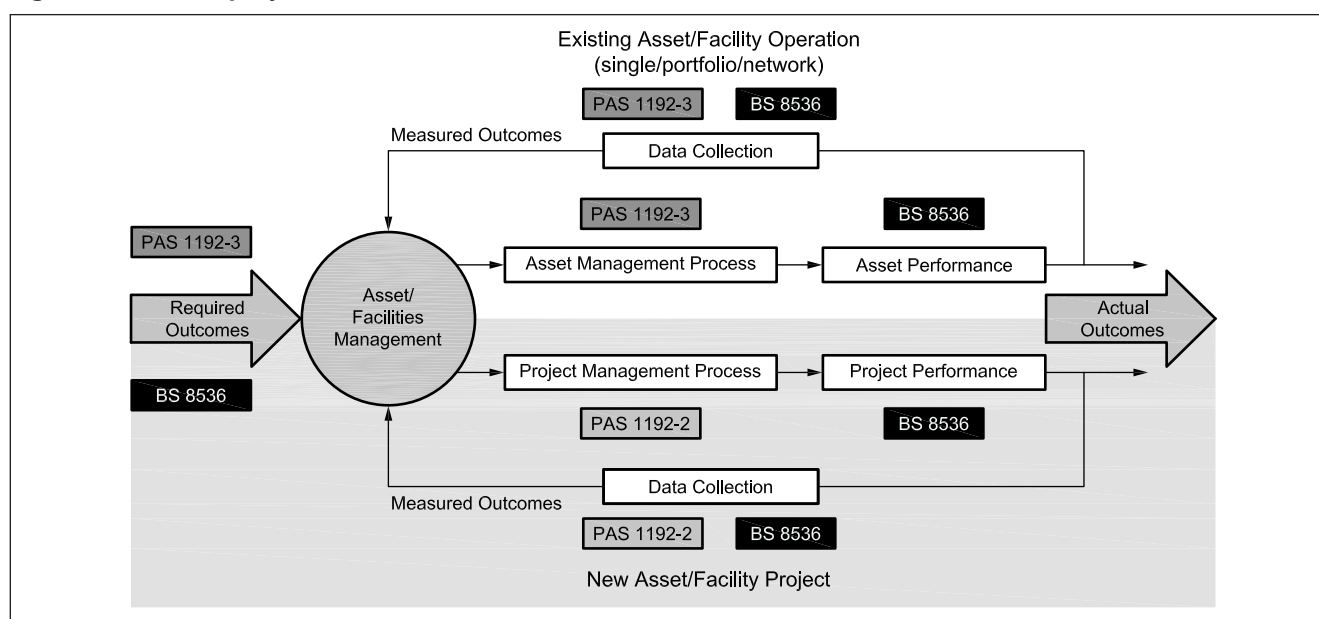
- d) the structure and format of the asset information model (AIM) that will receive the content from the project information model (PIM) – PAS 1192-3 and PAS 1192-5 provide guidance in this regard;

- e) details of how content from the project information model (PIM) is to be transferred into the owner's asset information model (AIM) – PAS 1192-2, PAS 1192-3 and PAS 1192-5 provide guidance in this regard;
- f) requirements, policy, processes and procedures for the security of information and data, including the management of access both physically and digitally – PAS 1192-5 provides guidance in this regard; and
- g) software to be used to meet operational and security requirements such as the owner's defined enterprise system (see PAS 1192-3 and PAS 1192-5), a computer-aided facilities management (CAFM) system or other means – BS 8587 provides guidance in the latter regard.

NOTE 2 PAS 1192-5 specifies the processes which will assist an organization in identifying and implementing appropriate and proportionate measures to reduce the risk of loss or disclosure of information and data.

NOTE 3 Figure 3 illustrates the connection between the project information model (PIM) and the asset information model (AIM) and the need for the measurement of outcomes from projects to support efficient and cost-effective asset/facilities management. The figure emphasizes the important relationship between this British Standard and those standards supporting "Level 2 BIM", namely PAS 1192-2 and PAS 1192-3. PAS 1192-5 contains further information on how security requirements can be integrated into these information models.

Figure 3 Asset-project model and feedback



4.10 Arrangement of work stages

NOTE Clause 5 that follows is structured in accordance with the work stages outlined in the plan of work (see 4.5) as the project progresses from its commencement to the operation of the asset/facility. The same or similar headings are used in each work stage, wherever practicable, to ensure consistent treatment of both guidance and recommendations. In a number of cases, the latter are broadly similar, although might contain important differences.

The users of this standard should ensure that the requirements contained in each work stage (see Clause 5) are properly considered before they are encountered and that the previous stage, where appropriate, has been concluded satisfactorily before making the transition to the next work stage. Users are advised not to omit work stages or parts of them, but to scale down the approach if it is felt that the requirements are inappropriate or in excess of reasonable needs.