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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT)), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization of information about construction works*.

This second edition cancels and replaces the first edition (ISO 12006-2:2001), which has been technically revised.

ISO 12006 consists of the following parts, under the general title *Building construction — Organization of information about construction works*:

— *Part 2: Framework for classification*

— *Part 3: Framework for object-oriented information*

Annexes A and B of this part of ISO 12006 are for information only.

Introduction

0.1 Background

This part of ISO 12006 was first produced when there was little international standardization of classification systems for construction. Now, several national classification systems have been developed, for example, in North America, Scandinavia, and the UK, that implement the 2001 edition. Lessons learned in these implementations have been applied in this second edition.

This part of ISO 12006 has also been revised to take into account developments in information technology (notably building information modelling) and construction procurement (for example, design-build and design-build-operate). It has been extended and definitions have been refined to better serve all construction sectors, including building, civil engineering, and even process engineering. However, it continues to serve traditional information technologies and procurement methods.

A survey conducted as part of the work towards this edition showed that the most widely used classifications remain work results (mainly for specifications) and elements (mainly for cost analysis). They are also the most widely varied classification tables not only in their itemization and structure but also in the range of purposes to which they are put. There are other classifications, potentially just as important, which are used to a lesser degree, e.g. for construction products and properties.

0.2 The need for standardization

Building information modelling and modern forms of procurement require all these construction object classes to be used, along with many others. Building information modelling, in particular, is about exchange of information of all types along the project time line and between participants and applications. This is also the case for cooperative forms of procurement. For this exchange to be successful, a complete and consistent approach to construction object classification is required within the project, and between projects. This part of ISO 12006 is intended to facilitate this exchange.

Information types include geometrical data, functional and technical data, and cost data and maintenance data. The project timeline runs from inception to eventual demolition. Participants include clients, designers, authorities, constructors, end users, and operators. Applications include modelling, specification, product information, and cost information systems. Even now, there is still pressure for each of these to retain, or even develop, its own classification silo. This is not sustainable.

While national classifications that implement this part are still likely to differ in their detail (for example, due to differences in construction culture and legislation), mapping between them should be fairly straightforward. This is because they will be using the same overarching classification framework and construction object class definitions. This, in turn, will help with international construction project work (with participants from many countries), and with development of applications intended to be used internationally.

0.3 The content of this part

This part of ISO 12006 defines a framework for construction-sector classification systems and identifies a set of recommended classification tables and their titles for a range of construction object classes according to particular views, supported by definitions.

Building construction — Organization of information about construction works — Part 2: Framework for classification

1 Scope

This part of ISO 12006 defines a framework for the development of built environment classification systems. It identifies a set of recommended classification table titles for a range of information object classes according to particular views, e.g. by form or function, supported by definitions. It shows how the object classes classified in each table are related, as a series of systems and sub-systems, e.g. in a building information model.

This part of ISO 12006 does not provide a complete operational classification system, nor does it provide the content of the tables, though it does give examples. It is intended for use by organizations which develop and publish such classification systems and tables, which may vary in detail to suit local needs. However, if this part of ISO 12006 is applied in the development of local classification systems and tables, then harmonization between them will be facilitated.

This part of ISO 12006 applies to the complete life cycle of construction works, including briefing, design, documentation, construction, operation and maintenance, and demolition. It applies to both building and civil engineering works, including associated engineering services and landscaping.

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.

ISO 22274, *Systems to manage terminology, knowledge and content — Concept-related aspects for developing and internationalizing classification systems*

3 Terms and definitions

3.1 General

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

NOTE 1 The definitions are arranged in the following order: construction resource, construction process, construction result, and construction properties.

NOTE 2 In the definitions, terms that are defined elsewhere within this clause are shown in *italics*.

NOTE 3 Examples are given in Annex A.

3.1.1
object
any part of the perceivable or conceivable world

Note 1 to entry: An object is something abstract or physical toward which thought, feeling, or action is directed.

3.1.2
construction object

object (3.1.1) of interest in the context of a *construction process* (3.3.2)

3.1.3
construction system
interacting *construction objects* (3.1.2) organized to achieve one or more purposes

Note 1 to entry: Construction systems can be classified in accordance with this International Standard.

[SOURCE: ISO/IEC 15288:2008, modified]

3.1.4
type-of relation
relation between two concepts where the intention of one of the concepts includes that of the other concept and at least one additional delimiting characteristic

Note 1 to entry: Type-of relation is also known as generic relation.

[SOURCE: ISO 1087-1:2000, 3.2.21]

3.1.5
part-of relation
relation between two construction objects where one object constitutes the whole and the other a part of that whole

Note 1 to entry: Part-of relation is also known as partitive relation, part-whole relation, or whole-part relation.

Note 2 to entry: See also ISO/IEC 81346-1.

[SOURCE: ISO 1087-1:2000, 3.2.22, modified]

3.1.6
natural environment
non-artificial environment of any physical *construction object* (3.1.2)

3.1.7
built environment
physical *construction result* (3.4.6) intended to serve a function or user activity

Note 1 to entry: The built environment may be viewed as a system of either built space or built structure.

3.1.8
space
limited three-dimensional extent defined physically or notionally

3.1.9
activity space
space (3.1.8) defined by the spatial extension of an activity

Note 1 to entry: A spatial extension of an activity, for example, a table or a bed, and the activity space around them.

3.2 Construction resource

3.2.1
construction agent
human *construction resource* (3.2.5) carrying out a *construction process* (3.3.2)

3.2.2
construction aid
construction resource (3.2.5) intended to assist in carrying out a *construction process* (3.3.2)

Note 1 to entry: A construction aid is generally not intended for incorporation in a permanent manner in a construction entity.

3.2.3
construction information
information of interest in a *construction process* (3.3.2)

Note 1 to entry: Construction information may be seen both as a construction resource and as a construction result.

3.2.4
construction product
product intended to be used as a *construction resource* (3.2.5)

Note 1 to entry: Construction products have different complexity and can be, by themselves or together with others, make up the parts in any level of assembly of construction entities.

3.2.5
construction resource
construction object (3.1.2) used in a *construction process* (3.3.2) to achieve a *construction result* (3.4.6)

3.3 Construction process

3.3.1
construction activity
component process of construction process

3.3.2
construction process
process which uses *construction resources* (3.2.5) to achieve *construction results* (3.4.6)

Note 1 to entry: Each construction process may be split up into its component processes.

Note 2 to entry: See also ISO 22263:2008.

3.3.3
construction process lifecycle
sequence of stages from the start to the end of the *construction process* (3.3.2)

3.3.4
pre-design process
construction process (3.3.2) determining *construction properties* (3.5.1) for the *built environment* (3.1.7) before it is designed

3.3.5
design process
construction process (3.3.2) determining *construction properties* (3.5.1) for the *built environment* (3.1.7) before it is made physical

3.3.6
production process

construction process (3.3.2) resulting in *built environment* (3.1.7)

Note 1 to entry: Production process includes demolition and recycling process.

3.3.7
maintenance process
construction process (3.3.2) preserving the function of, or operating, the *built environment* (3.1.7)

3.3.8
management
control activity in a *construction process* (3.3.2) by one or more *construction agents*

3.4 Construction result

3.4.1
construction complex
aggregate of one or more *construction entities* (3.4.2) intended to serve at least one function or user activity

Note 1 to entry: A construction complex can be analysed and the construction entities that go to make it up, can be identified; e.g. an airport typically is composed of the construction entities runway, control tower, terminal building, aircraft hangar, etc. A business park typically is composed of a number of buildings, access roads, and landscaping (each a construction entity in its own right). A motorway from A to B typically is composed of service stations, the motorway pavement, bridges, embankments, landscaping, etc.

3.4.2
construction entity
independent unit of the *built environment* (3.1.7) with a characteristic form and spatial structure, intended to serve at least one function or user activity

Note 1 to entry: A construction entity is the basic unit of the built environment. It is recognizable as a physically independent construction even though a number of construction entities might be seen as parts of a particular construction complex. Ancillary works such as access roads, landscaping, service connections, may be regarded as part of a construction entity. Conversely, when ancillary works are of sufficient scale, they may be regarded as construction entities in their own right.

3.4.3
construction element
constituent of a *construction entity* (3.4.2) with a characteristic function, form, or position

Note 1 to entry: For practical purposes, such as when carrying out a cost analysis of a construction entity, it is vital that construction elements are mutually exclusive, in order to ensure that each part is counted once and only once.

3.4.4
built space
space (3.1.8) defined by *built* (3.1.7) *or natural environment* (3.1.6) or both, intended for user activity or equipment

Note 1 to entry: A built space is, for example, a room defined by floor, ceiling, and wall, or a footpath, or power-line corridor defined by a natural forest.

Note 2 to entry: Spaces occupied by construction elements are known as construction spaces, and are handled as properties of construction elements themselves.

3.4.5
zone

space (3.1.8) or spaces with a particular function

Note 1 to entry: Zones may be defined by physical or notional properties, e.g. fire safety zone, climate zone, smoking area, and quiet zone.

3.4.6
construction result
construction object (3.1.2) which is formed or changed in state as the result of one or more *construction processes* (3.3.2) using one or more *construction resources* (3.2.5)

3.4.7
construction result lifecycle
period of time from inception to the demolition of a *construction result* (3.4.6)

3.4.8
work result
view of *construction result* (3.4.6) by type of work activity and resources used

Note 1 to entry: A production work result can be enabling, creating resources.

3.5 Construction property

3.5.1
construction property
property of a *construction object* (3.1.2)

4 Basic principles

4.1 Object and process model

This text is supported by Figure 1.

The starting point for the design of construction complexes and construction entities is a need. Documentation of user activities and functional requirements is an important part of the information needed in the construction process. However, classification of user activity is considered outside the scope of this International Standard.

The different classes in the standard are related in a basic process model which states that a construction process uses construction resources to achieve construction results. It creates a principal structure for the classes of greatest interest. The stage of the construction process lifecycle characterizes a construction process. There are four main types of construction processes: pre-design process, design process, production process, and maintenance process.

Construction entities enable user activities and functional requirements. They can be aggregated into construction complexes. Construction entities consist of construction elements which can be made up of parts in several levels of complexity.

A space is an activity space, a built space, or a construction space. A built space is defined by construction results. Spaces can have spatial relationships such as ‘contained in’ or ‘adjoining’.

Construction resources comprise construction products, construction aids, construction agents, and construction information. The difference between a construction resource and a construction result is a question of its relation to a construction process and not of difference in object class. For example, construction information may be used as a resource to inform and control a construction process, or may be the result of such a process itself.

Construction objects have construction properties. Properties are represented as attributes in construction information.

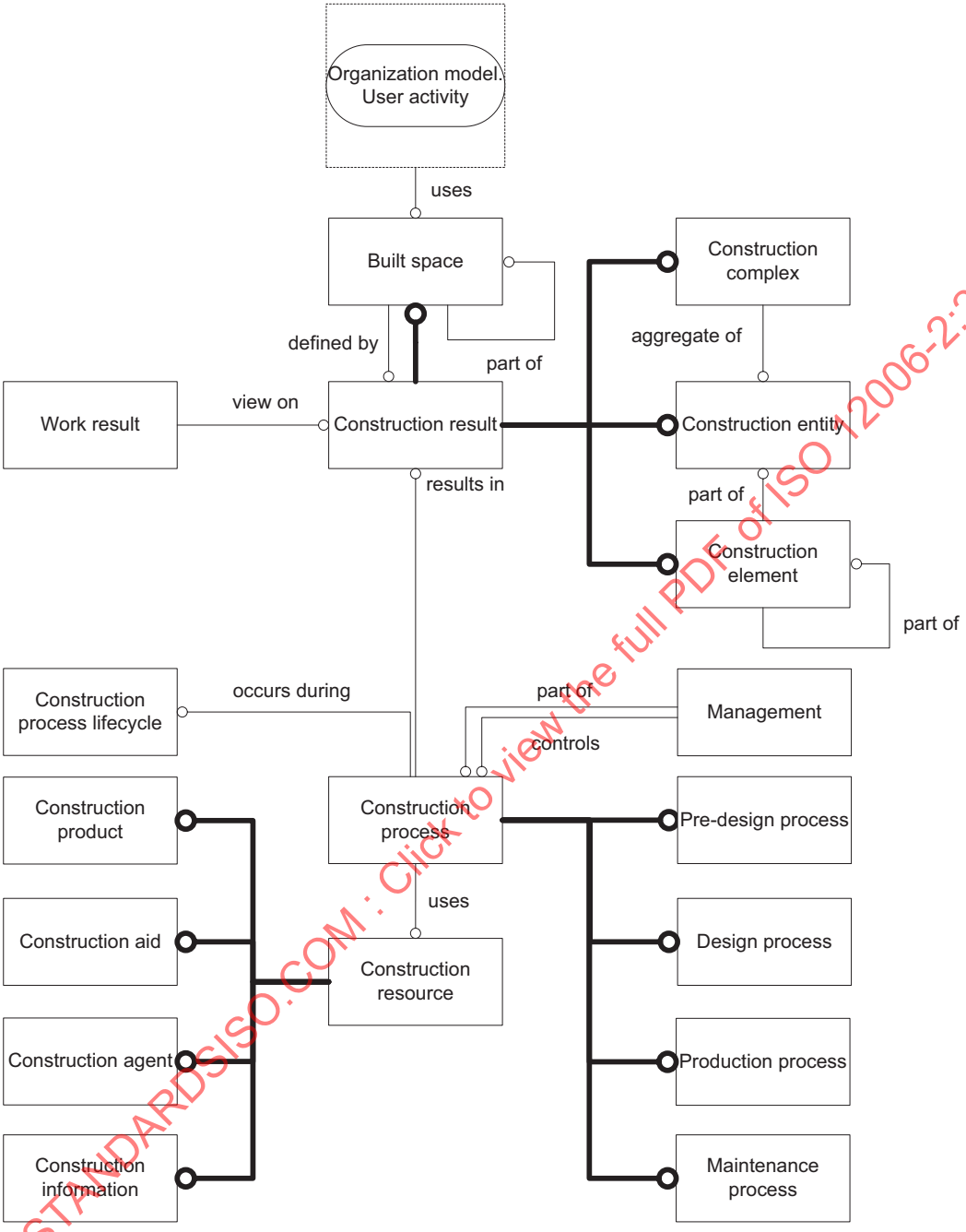

Figure 1 — Classes and the general relationship between them

The schema notation is in simplified form of EXPRESS-G.

A bold line with a circle depicts a type-of relation and a non-bold line other relations. The rounded box represents reference to another schema.

Figure 1 is simplified and should be read together with other parts of this International Standard.

4.2 Classification and composition

Classification systems may, apart from a level order of specialization (classes and subclasses), also have a level order of composition, called compositional structuring. See Figure 2.

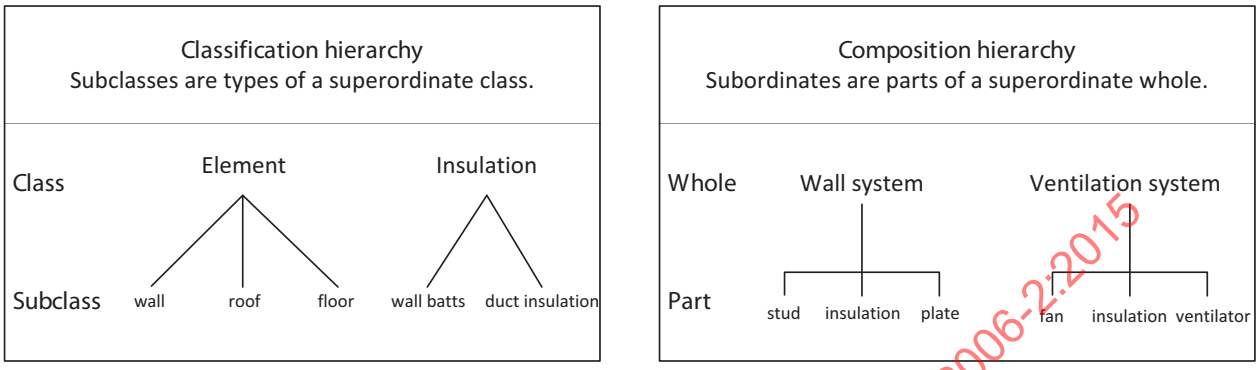

Figure 2 — Illustration of a classification hierarchy and a composition hierarchy

As an illustration, Figure 2 shows that wall batts and duct insulation are subordinate classes of insulation and can form part of a wall system and part of a ventilation system respectively.

NOTE Figure 2 illustrates the principle behind each kind of hierarchy (type-of and part-of). The graphic representation is based on ISO 1087, Annex A.1. It serves to illustrate the principle and does not attempt to standardize any class, sub-class, wholes, or parts.

Figure 3 shows a combination of composition and classification.

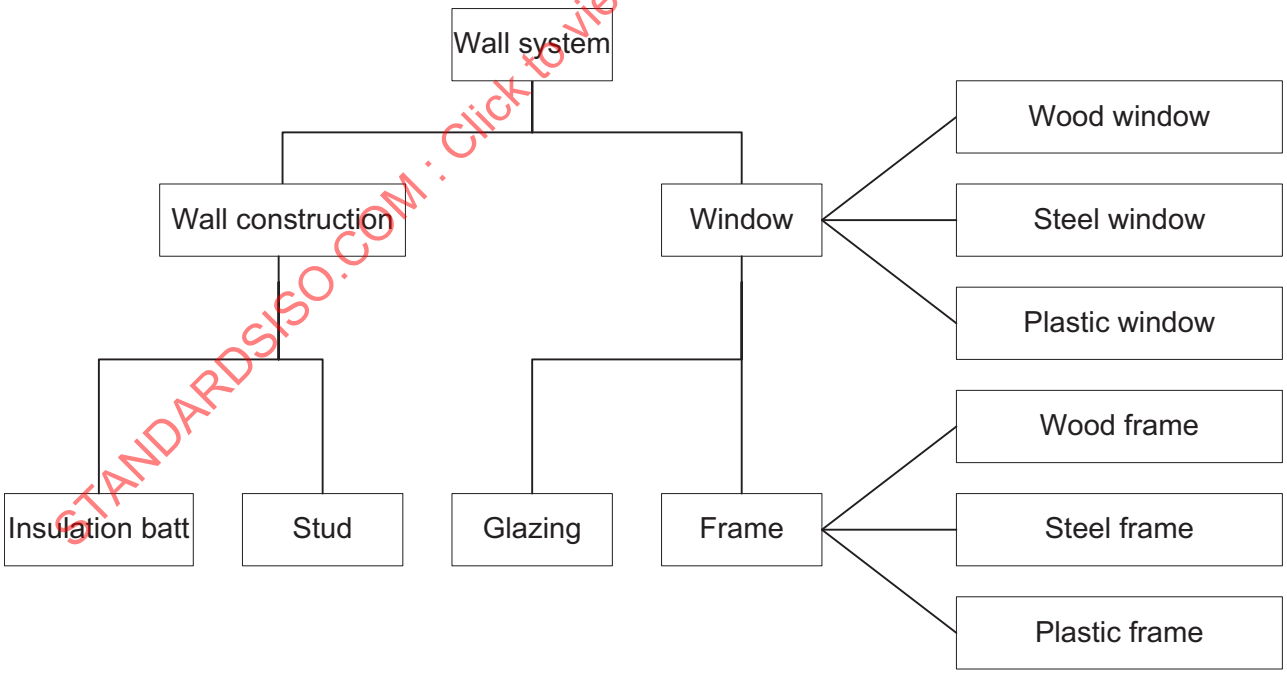

Figure 3 — Illustration of a combination of composition and classification

NOTE Figure 3 serves to illustrate the principle and does not attempt to standardize any class, sub-class, wholes, or parts.

4.3 Classification (type-of)

The purpose of classifying is to distinguish between objects in a collection based on properties of interest. Classes are defined by attributes representing the properties of interest.

Initially, the properties common to the whole collection must be determined. The resulting class is the most general in the classification. Then, the general class may be subdivided into more specialized classes in several steps based on differences in properties of interest.

The subdivision results in classes that run from the general to the specialized. The classes are ordered in levels determined by the relation type-of, where specific classes are types of more general classes. The classified objects are members of the classes.

4.4 Systems and compositional structuring (part-of)

The concept of system is not linked to any specific domain, but is to be used in a broad sense.

In the context of this International Standard, all objects can be seen as systems.

The system approach allows a designer to handle wholes (as distinct from parts). By identifying related systems, the relationships among these can be determined, and monitored e.g. to ensure that all systems operate correctly. Examples of relationships are input to or output from a system to its environment.

EXAMPLE Load-bearing system, roof system, wall system, HVAC system, drainage system, electrical system, communication system, transportation system, planting system, painting system, hospital system, ecosystem, landscape system, repair system, management system, educational system, window system, suspension system, hinge system, fan system, prefabrication system, procurement system.

Systems can consist of sub-systems in different compositional levels. By subdividing or structuring a system in sub-systems, using part-of relations, large sets of information in a complex design can be handled in smaller parts. Compositional structuring may, thus, provide an overview of a system, e.g. for the purpose of understanding, establishing, and modifying. A system of systems brings together a set of systems for a task that none of the systems can accomplish on its own.

An object is a part if when added to a whole, the whole still remains, e.g. if a brick is added to or subtracted from a wall system, the whole is still a wall system, or if a wall system is added to a construction entity, the whole is still a construction entity.

Parts may be identified from different aspects. Depending on the aspect, there may be different part-whole relations, the following are examples:

— using a functional aspect, the function of a part is fundamental to the function of the whole;

— using a spatial aspect, the spatial extension of a part is included in that of the whole;

— using an assembly aspect, the part-whole relation means that the existence of a physical part precedes the existence of the whole.

The structuring principles recognize the stage within the life-cycle as important for the application of different structures based on different aspects of the system of interest.

4.5 Other classification tables

This International Standard provides guidelines for recommended tables related to the basic process model described in 4.1. The corresponding recommended tables are given in Clause 5. A general description of classification concepts is given in Annex B.

It may be necessary to use other sorting criteria or classification schemes than described within the context of this International Standard. Subsequently, comparison with other similar classification tables could be difficult.

To comply with this International Standard, other classification tables shall be constructed in accordance with the guidelines given in ISO 22274, with a supporting document which clearly states the sorting criteria and classification scheme applied within the classification system developed.

4.6 Properties

Members of classes have properties. These properties can be used to define and subdivide the classes to finer levels of detail.

Properties are objects in their own right and, therefore, need to be treated as a special class which pervades results, processes, and resources.

5 Recommended classification tables

Classes can be divided into subclasses by a principle of specialization, resulting in a classification table. If a second principle of specialization is important for a particular class, then this can be applied separately and another classification structure generated.

There are other possible ways of specializing the object classes, see 4.5.

An object shall only be of one class. For example, if an object is classified as a construction entity, it cannot also be classified as a construction complex. Within a table, an object shall only have one classification. The choices of classification for many of the classification tables suggested in Table 1 are intended to allow classifiers some flexibility.

Table 1 shows which principles of specialization are applied to each important class in order to give the recommended classification tables. A cross-reference is given Annex A in which informative examples are given for each table.

The tables are intended to be used in combination or independently, according to need.

Table 1 — Principles of specialization applied to object classes

Class	Table	
	Classified by	Annex A reference
CLASSES RELATED TO RESOURCE		
Construction information	Content	A.2
Construction product	Function or form or material or any combination of these	A.3
Construction agent	Discipline or role or any combination of these	A.4
Construction aid	Function or form or material or any combination of these	A.5
CLASSES RELATED TO PROCESS		
Management	Management activity	A.6
Construction process	Construction activity or construction process lifecycle stage or any combination of these	A.7
CLASSES RELATED TO RESULT		

Construction complex	Form or function or user activity or any combination of these	A.8
Construction entity	Form or function or user activity or any combination of these	A.9
Built space	Form or function or user activity or any combination of these	A.10
Construction element	Function or form or position or any combination of these	A.11
Work result	Work activity and resources used	A.12
CLASSES RELATED TO PROPERTY		
Construction property	Property type	A.13

Annex A
(informative)

Classification table titles and examples

A.1 General

The tables titles given in this annex are recommended, but the examples given and their sequence are for information only and are not exhaustive.

A.2 Construction information (by content)

The following are examples of classes (by content):

— agreement;

— economy;

— analyses;

— minutes;

— geometry;

— specification;

— quality management;

— time management;

— resource management.

NOTE Classification of metadata is given in ISO/IEC 82045.

A.3 Construction products (by function or form or material or any combination of these)

The following are examples of classes (by combination of function and form):

— ground treatment and retention products;

— structural and space division products;

— access, barrier, and circulation products;

— covering, cladding, lining products;

— general purpose civil engineering and construction fabric products;

— services products;

— fixtures and furnishing products.

The following are examples of classes (by material):

— wood products;

— stone products;

— cement-based products;

— metal products;

— plastic products;

— glass products;

— composite products.

A.4 Construction agents (by discipline or role or any combination of these)

The following are examples of classes (by discipline):

— Architects;

— Structural engineers;

— Civil engineers;

— Services engineers;

— Project managers;

— IT managers;

— Real estate agents;

— Financiers;

— Building control officers;

— Urban planners;

— Facilities managers;

— Commissioning agents;

— Product designers.

The following are examples of classes (by role):

— Client;

— Administrator;

— Main contractor;

— Sub-contractor;

— Supplier;

— Fabricator;

— Manufacturer;

— Designer;

— Project manager;

— Construction manager;

— Quality controller;

— Safety coordinator;

— Supervisor.

A.5 Construction aids (by function or form or material or any combination of these)

The following are examples of classes (by combination):

— ground water lowering plant, contractor's pumps;

— steel reinforcement cutting and bending plant and equipment;

— formwork and scaffolding;

— lifting appliances and conveyors;

— excavators, crawler and wheeled loaders, scrapers, bulldozers and graders;

— drafting equipment;

— model-making equipment;

— computers and ancillaries;

— maintenance tools;

— explosives;

— document copying equipment;

— ~~3d~~3D printers;

— portable production aids;

— ephemerals~~.~~.

A.6 Management (by management activity)

The following are examples of classes (by management activity):

— administrative management;

— financial management;

— personnel management;

— marketing/sales management;

— project management;

— risk management;

— cost management;

— time management.

A.7 Construction process (by construction activity or construction process lifecycle stage or any combination of these)

The following are examples of classes (by construction activity):

— inception;

— procurement planning;

— feasibility study;

— development of business case;

— briefing;

— design competition;

— outline proposals, programme preparation;

— scheme design/costing;

— detail design/costing;

— production information and bills of quantities preparation;

— tender action;

— construction preparation (mobilization);

— construction operations on site;

— completion;

— refurbishment, alteration and recommissioning;

— decommissioning/demolition;

— feedback.

The following are examples of classes (by construction process lifecycle stage):

— pre-design;

— design;

— production;

— maintenance.

A.8 Construction complexes (by form or function or user activity or any combination of these)

The following are examples of classes (by combination):

— transport complexes;

— public health complexes;

— industrial complexes;

— administrative complexes;

— health, welfare complexes;

— refreshment complexes;

— entertainment complexes;

— sports complexes;

— educational complexes;

— residential complexes.

A.9 Construction entities (by form or function or user activity or any combination of these)

The following are examples of classes (by form):

— buildings;

— prefabricated buildings;

— roads;

— railways;

— landscapes

— tunnels;

— embankments;

— retaining walls;

— tanks;

— bridges;

— masts;

— pipe ways.

The following are examples of classes (by combination of form and function and user activity):

— hospital buildings;

— footbridges;

— railway embankments;

— airport terminal buildings;

— school buildings;

— sports grounds;

— houses;

— residential buildings;

— car traffic roadways;

— tram track ways;

— waste water pipe ways.

A.10 Built spaces (by form or function or user activity or any combination of these)

The following are examples of classes (by function):

— space for human activity:

  — space for living;

  — space for sanitary;

  — space for isolation;

  — space for work;

  — space for production;

  — space for expression;

  — space for gathering;

— space for storage:

  — space for materials;

  — space for equipment;

  — space for animals;

  — space for plants;

— space for technical systems:

  — space for operational technique;

  — space for production equipment;

— space for infrastructure:

  — space for connecting spaces;

  — space for routing;

  — space for transportation.

The following are examples of classes (by combination):

— office spaces;

— operating theatres;

— hospital wards;

— consulting rooms;

— sick bays;

— canteens;

— auditoria;

— amphitheatres;

— sports stadium;

— living room;

— bedrooms;

— turnabout;

— roadways;

— corridors.

A.11 Construction elements (by function or form or position or any combination of these)

The following are examples of classes (by function):

— floor construction system;

— wall construction system;

— roof construction system;

— water supply system;

— cooling supply system;

— ventilation supply system;

— power supply system;

— garbage system;

— transportation system;

— fire protection system;

— storage system;

— planting system;

— furniture system.

The following are examples of classes (by combination of position and form):

— substructure:

  — pile;

  — foundation masonry;

  — natural ground;

— superstructure:

  — road embankment;

  — road pavement;

  — railway tracks;

  — slab;

  — wall;

  — beam;

  — column;

  — window;

  — roof;

  — furniture.

A.12 Work results (by work activity and resources used)

The following are examples of classes (by work activity and resources used):

— Pre-design work results for construction complexes, entities and elements: