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Building information modelling (BIM) — Data templates for construction objects used in the life cycle of built assets — Concepts and principles

Modélisation des informations de la construction (BIM) — Modèles de données pour les objets de construction utilisés durant le cycle de vie des biens construits — Concepts et principes

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 442, *Building Information Modelling (BIM)*, in collaboration with ISO Technical Committee TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Building information modelling (BIM) provides a digital process for describing and displaying information required in the planning, design, construction and operation of constructed facilities. This approach encompasses all aspects of the built environment, including civil infrastructure, utilities and public space.

ISO 19650 (all parts) 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 when using building information modelling (BIM). To support the management and production of information in these business processes, standardization is of the highest importance. Machine-readable data is essential to provide a reliable and sustainable exchange of information in an asset life cycle process.

Data templates provide a standardized data structure to describe the characteristics of construction objects, enabling seamless information exchanges of construction industry business semantics through the life cycle of any built asset.

Data templates should be standardized and made available across the built environment sector through data dictionaries based on ISO 12006-3:2007.

Data templates should be used in conjunction with Industry Foundation Classes (IFC) in ISO 16739-1 to enable and support open BIM processes.

Building information modelling (BIM) — Data templates for construction objects used in the life cycle of built assets — Concepts and principles

1 Scope

This document sets out the principles and structure for data templates for construction objects. It is developed to support digital processes using machine-readable formats using a standard data structure to exchange information about any type of construction object, e.g. product, system, assembly, space, building etc., used in the inception, brief, design, production, operation and demolition of facilities.

This document provides the specification of a taxonomy model that defines concepts from ISO 12006-3:2007, i.e. objects, collections and relationships between them, to support the information need for the specific purpose of the data template.

This document provides an EXPRESS specification with extensions of the EXPRESS-G notation and specification from ISO 12006-3:2007. These extensions have been provided to support market needs developed since the publication of ISO 12006-3 in 2007.

This document provides the rules for linking between data templates and IFC classes within a data dictionary based on ISO 12006-3:2007.

This document provides the rules for linking between data templates and classification systems within a data dictionary based on ISO 12006-3:2007.

The target audience of this document is software developers and not construction industry domain experts appointed to create data templates based on sources describing information needs.

It is not in the scope of this document to provide the content of any data templates. The data structure provided is intended to be used for developing specific data templates based on standards developed in ISO/IEC, CEN/CENELEC, national standardization organizations, or other sources describing information needs.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10303-11, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 12006-3:2007, *Building construction — Organization of information about construction works — Part 3: Framework for object-oriented information*

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/

3.1
component
named and individually scheduled physical item and feature that might require management, such as inspection, maintenance, servicing or replacement, during the in-use phase

Note 1 to entry: Components can serve as interacting objects in a *system* (3.13).

[SOURCE: ISO 6707-1:2017, 3.4.1.4, modified — Note 1 to entry has been added.]

3.2
data dictionary
centralized repository of information about data such as meaning, relationships to other data, origin, usage and format

Note 1 to entry: The definition is from IBM Dictionary of Computing.

[SOURCE: ISO 23386:2020, 3.9]

3.3
data template
data structure used to describe the characteristics of *construction objects* (3.4)

EXAMPLE 1 A data template provides a view based on an information exchange, e.g. a heating, ventilation and air conditioning (HVAC) system designer is asking for the descriptions of the HVAC products that can be loaded into the design system.

EXAMPLE 2 A data template provides manufacturers a standardized data structure that can be applied to any internal system and/or process of handling product data, e.g. one or several product information management systems can apply or map to this structure to enable machine readability, both internally and with any requests from any software using the same data template structure. An HVAC product manufacturer can then answer the request from any stakeholder including the HVAC system designer.

Note 1 to entry: The relevant scope of the data template can be used together with the term "data template". E.g. a data template for a *product* (3.9) can be named "product data template". A data template for a *system* (3.13) can be named "system data template", etc.

Note 2 to entry: A data template can be used in an information exchange for a specific purpose for a construction object in the inception, brief, design, production, operation and demolition of facilities.

3.4
construction object
object of interest in the context of a construction process

EXAMPLE 1 The construction object "wall" is a type of *system* (3.13).

EXAMPLE 2 The construction object "calcium silicate masonry unit" is a type of *product* (3.9).

[SOURCE: ISO 12006-2:2015, 3.1.2, modified — EXAMPLEs 1 and 2 have been added.]

3.5
enumerated type value
data type consisting of a set of named values called elements, members, enumeral, or enumerators of the type

3.6
globally unique identifier
GUID
unique identifier generated using an algorithm

Note 1 to entry: In ISO 16739-1 and ISO 12006-3 the compressed version of GUID is used.

[SOURCE: ISO 23386:2020, 3.13]

3.7
group of properties
collection enabling the *properties* (3.10) to be prearranged or organized

Note 1 to entry: In this document, "group of properties" is used for organizing properties through the use of xtdCollection.

[SOURCE: ISO 23386:2020, 3.14, modified — Notes 1 to 4 to entry have been removed; new Note 1 to entry has been added.]

3.8
Industry Foundation Classes
IFC
conceptual data schema and exchange file format for building information modelling (BIM) data

Note 1 to entry: See ISO 16739-1.

3.9
product
construction product
item manufactured or processed for incorporation in construction works

[SOURCE: ISO 6707-1:2017, 3.4.1.3, modified — Note 1 to entry has been removed.]

3.10
property
inherent or acquired feature of an item

EXAMPLE 1 Length, sound reduction index (properties).

EXAMPLE 2 Length according to EN 12058, sound reduction index according to ISO 10140-4 (specific properties).

Note 1 to entry: When a property is named together with reference to a technical specification, where the instructions to assess the performance are available (usually standards), it is to be regarded as a specific property. The relationship between the property and the specific property is modelled as a parent child relationship.

[SOURCE: ISO 6707-1:2017, 3.7.1.3, modified —EXAMPLEs 1 and 2 and Note 1 to entry have been added.]

3.11
quantity
property (3.10) of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference

EXAMPLE 1 Length, mass, electric current (ISQ base quantities).

EXAMPLE 2 Plane angle, force, power (derived quantities).

Note 1 to entry: Quantities can appear as base quantities or derived quantities.

[SOURCE: ISO 80000-1:2009, 3.1, modified — Notes 1 to 6 to entry have been removed; EXAMPLEs 1 and 2 and new Note 1 to entry have been added.]

3.12
reference document
publication that is consulted to find specific information, particularly in a technical or scientific domain

EXAMPLE See EN 771-1:2011+A1:2015.

Note 1 to entry: A reference document can be associated with any data present in a *data dictionary* (3.2). It can include document date and version.

[SOURCE: ISO 23386:2020, 3.18, modified — EXAMPLE has been added; in Note 1 to entry, the second sentence has been added.]

3.13
system
interacting objects organized to achieve one or more stated purpose

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46, modified — The words "combination of" at the beginning have been removed; "elements" has been replaced by "objects"; Notes 1 to 3 to entry have been removed.]

3.14
UML
Unified Modelling Language
language to provide *system* (3.13) architects, software engineers, and software developers with tools for analysis, design, and implementation of software-based systems as well as for modelling business and similar processes

Note 1 to entry: See ISO/IEC 19505-1.

3.15
unit
unit of measurement
measurement unit
real scalar *quantity* (3.11), defined and adopted by convention, with which any other quantity of the same kind can be compared to express the ratio of the second quantity to the first one as a number

[SOURCE: ISO 80000-1:2009, 3.9, modified — The preferred term has been changed from "unit of measurement" to "unit"; Notes 1 to 5 to entry have been removed.]

4 Data template structure — UML diagram

Objects, collections and relationships are the basic entities of the model in ISO 12006-3:2007. A data template is a subset of this model, providing the concepts and relations needed to describe information about construction objects.

This clause provides the general structure of a data template and how it is modelled in UML based on ISO/IEC 19505 (all parts). The UML diagram in Figure 1 provides the rules that apply to a data template established within a data dictionary based on ISO 12006-3:2007.

The concepts used in the UML diagram are in accordance with ISO 12006-3:2007, whilst in this document some of the concept names have been modified to better fit with market terminology. Table 1 provides the link between the terminology in this document and ISO 12006-3:2007.

Table 1 — ISO 23387 and ISO 12006-3:2007 naming relations

ISO 23387 names	ISO 12006-3 names
Data template	xtdBag
Reference document	xtdExternalDocument
Construction object	xtdSubject
Group of properties	xtdNest
Generic property	xtdProperty
Specific property	xtdProperty
Quantity	xtdMeasureWithUnit
Unit	xtdUnit
Enumerated type value	xtdValue

The UML diagram in Figure 1 provides the data structure for data templates using objects, collections and relationships between them. The multiplicities in the UML diagram specify the range of allowable cardinality values, giving a specification of a data template within a data dictionary.