
Framework for building information modelling (BIM) guidance

Cadre pour les directives de modélisation des données du bâtiment

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 12911 was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization of information about construction works*.

Framework for building information modelling (BIM) guidance

1 Scope

This Technical Specification establishes a framework for providing specifications for the commissioning of building information modelling (BIM).

This Technical Specification is applicable to any range of modelling of buildings and building-related facilities, from a portfolio of assets at a single site or multiple sites, to assets at a single small building and at any constituent system, subsystem, component or element. It is applicable to any asset type, including most infrastructure and public works, equipment and material. BIM processes are applicable across the entire life cycle of a portfolio, facility or component, which can span inception to end-of-use. The main user of the framework is the information manager, who utilizes the framework to assist in structuring an international-, national-project- or facility-level BIM guidance document. The framework can also be used for BIM guidance provided by application providers.

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.

ISO 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*

ISO 29481-1:2010, *Building information modelling — Information delivery manual — Part 1: Methodology and format*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1 and the following apply.

3.1

building information model

building (construction) information model

BIM

shared digital representation of physical and functional characteristics of any built object, including buildings, bridges, roads, process plant

NOTE 1 Adapted from ISO 29481-1:2010, definition 2.2.

NOTE 2 Building information model is frequently used as a synonym for BIM.

NOTE 3 It may form the common basis for decisions and may form the contractual point of reference, across one or more stages in the life cycle.

3.2

building information modelling

building construction information modelling

process of managing information related to the facilities and projects in order to coordinate multiple inputs and outputs, irrespective of specific implementations

NOTE BIM is the most common acronym for a broad range of methods being applied in the facilities project sector. The reference to building is historic, as the change in approach from conventional documentation is most pronounced in the building sector, but similar changes are affecting infrastructure and other facilities.

3.3

BIM guidance document

document that aids users in achieving their intended results through the use of BIM

NOTE 1 See ISO/TR 18529.

NOTE 2 BIM can aid users in discovering the capabilities of a system, enable them to generate a plan for accomplishing their goals, assist users in accomplishing a goal or help users manage error situations.

EXAMPLE Guide, guideline, manual, handbook.

3.4

IDM

information delivery manual

strategy for identifying the processes, exchange requirements, business rules and functional parts for information exchanges in facility projects

NOTE See ISO 29481-1:2010.

3.5

information model

formal model of a set of facts, concepts or instructions to meet a specific requirement

3.6

constraint

relationship between two or more elements in a model, which should be maintained in any modifications made subsequent to a model transfer

NOTE 1 See ISO 10303-108.

NOTE 2 A constraint is either an objective or a measure.

3.7

project

unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources to effect change to the physical or operational aspects of a facility

NOTE Adapted from ISO 9000:2005, definition 3.4.3.

3.8

clause

subsection of a guidance document which contains an objective and one or more definitions and requirements

3.9

facility

physical structure or installation, including related site works, serving one or more main purpose

NOTE It can require management over part or all of its life cycle.

3.10

framework

structure of processes and specifications designed to support the accomplishment of a specific task

[ISO/IEEE 11073-10201:2004, definition 3.22]

3.11

measure

quantitative or qualitative assessment of relative achievement of a desired quality characteristic

NOTE 1 It is able to be tested against a descriptive model, such as a BIM or a BIM guidance document.

NOTE 2 The outcome is true, false or unknown.

3.12**objective**

constraint that is measurable by examination of its constituent objectives and measures

3.13**life cycle**

stages and activities spanning the life of the system from the definition of its requirements to the termination of its use, covering its conception, development, operation, maintenance support and disposal

NOTE 1 Adapted from IEC 61508 and ISO/IEC 15288:2008, definition 4.10.

NOTE 2 Adapted from ISO/TR 18529:2000, Clause 3.

4 Intentions**4.1 Intention of the framework**

The construction and facilities industry is adopting the use of object-orientated methods in capturing the information about its products. This is being driven internally by demands for efficiency and externally by demands for a higher quality and value in the product. In order to maximize the return on this investment, the industry needs better structured and more re-usable performance specifications. This Technical Specification specifies a framework for providing a specification for the commissioning of BIM. The framework allows international-, national- and project-specific BIM guidance documents to be collated and partners in new projects to assimilate the practices and expectations of other partners. It is intended that supplements be merged into or appended to this Technical Specification. The objectives of the framework are the following.

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- a) Create a common framework giving guidance for the application of BIM:
 - 1) aid the development of clear and repeatable processes;
 - 2) allow international, national and project/enterprise guidance document to be prepared according to a common framework;
 - 3) allow application guidance documents to be prepared according to the same common framework.
 - b) Make BIM guidance documents manageable:
 - 1) encourage completeness of guidance documents by providing a check-list of outcomes, management and inputs;
 - 2) encourage the provision of reasoned explanations for demanded performance;
 - 3) achieve extensibility of guidance documents;
 - 4) support the merging and comparing of "BIM guidance" documents.
 - c) Make BIM guidance able to be tested:
 - 1) encourage the testing of guidance documents against this framework;
 - 2) encourage the testing of BIM usage against guidance documents;
 - 3) encourage the use of formal contractual clauses which refer to guidance documents.

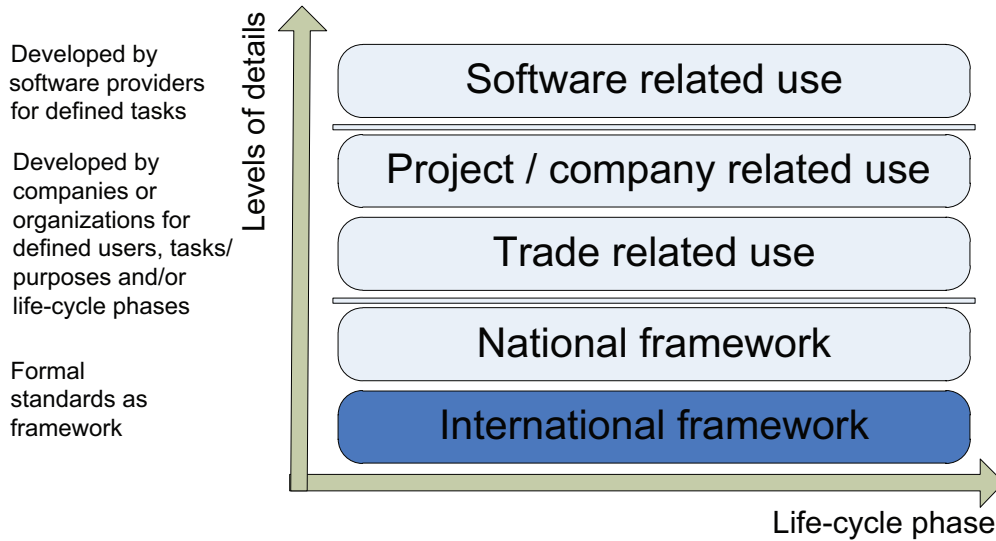


Figure 1 — BIM guidance provided at various levels

4.2 Intention of BIM guidance documents

BIM guidance documents are used for a variety of purposes, including to

- a) establish the desired outcomes and define appropriate quality,
- b) identify appropriate management effort and tools,
- c) identify necessary effort and resourcing, and
- d) achieve and maintain a common understanding within the national and project contexts.

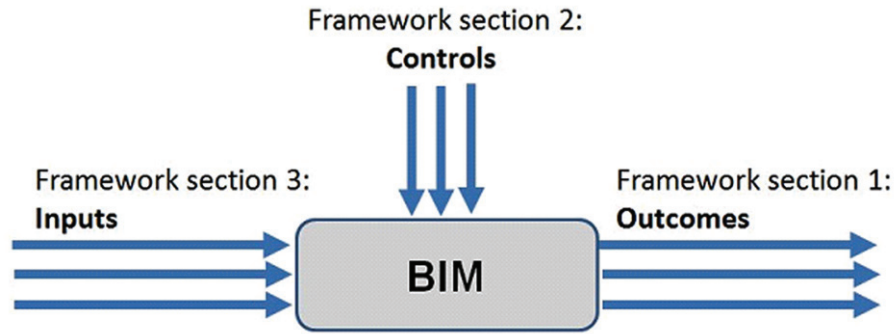
4.3 Overview of framework sections

BIM guidance documents may additionally address the presentational conventions for application in the generation of drawings and documents. This content may be carried forward from national and project drawing and document production standards.

Principals, design managers and end users should be able to easily navigate and understand any BIM guidance document that results from implementation of this Framework. The enterprise is supported when the objectives for using BIM (BIM guidance Framework section 1: Outcomes) is reviewed and approved at the principal level. Design management (BIM guidance Framework section 2: Controls) is supported by reviewing and implementing the management policies needed. Since these policies are keyed into the overall objectives, the dialogue between the design manager and the principals is supported. Design teams can review and implement the input requirements (BIM guidance Framework section 3: Controls) as this defines what they shall do. Again, since these requirements are keyed into the management policies, the dialogue between the design teams and design manager is supported.

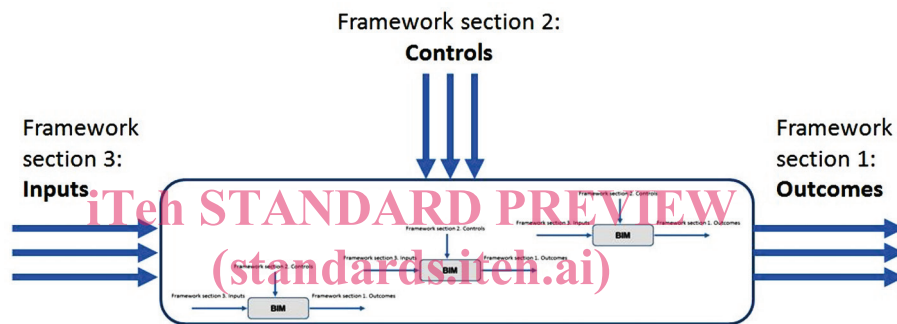
The style and content is intended to ensure that the requirements within the guidance document are directly measurable either by human inspection or by automated checking.

A BIM guidance document may be provided at an overall project or facility level, but may also be provided more specifically for individual BIM sub-processes within those overall objectives. These individual processes may be arranged in series and in parallel. The IDM methodology (as given in ISO 29481-1) shall be used to document, review and specify new BIM processes. The outcomes of review of new processes should then be documented in the BIM guidance document, thus adhering to this framework.



NOTE BIM process: the desired results determine the required inputs and controls.

Figure 2 — Overview of framework sections in the BIM process



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 Figure 3 — Interaction of BIM subprocesses

5 Formal aspects of BIM information exchange

5.1 General recommendations

The following recommendations are intended as a checklist for the formal aspects of information exchange arising from the use of BIM a guidance document.

5.2 Delivery agreement

An agreement may be written for each process where data are exchanged between actors, for a project or a facility. The objective of the agreement is to specify the purpose, how the delivery shall be conducted and controlled and what data are to be delivered. The agreement should be harmonized with national legislation, as well as with other contractual documents. It may be included as part of a contract for a service or as an attachment to the contract. It may specify the consequences of non-fulfillment of the requirements. The agreement on information delivery/exchange should only cover this where the compensation for faults in delivered information is not covered by the main contract for the assignment.

5.3 Specification of content

The intended result (deliverables) may be specified by use of this framework. The agreement may cover how the information shall be delivered and/or stored, including:

- a) file or database format;
- b) data schema;

c) media or data repositories.

5.4 Acceptance

The process of checking/reviewing the information may be stated, whether by the sender and/or the receiver; the methods and tools to be used may be stated also.

5.5 Owner's rights and rights for use of information

If ownership of the information is not explicitly transferred, the agreement may allow or disallow other usage and/or modification of the information. The terms of the agreement should comply with intellectual property rights as expressed in laws and industry agreements.

5.6 Responsibility

Normally, the supplier of the information is responsible for the information fulfilling the requirements. A model may, however, contain information that is not appropriate for the purpose of the delivery. The agreement should make clear whether responsibility should include all information delivered, only a specified subset or everything except a specified subset. A model may include information supplied by several actors. It should be made clear whether one actor takes responsibility for all content or if each actor is responsible for separate contributed parts. A third option is for responsibility to be shared by the group which participated in creating the model, without pointing out specific parts.

5.7 Traceability

In order to follow up on an agreement, the entities delivered on different occasions should be recorded; communication regarding the deliveries should be recorded as well.

If responsibility for parts of an information model is divided between actors, there should also be a method for documenting the responsible actor for each part of the model and the actions/versions for each part.

5.8 Compliance

This framework is intended to support rigorous testing of compliance with the BIM guidance document. This should be achieved by inspection or by the application of automatic compliance checking configured with the content of a BIM guidance document. In either case, it is expected that:

- a) every BIM object, attribute and relationship shall satisfy all of the objectives defined in Framework section 1: Outcomes;
- b) the results make reference to objectives from other clauses of the document;
- c) a BIM object, attribute and relationship shall satisfy an objective by showing that it is not applicable, is not selected, is excepted or is as required.

5.9 Implications of non-compliance

Compliance with the framework is intended to be tested according to Section 6. Non-compliance can impact usability of the BIM guidance document and create difficulties in the coordination of separate BIM guidance documents and so lead to contractual ambiguities.

Compliance with the BIM guidance document is intended to be tested against the levels of results, the management and the input stages documented in A.1, A.2 and A.3. Non-compliance can impact the quality and efficiency of project/facility delivery.

6 The framework for the BIM guidance document

6.1 Overview of the framework

6.1.1 General

The framework shall be mandated/adopted/applied/implemented for use by authors at international, national and project/facility levels. National bodies and organizations responsible for projects or facilities may mandate the framework and BIM guidance document produced according to it.

It shall be implemented for use in BIM guidance documents on specific facilities and projects.

The authoring conventions for International Standards should be maintained at every level of the guidance document so that titles have no effect, but the body text shall be normative, including the invocation of other clauses. It shall be possible to test every framework section.

The guidance document shall be divided into three sections or areas; for BIM Sections 1 to 3, see Figure 2. For additional details, see Annex A.

6.1.2 Framework section 1: Outcomes

The outcomes section shall provide guidance for the specification of the desired results.

The content may be derived from the IDM process and exchange requirement deliverables or other documents defining the structure and content of the desired results.

6.1.3 Framework section 2: Controls

The controls section shall provide guidance for the specification of managerial processes and quality assessment associated with the process of BIM.

The content may be derived from the IDM validation rules and business rules deliverables or other documents defining the constraints on the desired results.

6.1.4 Framework section 3: Input

The input section shall provide guidance for the specification of the inputs required to achieve the aims selected in Framework section 1: Outcomes and the managerial processes required by Framework section 2: Controls.

The content may be derived from the IDM functional parts and concepts, deliverables or other documents defining units of information necessary for the desired results.

6.2 Integrity

The fundamental structure of the framework shall be maintained.

The fundamental structure of the framework makes certain that there is consistency and compatibility between guidance documents. This ensures that each BIM process can be developed, approved and implemented at the appropriate level of management and responsibility, and ensures that similar clauses can be easily located and reviewed.

The following features are required.

- a) The guidance document shall be organized into three framework sections, relating to the desired outcomes, controls and inputs.
- b) Decimal numbering shall be used and each clause shall have a title. There shall be further subdivisions as indicated in Annex A.

- c) The ordering and numbering of the clauses shall be maintained.
- d) Three levels of guidance shall be distinguished:
 - 1) international clauses shall be entitled “Common ... ” and their numbers given the suffix “A”;
 - 2) nationally and regionally mandated policies shall be entitled “National ... ” and their numbers given the suffix “B”. This may include guidance provided by professions and associations;
 - 3) project- and facility-specific implementations shall be entitled “Specific ... ” and their numbers given the suffix “C”. This may include guidance provided with specific applications and implementation conventions, including owners or corporate policies.
- e) every reference to a clause shall correspond to a clause appearing later.

6.3 Extensions

The integrity of the framework, as defined in 6.2, shall be maintained when the guidance document is

- a) expanded by the insertion of additional clauses at the end of the existing framework sections or by the subdivision of a framework section,
- b) translated into other languages, or
- c) trimmed (filleted) to suppress clauses not relevant to specific implementation.

A guidance document, being an implementation of this framework, may suppress (sub)clauses within sections and/or add additional clauses. It may not suppress any of the three framework sections. It is possible for future revisions of this Technical Specification to incorporate additional clauses to reflect the increasing scope of the application of BIM.

6.4 Clauses

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Clauses, being the “leaf terminal subsections” of the guidance document, shall be written in order to express the normative objective by the clear expression of requirements, exceptions, applicability and selection.

6.4.1 Objective

Every clause shall have an objective which summarizes the intention and implies the impact of non-compliance.

6.4.2 Applicability

Every clause shall identify the scope of application. This shall be one or more measures, which progressively focus on the objects relevant to the objective.

6.4.3 Selections

Any clause may identify the scope of selection. This may be one or more measures, which collectively widen the focus of objects relevant to the objective.

6.4.4 Exceptions

Any clause may identify the exceptions to the scope. This may be one or more alternative measures, which eliminate objects as not relevant to the objective.

6.4.5 Requirements

Every clause shall identify the requirements and/or definitions. This may be one or more measures that individually constrain the objects to fulfil the objectives.