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Organization of information about construction works — Information management using building information modelling — Part 1: Concepts and principles

Organisation des informations concernant les ouvrages de construction — Gestion de l'information par la modélisation des informations de la construction — Partie 1: Concepts et principes

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This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, SC 13, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM).*

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A list of all parts in the ISO 19650 series can be found on the ISO website.

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Introduction

This document sets out the recommended concepts and principles for business processes across the built environment sector in support of the management and production of information during the life cycle of built assets (referred to as "information management") when using building information modelling (BIM). These processes can deliver beneficial business outcomes to asset owners/operators, clients, their supply chains and those involved in project funding including increase of opportunity, reduction of risk and reduction of cost through the production and use of asset and project information models. In this document, the verbal form "should" is used to indicate a recommendation.

This document is primarily intended for use by:

— those involved in the procurement, design, construction and/or commissioning of built assets; and

— those involved in delivering asset management activities, including operations and maintenance.

This document is applicable to built assets and construction projects of all sizes and all levels of complexity. This includes large estates, infrastructure networks, individual buildings and pieces of infrastructure and the projects or sets of projects that deliver them. However, the concepts and principles included in this document should be applied in a way that is proportionate and appropriate to the scale and complexity of the asset or project. This is particularly the case where small and medium-sized enterprises are mainly appointed for asset management or project delivery. It is also important that procurement and mobilization of asset or project appointed parties should be integrated as far as possible with existing processes for technical procurement and mobilization.

The concepts and principles contained in this document are aimed at all those involved in the asset life cycle. This includes, but is not limited to, the asset owner/operator, the client, the asset manager, the design team, the construction team, an equipment manufacturer, a technical specialist, a regulatory authority, an investor, an insurer and an end-user.

The specific requirements for information management during the delivery of built assets are provided in ISO 19650-2. These are based on the concepts and principles within this document, but on its own this document includes no obligation to apply ISO 19650-2 or any other part of the ISO 19650 series to be published.

There are many different ways that asset owners/operators or clients can best meet their particular requirements or respond to their national contexts. This includes procurement routes and appointment arrangements. The concepts and principles for information management described in this document should be adopted and applied in accordance with the specific circumstances and requirements of the asset management or project delivery activities. The information requirements should specify or guide how this will be achieved and the details should be agreed in time for the requirements to be delivered efficiently and effectively.

Collaboration between the participants involved in construction projects and in asset management is pivotal to the efficient delivery and operation of assets. Organizations are increasingly working in new collaborative environments to achieve higher levels of quality and greater re-use of existing knowledge and experience. A significant outcome of these collaborative environments is the potential to communicate, re-use and share information efficiently, and to reduce the risk of loss, contradiction or misinterpretation.

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True collaborative working requires mutual understanding and trust and a deeper level of standardized process than has typically been experienced, if the information is to be produced and made available in a consistent timely manner. Information requirements need to pass along supply chains to the point where information can be most efficiently produced, and information needs to be collated as it is passed back. At present, considerable resources are spent on making corrections to unstructured information or incorrect management of information by untrained personnel, on solving problems arising from

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uncoordinated efforts of delivery teams, and on solving problems related to information reuse and reproduction. These delays can be reduced if the concepts and principles within this document are adopted.

To improve future editions of the ISO 19650 series, national asset owners, public clients and authorities are recommended to gather information and experiences about its implementation and use.

The ISO 19650 series can benefit from a formal process for managing assets, for example as in the ISO 55000 series. The ISO 19650 series can also benefit from a systematic approach to quality within an organization, for example as in ISO 9001, although certification to ISO 9001 is not a requirement of the ISO 19650 series. Other standards that relate to information structures and delivery methods are also listed in the Bibliography.

Organization of information about construction works — Information management using building information modelling — Part 1: Concepts and principles

1 Scope

This document outlines the concepts and principles for information management at a stage of maturity described as "building information modelling (BIM) according to the ISO 19650 series".

This document provides recommendations for a framework to manage information including exchanging, recording, versioning and organizing for all actors.

This document is applicable to the whole life cycle of any built asset, including strategic planning, initial design, engineering, development, documentation and construction, day-to-day operation, maintenance, refurbishment, repair and end-of-life.

This document can be adapted to assets or projects of any scale and complexity, so as not to hamper the flexibility and versatility that characterize the large range of potential procurement strategies and so as to address the cost of implementing this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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3.1 General terms

3.1.1
responsibility matrix
chart that describes the participation by various functions in completing tasks or deliverables

Note 1 to entry: A responsibility matrix can indicate accountability, consultation and informing, alongside the obligation to complete tasks or deliverables.

[SOURCE: ISO 37500:2014, 3.16, modified — The word "roles" has been replaced with "functions"; the words "for an outsourcing arrangement" have been removed; Note 1 to entry has been added.]

3.1.2
space
limited three-dimensional extent defined physically or notionally

[SOURCE: ISO 12006-2:2015, 3.1.8]

3.2 Terms related to assets and projects

3.2.1
actor
person, organization or organizational unit involved in a construction process

Note 1 to entry: Organizational units include, but are not limited to, departments, teams.

Note 2 to entry: In the context of this document, construction processes take place during the *delivery phase* (3.2.11) and the *operational phase* (3.2.12).

[SOURCE: ISO 29481-1:2016, 3.1, modified — The words "such as a department, team, etc." have been removed; Note 1 and 2 to entry have been added.]

3.2.2
appointment
agreed instruction for the provision of *information* (3.3.1) concerning works, goods or services

Note 1 to entry: This term is used whether or not there is a formal appointment between the parties.

3.2.3
appointed party
provider of *information* (3.3.1) concerning works, goods or services

Note 1 to entry: A lead appointed party should be identified for each *delivery team* (3.2.6) but this can be the same organization as one of the *task teams* (3.2.7).

Note 2 to entry: This term is used whether or not there is a formal written *appointment* (3.2.2) in place.

3.2.4
appointing party
receiver of *information* (3.3.1) concerning works, goods or services from a lead *appointed party* (3.2.3)

Note 1 to entry: In some countries the appointing party can be termed *client* (3.2.5), owner or employer but the appointing party is not limited to these functions.

Note 2 to entry: This term is used whether or not there is a formal *appointment* (3.2.2) between the parties.

3.2.5
client
actor (3.2.1) responsible for initiating a project and approving the brief

3.2.6
delivery team
lead *appointed party* (3.2.3) and their appointed parties

Note 1 to entry: A delivery team can be any size, from one person carrying out all the necessary functions through to complex, multi-layered *task teams* (3.2.7). The size and structure of each delivery team are in response to the scale and complexity of the asset management or project delivery activities.

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Note 2 to entry: Multiple delivery teams can be appointed simultaneously and/or sequentially in connection with a single asset or project, in response to the scale and complexity of the asset management or project delivery activities.

Note 3 to entry: A delivery team can consist of multiple task teams from within the lead appointed party's organization and any appointed parties.

Note 4 to entry: A delivery team can be assembled by the *appointing party* (3.2.4) rather than the lead appointed party.

3.2.7
task team
individuals assembled to perform a specific task

3.2.8
asset
item, thing or entity that has potential or actual value to an organization

[SOURCE: ISO 55000:2014, 3.2.1, modified — Note 1, 2 and 3 to entry have been removed.]

3.2.9
project information
information (3.3.1) produced for, or utilized in, a particular project

[SOURCE: ISO 6707-2:2017, 3.2.3]

3.2.10
life cycle
life of the *asset* (3.2.8) from the definition of its requirements to the termination of its use, covering its conception, development, operation, maintenance support and disposal

[SOURCE: ISO/TS 12911:2012, 3.13, modified — The words "stages and activities spanning the life of the system" have been replaced with "life of the asset"; NOTEs 1 and 2 have been removed.]

3.2.11
delivery phase
part of the *life cycle* (3.2.10), during which an *asset* (3.2.8) is designed, constructed and commissioned

Note 1 to entry: Delivery phase normally reflects a stage-based approach to a project.

3.2.12
operational phase
part of the *life cycle* (3.2.10), during which an *asset* (3.2.8) is used, operated and maintained

3.2.13
trigger event
planned or unplanned event that changes an *asset* (3.2.8) or its status during its *life cycle* (3.2.10), which results in *information exchange* (3.3.7)

Note 1 to entry: During the *delivery phase* (3.2.11), trigger events normally reflect the ends of project stages.

3.2.14
key decision point
point in time during the *life cycle* (3.2.10) when a decision crucial to the direction or viability of the *asset* (3.2.8) is made

Note 1 to entry: During a project these generally align with project stages.

3.3 Terms related to information management

3.3.1
information
reinterpretable representation of data in a formalized manner suitable for communication, interpretation or processing

Note 1 to entry: Information can be processed by human or automatic means.

[SOURCE: IEC 82045-1:2001, 3.1.4, modified — The term has been changed from "data" to "information": in the definition, the word "information" has been replaced with "data".]

3.3.2
information requirement
specification for what, when, how and for whom *information* (3.3.1) is to be produced

3.3.3
organizational information requirements
OIR
information requirements (3.3.2) in relation to organizational objectives

3.3.4
asset information requirements
AIR
information requirements (3.3.2) in relation to the operation of an *asset* (3.2.8)

3.3.5
project information requirements
PIR
information requirements (3.3.2) in relation to the delivery of an *asset* (3.2.8)

3.3.6
exchange information requirements
EIR
information requirements (3.3.2) in relation to an *appointment* (3.2.2)

3.3.7
information exchange, verb
act of satisfying an *information requirement* (3.3.2) or part thereof

3.3.8
information model
set of structured and unstructured *information containers* (3.3.12)

3.3.9
asset information model
AIM
information model (3.3.8) relating to the *operational phase* (3.2.12)

3.3.10

project information model
PIM
information model (3.3.8) relating to the *delivery phase* (3.2.11)

Note 1 to entry: During the project, the project information model can be used to convey the design intent (sometimes called the design intent model) or the virtual representation of the asset (3.2.8) to be constructed (sometimes called the virtual construction model).

3.3.11
federation
creation of a composite *information model* (3.3.8) from separate *information containers* (3.3.12)

Note 1 to entry: The separate information containers used during federation can come from different *task teams* (3.2.7).

3.3.12
information container
named persistent set of *information* (3.3.1) retrievable from within a file, system or application storage hierarchy

EXAMPLE Including sub-directory, information file (including model, document, table, schedule), or distinct sub-set of an information file such as a chapter or section, layer or symbol.

Note 1 to entry: Structured information containers include geometrical models, schedules and databases. Unstructured information containers include documentation, video clips and sound recordings.

Note 2 to entry: Persistent information exists over a timescale long enough for it to have to be managed, i.e. this excludes transient information such as internet search results.

Note 3 to entry: Naming of an information container should be according to an agreed naming convention.

3.3.13
status code
meta-data describing the suitability of the content of an *information container* (3.3.12)

3.3.14
building information modelling
BIM
use of a shared digital representation of a built *asset* (3.2.8) to facilitate design, construction and operation processes to form a reliable basis for decisions

Note 1 to entry: Built assets include, but are not limited to, buildings, bridges, roads, process plants.

[SOURCE: ISO 29481-1:2016, 3.2, modified — The word “object” has been replaced with “asset”; the words “including buildings, bridges, roads, process plants, etc.” have been removed; original Note 1 to entry has been replaced with a new one.]

3.3.15
common data environment
CDE
agreed source of *information* (3.3.1) for any given project or *asset* (3.2.8), for collecting, managing and disseminating each *information container* (3.3.12) through a managed process

Note 1 to entry: A CDE workflow describes the processes to be used and a CDE solution can provide the technology to support those processes.

3.3.16
level of information need
framework which defines the extent and granularity of *information* (3.3.1)

Note 1 to entry: One purpose of defining the level of information need is to prevent delivery of too much information.

3.3.18
capability
measure of ability to perform and function

Note 1 to entry: In the context of this document, this relates to skill, knowledge or expertise to manage *information* (3.3.1).

[SOURCE: ISO 6707-1:2017, 3.7.1.11, modified — Note 1 to entry has been added.]

3.3.19
capacity
resources available to perform and function

Note 1 to entry: In the context of this document, this relates to means, resources and procedures to manage *information* (3.3.1).

4 Asset and project information, perspectives and collaborative working

4.1 Principles

Asset information models (AIM) and project information models (PIM) are the structured repositories of information needed for making decisions during the whole life cycle of a built environment asset. This includes the design and construction of new assets, refurbishment of existing assets, and the operation and maintenance of an asset. It should be expected that the amount of information stored in information models, and the different purposes it will be used for, will mostly increase during project delivery and asset management.

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AIM and PIM can include structured and unstructured information. Examples of structured information include geometrical models, schedules and databases. Examples of unstructured information include documentation, video clips and sound recordings. Physical sources of information, such as soil and product samples, should be managed using the information management process described in this document through appropriate cross-references, for example sample numbers.

Most projects involve work on an existing asset, even if this is a previously undeveloped site. These projects should include some pre-existing asset information to support the development of the project brief and be available for lead appointed parties working on the project.

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Information management processes within this document include the transfer of relevant information between an AIM and a PIM at the start and end of a project.

Asset and project information has substantial value to appointing, lead appointed and appointed parties involved in asset management and project delivery. This includes where no formal appointments exist. Appointing, lead appointed and appointed parties include the owners, operators and managers of built assets, and those delivering design and construction projects. Asset and project information is also valuable to policymakers, regulators, investors, insurers and other external parties.

The concepts and principles contained within this document should be applied in a way that is proportionate and appropriate to the scale and complexity of the asset or project.

4.2 Information management according to the ISO 19650 series

The recommendations and requirements for information management in the ISO 19650 series are based on appointing, lead appointed and appointed parties working collaboratively together, and all parties should participate in the implementation of the ISO 19650 series.

Information management can be represented as a sequence of maturity stages, shown as Stages 1, 2 and 3 in Figure 1. This Figure shows that development of standards, advances in technology and more sophisticated forms of information management all combine to deliver increasing business benefit. The ISO 19650 series has application mainly at Stage 2 maturity, but also can be partly applied at Stages 1 and 3.

Stage 2 maturity is also identified as "BIM according to the ISO 19650 series". This is where a mixture of manual and automated information management processes are used to generate a federated information model. The information model includes all information containers delivered by task teams in relation to an asset or a project.

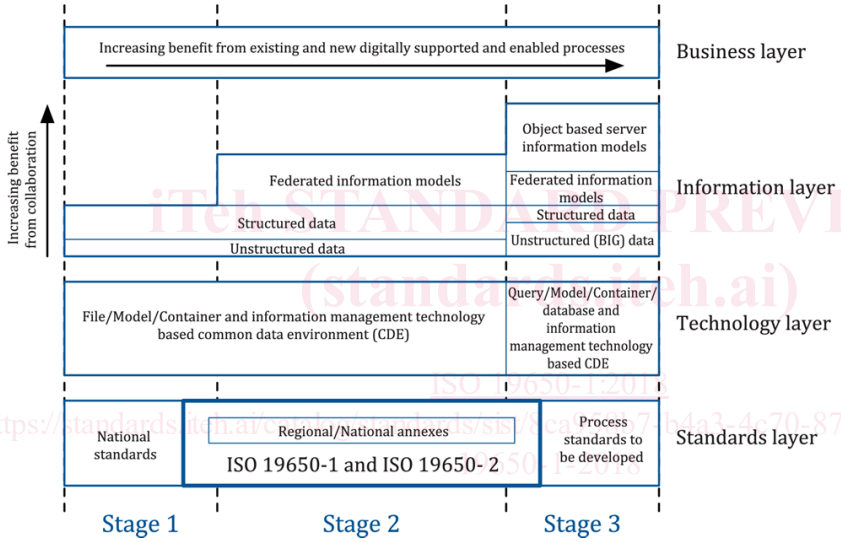

Figure 1 — A perspective on stages of maturity of analogue and digital information management

4.3 Information management perspectives

Different information management perspectives should be recognized by the information management process and should be incorporated in the process in the following ways:

— in the specification of information requirements;

— in the planning for information delivery; and

— in the delivery of information.

Information management perspectives should be defined on a case-by-case basis, but the four perspectives described in Table 1 are recommended. Other perspectives can also be helpful, depending on the nature of the asset or project.

Table 1 — Information management perspectives

Perspective	Purpose	Example deliverables
Asset owner's perspective	To establish and maintain the purpose of the asset or project. To make the strategic business decisions.	Business plan Strategic asset portfolio review Life cycle cost analysis
Asset user's perspective	To identify the true requirements of the user and make sure the asset solution has the right qualities and capacities.	Project brief AIM PIM Product documentation
Project delivery or asset management perspective	To plan and organize the work, mobilize the right resources, coordinate and control development.	Plans, for example BIM Execution Plans Organizational charts Function definitions
Society's perspective	To make sure the community's interest is taken care of during the asset life cycle (planning, delivery and operation).	Political decisions Area plans Building permits, concessions
NOTE The example deliverables are relevant to the point of view of each perspective and do not indicate ownership of the deliverables or who does the work to produce the deliverables.		

5 Definition of information requirements and resulting information models

5.1 Principles

The appointing party should understand what information is required concerning their asset(s) or project(s) to support their organizational or project objectives. These requirements can come from their own organization or interested external parties. The appointing party should be able to express these requirements to other organizations and individuals that have to know them to either specify or inform their work. This applies to assets and projects of all sizes, but the principles in this document should be applied proportionately. Less experienced appointing parties can seek expert assistance to help with these tasks.

Appointed parties, including lead appointed parties, can add their own information requirements to those they receive. Some of the information requirements can be passed to their own appointed parties, particularly where information exchange within a delivery team is necessary and this information is not to be exchanged with the appointing party.

The appointing party should state their purposes for requiring information deliverables, including the aspects of the asset that are intended to be managed. These purposes can include:

— asset register: a register of assets should be provided to support accurate auditing and reporting; this should include both spatial and physical assets and their groupings;

— support for compliance and regulatory responsibilities: the appointing party should specify the information required to support the maintenance of the health and safety of the users of the asset;