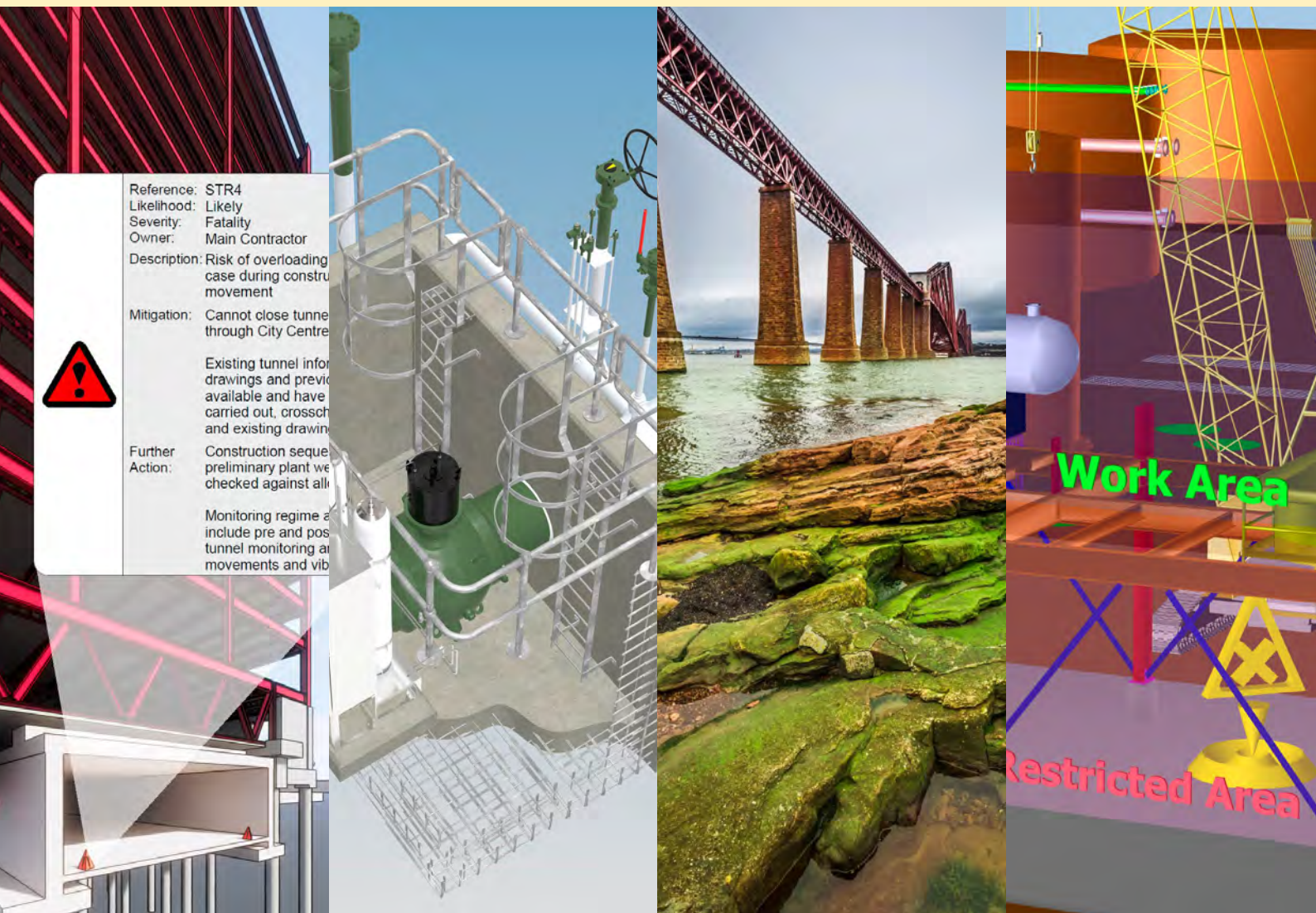


PAS 1192-6:2018

Specification for collaborative sharing and use of structured Health and Safety information using BIM



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Foreword

This PAS is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 19 February 2018.

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 It will be withdrawn upon publication of its content in, or as, a British Standard.

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

Use of this document

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 smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause J.1.1, which states, “Requirements should be expressed using wording such as: ‘When tested as described in Annex A, the product shall ...’”. This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

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.

Particular attention is drawn to the following specific regulations and their regional equivalents:

- The Health and Safety at Work etc. Act 1974 [1];
- The Construction (Design and Management) Regulations (CDM) 2015 – SI. 2015 No.52; [2];
- The Management of Health and Safety at Work Regulations (MHSWR) 1990 – SI. 1999 No.3242 [3]
- Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) [4]
- The Regulatory Reform (Fire Safety) Order, 2005 [5]
- Work at Height Regulations 2005 [6]
- Control of Substances Hazardous to Health Regulations 2002 [7]
- Control of Asbestos Regulation 2012 [8]
- The Ionising Radiations Regulations 1999 [9]
- The Dangerous Substances and Explosive Atmospheres Regulations 2002 [10]
- The Lifting Operations Lifting Equipment Regulations 1998 [11]
- The Electricity at Work Regulations 1989 [12]

Introduction

The UK Construction sector is obliged to manage and protect the occupational health and safety (H&S) of its workers and the public affected by its activities. In planning, designing and constructing buildings or infrastructure clients, designers and contractors are obliged to apply the principles of prevention and mitigate the inherent H&S risks within the constructed design solution and those hazards associated with the intended activities of the end user(s) or occupier(s).

These obligations are a requirement of the UK Health and Safety at Work etc. Act 1974 [1], the Construction (Design and Management) Regulations 2015 (CDM) [2] and other statutory instruments; and are enforced by the UK Health and Safety Executive or designated Local Authority.

H & S has always advocated the anticipation of risk, for example, the duty in CDM that designers must identify “foreseeable risk”. The increased use of digital information and modelling software applications in design development and delivery enhances the designer’s ability to anticipate, spot and foresee hazards and risks in the design. Designers can use a variety of applications which enable locations to be accurately visualized, sequences of activity to be realistically demonstrated and construction programmes simulated.

Software applications enable multi-discipline 3D models and construction programmes to be brought together to create ‘4D’ time-line models. A 4D animation can be used to review, assess and communicate construction options, hazards and risks. A 4D animation of difficult construction sequences is more easily understood by those who have to take responsibility and accountability for risk mitigation, control and management. The use of 3 D and 4D models in design supports the principles relating to an ‘inherently safer design’, ‘safety by design’ and the legislative duties on designers.

The further challenge is to document and share knowledge of these risks, throughout the lifecycle of the project, the built asset and across the wider construction industry.

The opportunity is presented in this PAS to integrate H&S information into the models, processes and applications which are common to BIM. This includes the opportunity to contribute to and benefit from wider knowledge and experience. All stakeholders can contribute to efficiently manage and mitigate H&S risks and improve outcomes, as part of the collaborative BIM process. The integration of H&S and BIM enables the output health & safety file (HSF) as part of the BIM information model to be transferred to asset owners, operators and users via a consistent integrated digital open standard format.

Risk can be identified earlier using information models, and controlled better, through collaboration around these models. This PAS is intended to support collaboration and encourage the opportunity that appropriately shared structured information can offer. Incorporated within this PAS are recommendations, potential approaches and proven techniques as to how information management, BIM processes and applications can be adopted to improve H&S standards and reduce the potential for harm.

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1 Scope

This PAS specifies requirements for the collaborative sharing of structured H&S information throughout the project and asset life-cycles.

The PAS supports the development of structured H&S information for all construction projects progressively from the outset.

The PAS provides guidance on how H&S information is produced, flows and can be used throughout the project and asset lifecycle. Whilst all H&S risk information can be included within an information model, this PAS requires the contextualization and filtering of hazards and risks to prioritize the elevated risks and aspects that are safety critical.

The PAS sets out a framework (risk information cycle) for the application of H&S information-use through BIM processes and applications. The principles and requirements of this PAS can be applied equally to non-BIM projects.

The PAS specifies how to use H&S information in order to:

- a) provide a safer and healthier environment for end-users;
- b) mitigate the inherent hazards and risks across the asset lifecycle;
- c) result in improved construction H&S performance, fewer incidents and associated impacts;
- d) provide for clearer, more assured and relevant H&S information to the 'right-people' at the 'right time';
- e) reduce construction and operational costs.

The exchange and use of H&S information is intended to support:

- 1) representation of the nature and characteristics of the project, site and built asset;
- 2) representation of H&S hazards, risks and associated factors;
- 3) the generalization, dissemination and re-use of H&S knowledge and experience.

The PAS is applicable to individuals and organizations that contribute to and influence the definition of design, construction, use (including maintenance) and end of life of a built asset.

This PAS does not define or change the duties set out in any relevant statutory provisions.

This PAS does not cover the commercial, operational or political risks nor risks which relate to the security threats associated to projects, built assets, sites or personnel.

NOTE *This PAS may be applied in conjunction with the duty holder's own management systems, policies and arrangements.*

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.

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

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

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

BS 8536-1, *Briefing for design and construction – Part 1: Code of practice for facilities management (Buildings infrastructure)*

BS 8536-2, *Briefing for design and construction – Part 2: Code of practice for asset management (Linear and geographical infrastructure)*

3 Terms and definitions

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

3.1 harm

injury or damage to the health of people, or damage to property or the environment

NOTE 1 Definition taken from ISO / IEC Guide 51:2014(E).

NOTE 2 Realization of a hazard with the potential to cause harm, to the:

- a) construction workforce;
- b) built asset operators and maintainers, and users; and/or
- c) general public.

This definition is often colloquially referenced in H&S publications and learning material.

NOTE 3 Figure 1 illustrates the relationship between harm and a hazard.

3.2 hazard

potential source of harm (3.1)

NOTE 1 Definition taken from ISO / IEC Guide 51:2014(E).

3.3 risk

combination of the probability of occurrence of harm (3.1) and the severity of that harm

NOTE 1 Definition taken from ISO / IEC Guide 51:2014(E).

NOTE 2 This includes H&S risks such as:

- known residual risks;
- temporary states and works;
- demolition, re-use and re-cycling;
- substances and materials hazardous to health;
- hazard and risk controls required by legislation;
- dangerous activities in use and in operation;
- maintenance and cleaning risks;
- critical equipment;
- emergency situations;
- functional hazards.

NOTE 3 The likelihood and consequence of incident(s) scenarios and to damage to health arising from working methods and end-user exposure may be evaluated and assessed.

3.4 mitigation

informed decisions, measures and activities undertaken to remove or manage the identified, known or perceived risks based on the general principles of prevention

NOTE 1 Attention is drawn to, Managing health and safety in construction (Design and Management) Regulations 2015 [2], Guidance on Regulation L153, Appendix 1, The general principles of prevention.

NOTE 2 See PD ISO Guide 73:2009, 3.8.1, definition of risk treatment.

NOTE 3 Figure 1 illustrates the opportunities for mitigation in the likelihood arising from risk sources associated to a hazard and the mitigation of the subsequent consequences.

3.4.1 agreed mitigation

actions and changes to mitigate a risk that have been agreed and incorporated

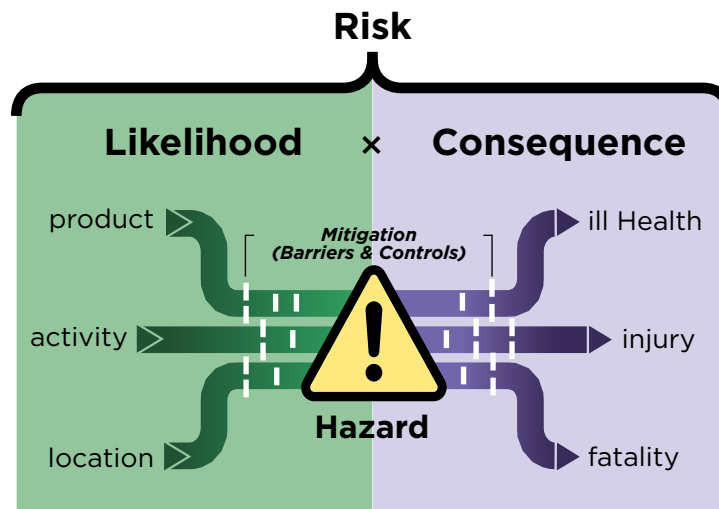
3.4.2 proposed mitigation

actions and changes to mitigate a risk that are proposed but have not been agreed or incorporated

NOTE 1 Action or change under discussion, under review, or that may require input from others; includes options and alternatives.

NOTE 2 Mitigation (barriers or controls) can operate either on the likelihood of a hazard being realized, or on the consequences of that realization being harmful.

Figure 1 – Mitigation of likelihood and of consequence



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3.5 risk management task

specified or required task, or series of tasks, undertaken to examine and act on specific H&S information and/or risk(s) as part of a project delivery strategy, or a stand-alone activity dependent on the level of the risk(s)

NOTE 1 This may be an activity, review, study or workshop with clear intentions and objectives.

NOTE 2 This may be specified by a participant as a requirement to fulfil a specific duty, expectation or deliverable within the remit of their role.

NOTE 3 For example, a client may want a specific hazard study undertaken to examine in a structured format the complex lift of a critical and costly piece of equipment with a long procurement period, seeking a high degree of certainty on a positive outcome of the task.

NOTE 4 For example, this may include specific hazard evaluation technique formats and formal safety assessments such as constructability reviews, HAZIDs, HAZOPs, HAZCONs, root cause, event bow tie analysis and others specific to particular industries.

3.6 information

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

NOTE 1 Definition taken from PAS 1192-2:2013.

3.6.1 context information

information or information model relating to a built asset, site and/or project indicative of the level of risk to be taken as moderate

NOTE 1 It is reasonable to expect the moderate level of H&S risk may be managed and controlled effectively by those with the requisite skills, knowledge and experience.

3.6.2 risk information

information of records relating to hazards, risks, opportunities, assessments, and mitigations

NOTE 1 Risk information should inform H&S risk information, and vice versa.

NOTE 2 Risks should be tagged to enable specific H&S risks to be extracted for identification, use and communication.

NOTE 3 Pre-construction information (PCI) is a set of information to improve risk management associated to the project lifecycle. Definition taken from, Managing health and safety in construction, Construction (Design and Management) Regulations 2015 [2], Guidance on Regulation L153, Appendix 2, Pre-construction information - information about the project that is already in the client's possession or which is reasonably obtainable by or on behalf of the client. PCI provides the H&S information needed by those preparing for a construction project to fulfil their CDM duties and obligations.

NOTE 4 Construction phase plan (CPP) is a set of information to improve risk management in the construction phase. Definition taken from, *Managing health and safety in construction, Construction (Design and Management) Regulations 2015 [2], Guidance on Regulation L153, Appendix 3, The construction phase plan*; the plan should record the arrangements for managing the significant health and safety risks associated with the construction phase of a project. It is the basis for communicating these arrangements to all those involved in the construction phase.

NOTE 5 Health and safety file (HSF) is a set of risk information related to the built asset. Definition taken from, *Managing health and safety in construction, Construction (Design and Management) Regulations 2015 [2], Guidance on Regulation L153, Appendix 4, The health and safety file*; The health and safety file is defined as a file appropriate to the characteristics of the project, containing relevant H&S information to be taken into account during any subsequent project. The file should contain information about the current project likely to be needed to ensure health and safety during any subsequent work, such as maintenance, cleaning, refurbishment or demolition.

3.7 risk source

entity which alone or in combination has the intrinsic potential to give rise to risk

NOTE 1 Definition taken from PD ISO Guide 73:2009 ISO GUIDE 73:2009(EIF).

NOTE 2 The entity may be taken as a causal factor of an identified hazard.

3.7.1 product association

source associated to the hazards and risks of a physical product (including elements and components of a product and prefabrications), material or substance, system or production processes

3.7.2 activity association

source associated to an activity, procedure, job or task, project or work packages

3.7.3 location association

source associated to a place, location, route, space, zone, level, region or site

3.7.4 quality association (latent defect)

source associated with a potential for failure resulting from works as built or materials used not fulfilling the design intent or specification

NOTE Other source associations include hazards referenced by legislation and consideration of changing risks during an emergency event and response.

3.8 risk analysis

systematic use of available information to identify hazards and to estimate the risk

NOTE Definition taken from ISO / IEC Guide 51:2014(E).

3.8.1 likelihood

chance of something happening

NOTE 1 See Figure 1.

NOTE 2 Definition taken from ISO / IEC Guide 51:2014(E).

NOTE 3 This may depend on risk sources such as location, physical and process entities and may be affected by the number of opportunities for the hazard to be realized.

3.8.2 consequence

outcome of an event affecting objectives

NOTE 1 See Figure 1.

NOTE 2 Definition taken from ISO / IEC Guide 51:2014(E).

NOTE 3 Particularly ill-health, injury or fatality; it may be affected by the number of realizations of the hazard.

3.8.3 level of risk

magnitude of risk or combinations of risks, expressed in terms of the combination of consequences and their likelihood

NOTE Definition taken from ISO / IEC Guide 51:2014(E).

3.8.4 risk matrix

tool for ranking and displaying risks by defining ranges for consequence and likelihood

NOTE 1 Definition taken from ISO / IEC Guide 51:2014(E).

NOTE 2 See ISO 31010, for other tools and Table 3 for consequences-probability matrix.

3.8.5 elevated risk

risk whose information is shared because of its exceptional nature or raised level given the agreed mitigation and context of the project

NOTE 1 This includes risks judged to:

- a) have potential consequence of single or multiple fatality, life changing or serious injuries, long lasting detriment to physical health, mental health and well-being
- b) be not obvious to a competent and experienced participant or outside of normal expectations
- c) remain a concern because of its potential occurrence within the asset lifecycle.

NOTE 2 Information about other risks, typically those below 'moderate', may also be shared

3.9 asset lifecycle

full life of an asset including creation, operation and use, maintenance and decommissioning or disposal

NOTE 1 See ISO 55000.

3.10 project lifecycle

phases of a construction project up to and including handover

NOTE The project lifecycle refers to the eight stage plan of work as defined in BS 8536-1 or BS 8536-2.

3.11 participant

person or entity fulfilling an active role in the use and sharing of H&S information and the risk management process

NOTE 1 See Clause 6.

NOTE 2 This PAS requires each participant to take into account H&S and risk management across the asset lifecycle.

NOTE 3 This PAS works in conjunction with the obligations placed on CDM duty holders with regard to construction projects.

NOTE 4 This PAS works in conjunction with the obligations placed on MHSWR duty holders with regard to business activities.

3.11.1 client

individual or organization commissioning a built asset

NOTE 1 Definition taken from PAS 1192-2:2013.

NOTE 2 The client may not necessarily be the end-user.

3.11.2 designer

any person who prepares or modifies a design relating to the construction, commissioning and use of the proposed built asset

NOTE 1 Where applicable and in accordance with CDM, a designer should be appointed as the Principal Designer.

NOTE 2 The definition of designer set out in CDM, Regulation 2 Interpretation, applies. This typically ranges from, but is not limited to, industry domain experts advising the client, architects, engineers (structural, civil, electrical, water, mechanical, materials, climate control, security) to temporary works and systems, and those who design testing and commissioning strategies and techniques.

3.11.2.1 design team

designers working in an integrated and collaborative approach to assure the constructability of an inherently safer design and safe functional performance of the asset

NOTE 1 Definition abridged from BS 8536-1:2015 and BS 8536-2:2016.

NOTE 2 Design management and coordination roles, and the CDM Principal Designer, should be included within the context of a design team.

3.11.3 contractor

any person who carries out, manages or controls construction work

***NOTE 1** Where applicable and in accordance with CDM, a contractor should be appointed as the Principal Contractor.*

***NOTE 2** The definition of contractor set out in CDM, Regulation 2 Interpretation, applies.*

3.11.3.1 construction team

contractors working in an integrated and collaborative approach to assure the safe build and functional performance of the asset

***NOTE 1** Definition abridged from BS 8536-1:2015 and BS 8536-2:2016.*

***NOTE 2** Construction management and supervisory roles, and the CDM Principal Contractor, should be included within the context of a construction team.*

3.11.4 commissioner

responsible for the test, testing and commissioning of the built solution to ensure the completed asset functions as the design solution intended

***NOTE 1** This is often undertaken by the contractor(s), and planned, managed and coordinated by the Principal Contractor.*

***NOTE 2** Commissioning is an aspect of construction work as defined by CDM.*

3.11.4.1 commissioning team

contractors and selected manufacturers and/or suppliers working in an integrated and collaborative approach to ensure the safe testing and commissioning of the built asset

3.11.5 end-user

user of the built asset, including those who operate, maintain and clean.

***NOTE** The application of this supports those who operate, maintain and clean the asset to comply with MHSWR duties and obligations.*

4 Applying the PAS – General

4.1 Invocation

The client shall invoke this PAS through the Employer's Information Requirements (EIR) in accordance with PAS 1192-2 for the development, delivery and sharing of H&S information in a structured form for the project lifecycle, see Table 1. Where the built asset is deemed sensitive from a security perspective, whether in whole or in part, this shall be done in accordance with PAS 1192-5.

NOTE 1 *This PAS adopts a five phase approach to the project lifecycle (the need, design, construct, commission, end use) to enable application across the many and varied strategies that can be applied to projects, their contracts and commercial arrangements.*

Table 1 – Phases aligned to plan of work stages

PAS Phase	Construction Industry Council Plan of Work Stages	
Need (Initiation)	CIC 0	Strategic Definition
	CIC 1	Preparation and Brief
Design	CIC 2	Concept Design
	CIC 3	Developed Design
	CIC 4	Technical Design
Construction	CIC 5	Construction and Commissioning
Commissioning	CIC 6	Handover and Close-Out
End-use	CIC 7	In-Use (including maintenance and replacement)

NOTE 2 See BS 1192-4 and BS 8536-1.

The other participants shall use the BIM Execution Plan (BEP) (see PAS 1192-2) or other information plans to invoke or accept this PAS for the development, delivery and sharing of H&S information.

NOTE 3 *This PAS applies to adaption, decommissioning and demolition of a built asset [CDM] by considering these as a distinct construction project.*

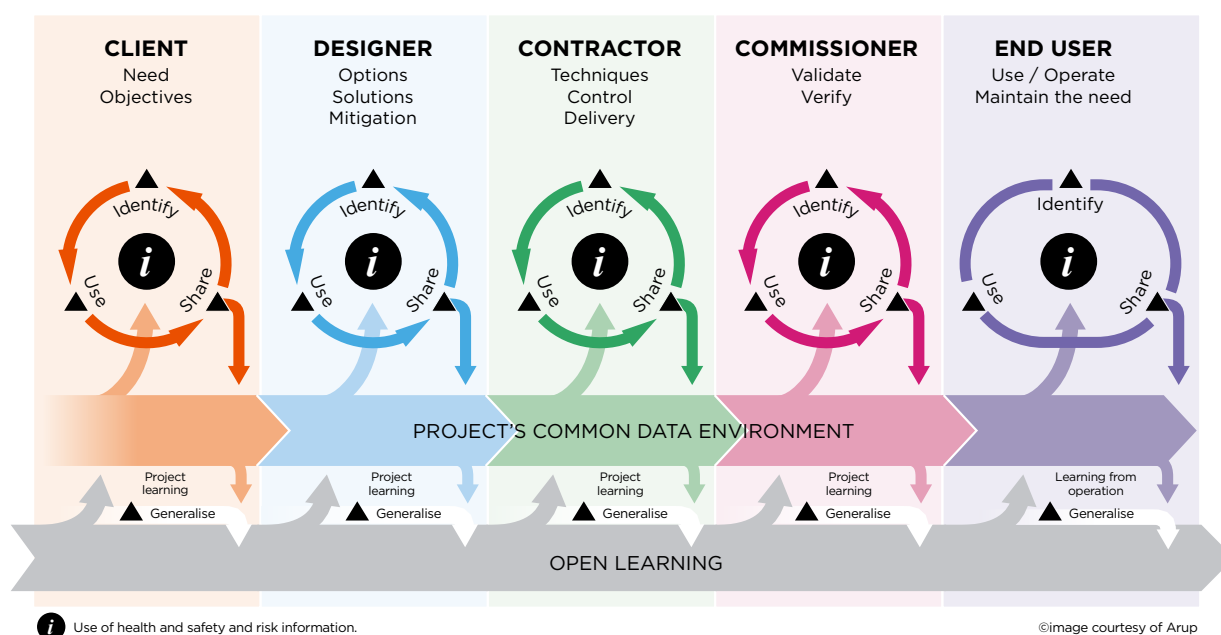
4.2 Operation

This PAS is structured to enable each participant (3.11) to, and accordingly each participant shall:

- adopt a H&S risk management strategy across the project lifecycle (see Clause 5);
- generate, use and share H&S information based on requirements, expectations and deliverables specific to each participant's role (see 6.1 to 6.5); and
- populate relevant and structured H&S information models of the project and built asset (see Clause 7) using consistent information exchange formats (see Clause 8, 9 and 10).

NOTE 1 *Figure 2 models the representation of the iterative approach progressing through the project lifecycle in a collaborative manner, accessing and developing the CDE(s), whilst benefitting from and contributing to continued learning.*

Figure 2 – Progressive development of H&S Information



Each participant shall construe and apply the requirements placed against them in a manner that reflects the nature and complexity of the project, the risks involved and the contractual scope of their services.

The participant responsible for H&S information at a particular delivery phase shall manage the processes relating to the inclusion of H&S information within the project's agreed approach (BEP), and the information exchange requirements in a manner consistent with any information security policy in place.

Through the risk information cycle (see Clause 5) H&S information shall be identified, used, shared, generalized and shared within wider community.

Each participant shall conduct a gap analysis between their internal management systems, the specific requirements of the project, the information provided and requirements of this PAS. The participant shall use the findings of the gap analysis to adopt or develop bespoke delivery strategies, procedures, processes or applications that fulfil and comply with the requirements of the project and this PAS.

NOTE 2 Each participant should be mindful that H&S and information management are independent disciplines that require different skills, knowledge and experience to fulfil effectively.

4.3 Information Management

4.3.1 BIM usage

Each participant shall establish a robust structured and managed system to record H&S information throughout the asset lifecycle; enabling proactive risk management, as required in Clause 7.

NOTE 1 The system should be designed, structured and maintained to provide, or make available, H&S information, models and documents to each participant that want, or need to use, the contained H&S information at the right time during construction and at construction completion.

Where the project is implementing BIM modelling processes, protocols, tools and applications then clauses Clause 9 and 10 shall be applied, otherwise if using a structured project document management system then Clause 8 shall be applied.

NOTE 2 Information needs varies widely across construction projects and the built asset. Each participant should identify and set out only the appropriate information they require to enable collaborative and effective sharing. Information use and sharing for a simple structure for low risk use will not be of the same magnitude for a complex high hazard operational facility. Information should not be generated for the sake of it. The need for information ownership and integrity should be respected.

NOTE 3 An information model is a collective instance of related 3D and 4D models, documents, drawings and other information needed to deliver contextual information for a stage, discipline or function e.g. H&S.

Where an asset is sensitive from a physical and/or an information security perspective, H&S information shall be managed and protected in accordance with the security requirements and policy established.

NOTE 4 An information security policy should include the security arrangements for an information system. The policy should typically include authorizations of access; barriers to unauthorized access to prevent manipulation and misuse; and procedures for information back-up and recovery. The policy and its implementation should ensure H&S information on safety critical systems and equipment, elevated risks, and key risk arrangements, is available at all times, see PAS 1192-5.

4.3.2 Use of CDE

Each participant shall:

- a) input H&S information into the CDE for use by other participants throughout design, construction, in commissioning and for end use; and
- b) expand, populate and utilize the attributes within the CDE to mitigate, manage and communicate H&S aspects, risks and controls.

Each participant shall use the CDE to ensure that the risk information is SHARED with the other participants. Formal H&S deliverables shall be PUBLISHED. Superseded information shall be held as ARCHIVE.

NOTE 1 Each participant should review and evaluate all the H&S information and risk management task requirements, and maintain, input and update the CDE in compliance with the EIR and project specific BEP, see PAS 1192- 2.

NOTE 2 The early involvement of an Information Manager can significantly benefit each participant in their determination of H&S information requirements and usage through the CDE.

NOTE 3 Where the client operates a parallel Asset Information Model (AIM) CDE, information including H&S information can be SHARED and/or PUBLISHED to the client at any stage to ensure that all parties are informed with appropriate information.

NOTE 4 Consideration should be given to the access time required for H&S information:

- a) Available – immediately on-hand for use, such as for use by fire fighters or COSHH assessments relating to maintenance – in a maintained and managed document system (required immediately, or within minutes);
- b) Accessible – required for occasional use or comparison, such as measured noise levels – stored and easily recoverable through examination of structured file paths (hours to recover, where this timescale is of no consequence);
- c) Archived – required for future use, such as a structural alteration – retrievable through a document controlled recovery procedure (days to retrieve, where this timescale is of no consequence).

4.3.3 Use of entities and annotation in models and documents

Each participant shall exchange and share risk information in open standard structured forms.

Each participant shall include information associating the H&S risks with relevant risk sources:

- a) by use of structured tables (see Clause 8); and/or
- b) by creating a COBie Issue (see Clause 9); and/or
- c) by adding the risk information to physical, spatial and/or process entities or types in the model or to annotation entities in close proximity to physical, spatial and/or process entities (see Clause 10).

NOTE 1 Annotation objects should use BS ISO 3864-3 symbols in 2D or 3D. Annotation should highlight critical edges or interfaces. Colour may be used to emphasize the level of risk.

NOTE 2 Repeated risks should not be duplicated to the extent of obscuring other issues.

4.3.4 Use of attributes

Each participant shall establish all the attribute requirements necessary to enable H&S risk information to be inputted and used throughout the project lifecycle (see Clause 5). Each participant shall incorporate attributes that support automated assessment queries, risk related studies and the specified risk tasks to be undertaken.

NOTE 1 Exchange strategies should be adopted to ensure all parties can readily use the H&S information. This can help each participant, particularly at early stages of a project, identify foreseeable risks and appropriate mitigation strategies.

NOTE 2 Attributes enable automated queries to be developed to support clash detection applications, determine risk zones and durations of risk exposure; attributes enable the development of animated visualization of techniques, 3D method statements, 4D construction sequencing hazard studies, coordination of temporary works and lifting operations; and early stage look-ahead phasing of works may facilitate and enhance the process.

Each participant shall adopt the use of the 3D or 4D construction sequencing model(s) to support the development and visualization of safe methods of access and working, including implications of working at height, temporary works, exclusion zones, restricted areas and works with a permit system.

4.3.5 Use for communication and learning

Each participant shall ensure that the H&S risk information held is available throughout the asset lifecycle and is used to support planning, training, H&S inductions and risk awareness of those at risk, whilst complying with any security policy for sensitive assets.

NOTE 1 This may take the form of animations, renderings, marked-up drawings, method statements and permits and specific task plans.

Each participant shall release generalized information on lessons learnt, innovation and improved practices associated to significant matters of H&S and risk management for continued learning through their management system arrangements or information sharing protocol.

NOTE 2 Each participant may release generalized information internally in accordance with their organizational arrangements or may share externally with industry, trade or professional associations, to raise awareness and improve learning for the benefit of current and future projects.

Each participant shall develop outputs that realise the benefits of an information model relating to H&S risks.

NOTE 3 Outputs extracted during the design phase from the information model may typically be:

- a) visualization of design assumptions, sequences and preferred methods of work;
- b) visual representation and duration of elevated risks, including designed-in provisions;
- c) information models for hazard evaluation and risk studies;
- d) clash detection, including auto-assessment of hazard zones, limitations and conflicts;

- e) structured risk assessments on the proposed or completed design mitigation;
- f) design in preparation for temporary works.

NOTE 4 Outputs extracted during the construction phase from the information model may typically be:

- a) construction technique selection, including options and evaluation;
- b) digital method statements, including 3D and 4D animations;
- c) digital permit to work systems, including auto-generation based on specific risk sources;
- d) verifying safe access routes and restricted areas, including conflicts and controls;
- e) temporary works requirements and restrictions;
- f) denoting real-time danger zones; and
- g) validation of as-built information.

NOTE 5 Outputs extracted during the commissioning phase from the information model may typically be:

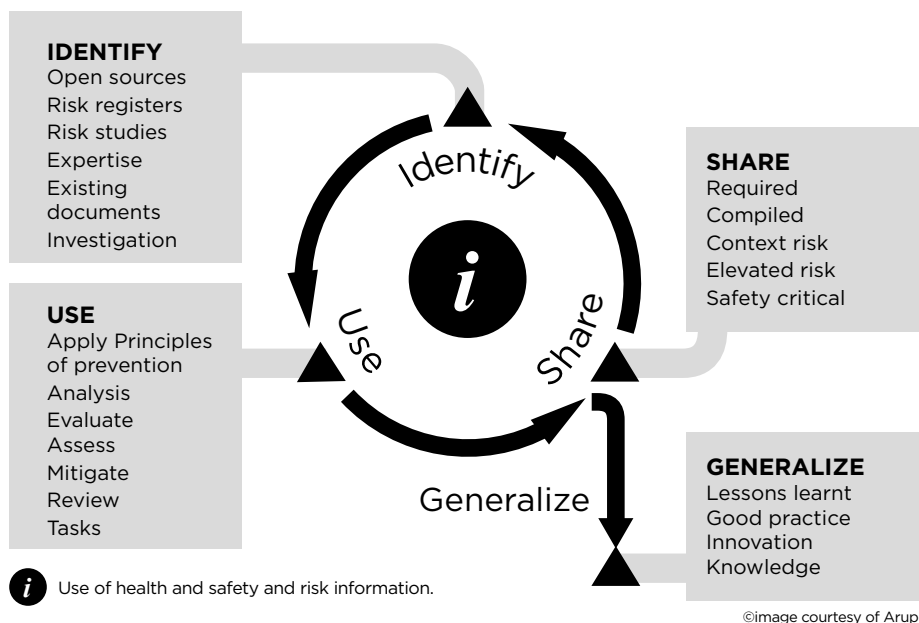
- a) digital test and commission procedures, including 3D and 4D animations;
- b) digital permit to test systems, including auto-generation based on specific risk sources;
- c) comparisons of design-intent against functional performance;
- d) denoting real-time exclusion zones; and
- e) verifying as-built information.

5 Risk Information cycle

5.1 Overview of risk information cycle

Each participant shall implement four components that provide the foundation and structure for the collaborative use of H&S risk information on a progressive, iterative and sharing basis throughout the project's lifecycle (see Figure 3).

Figure 3 – Risk information cycle



NOTE 1 Figures 4, 5, 6 and 7 expand on the four aspects of the risk information cycle and reference potential opportunities to benefit H&S.

NOTE 2 The techniques and solutions referenced in Figure 4, 5, 6 and 7, and others that evolve, are subsequently developed and become beneficial, can be applied appropriately by each participant in conjunction with the strategies and requirements as set out in Clause 6.

Each participant shall apply the four elements of the risk information cycle (see Figure 3):

- as an interface across each other – where an aspect in one has, or may in the future have, an impact in another;
- across all those associated to a project – each participant, associated project teams, project stakeholders, project management, supply chain, information management, facilities management, maintenance organizations; and
- throughout the asset lifecycle – from project outset, key project transitions, continuously.