
**Buildings and constructed assets —
Service life planning —**

**Part 1:
General principles**

*Bâtiments et biens immobiliers construits — Prévion de la durée de vie —
Partie 1: Principes généraux*
(standards.iteh.ai)

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

© ISO 2000

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

Foreword.....	v
Introduction.....	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
3.1 Service life and performance.....	2
3.2 Degradation and exposure	2
3.3 Performance.....	3
3.4 Parts of buildings.....	4
3.5 Maintenance activities.....	5
3.6 Acts and actors	5
3.7 Other terms.....	6
4 Abbreviated terms	6
5 Process of service life planning.....	6
5.1 General.....	6
5.2 Forecasting.....	7
6 Service life planning: Steps in the design process.....	8
6.1 The brief.....	8
6.2 Conceptual and initial design.....	9
6.3 Detailed design	9
6.4 Specification.....	10
6.5 Environmental characterization.....	11
6.6 Initial cost estimates	11
6.7 Maintenance plan.....	11
6.8 Performance requirements and acceptability.....	12
7 Service life forecasting	15
7.1 Introduction to forecasting	15
7.2 Issues that can affect forecasting.....	17
7.3 Types of data used for forecasting.....	18
8 Service life prediction based on exposure and performance evaluation	19
8.1 Use of predictions based on exposure and performance evaluation	19
8.2 Steps in the prediction process	20
9 Factor method for estimating service life	22
9.1 Outline of the factor method.....	22
9.2 Use of the factor method	23
9.3 Reference service life.....	24
9.4 Modifying factors.....	25
9.5 Assessment of components and assemblies.....	26
10 Financial and environmental costs over time.....	28
10.1 General.....	28
10.2 Life cycle assessment (LCA).....	28
10.3 Life cycle costing (LCC).....	28
11 Obsolescence, flexibility and reuse.....	29
11.1 Obsolescence.....	29
11.2 Types of obsolescence	29
11.3 Minimizing obsolescence	30

11.4 Future use of the building30
11.5 Demolition and reuse30
Annex A (informative) Typical financial costs of buildings over time (in UK and USA)31
Annex B (informative) Examples of critical property assessment of alternative specifications32
Annex C (informative) Agents affecting the service life of building materials and components33
Annex D (informative) Examples of requirements34
Annex E (informative) Method for estimating service life of components using factors to represent agents.....35
Annex F (informative) Worked examples of factorial estimates36
Bibliography39
Alphabetical index of terms41

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

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 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 15686 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15686-1 was prepared by Technical Committee ISO/TC 59, *Building construction*, Subcommittee SC 14, *Design life*.

ISO 15686 consists of the following parts, under the general title *Buildings and constructed assets — Service life planning*:

— Part 1: *General principles*

— Part 2: *Service life prediction procedures* [ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

— Part 3: *Performance audits and reviews*

— Part 4: *Data requirements*

— Part 5: *Life cycle costing*

Annexes A to F of this part of ISO 15686 are for information only.

Introduction

Service life planning is a design process which seeks to ensure, as far as possible, that the service life of a building will equal or exceed its design life, while taking into account (and preferably optimizing) the life cycle costs of the building. This part of ISO 15686 provides a methodology for forecasting the service life and estimating the timing of necessary maintenance and replacement of components. It thereby provides a means of comparing different building options. It also allows for checking that performance is not unacceptably reduced to meet budgetary constraints during design development.

This part of ISO 15686 is intended primarily for:

- building owners and users;
- design, construction and facilities management teams;
- manufacturers who provide data on long-term performance of products;
- maintainers of buildings;
- valuers of buildings;
- insurers of buildings;
- technical auditors of buildings;
- those who develop or draft product standards.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15686-1:2000](#)

<http://productstandardsatalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

It includes an introduction to predictions of long-term performance based on exposure and performance evaluation and estimates based on applying factors to adjust a reference service life, but it does not deal in detail with forecasts based on demonstrated performance or modelling of performance. However, judgements based on either of these techniques may provide important inputs to a factored estimate of service life.

A major impetus for production of this part of ISO 15686 has been concern over industry's need to forecast and control the cost of building ownership, because a high proportion of the life cycle costs of a building may be set by the time the building is complete. Where there is a large stock of older buildings, more than half of all construction expenditure is spent on maintenance and refurbishment (see annex A for details of typical maintenance costs in the UK and USA). For countries currently developing their building stock, the risk is that a similar pattern will occur if long-term performance is not taken into account at the outset.

Service life planning aims to reduce the costs of building ownership. An assessment of how long each part of the building will last, helps to decide the appropriate specification and detailing. When the service life of the building and its parts are estimated, maintenance planning and value engineering techniques can be applied. Reliability and flexibility of use can be increased and the likelihood of obsolescence reduced.

Five parts to this International Standard are planned, and work on drafting these has commenced. They will provide comprehensive guidance on the forecasting and assurance of the service life of building components and assemblies. Figure 1 shows how each part of ISO 15686 relates to the other parts, and to associated topics and other International Standards.

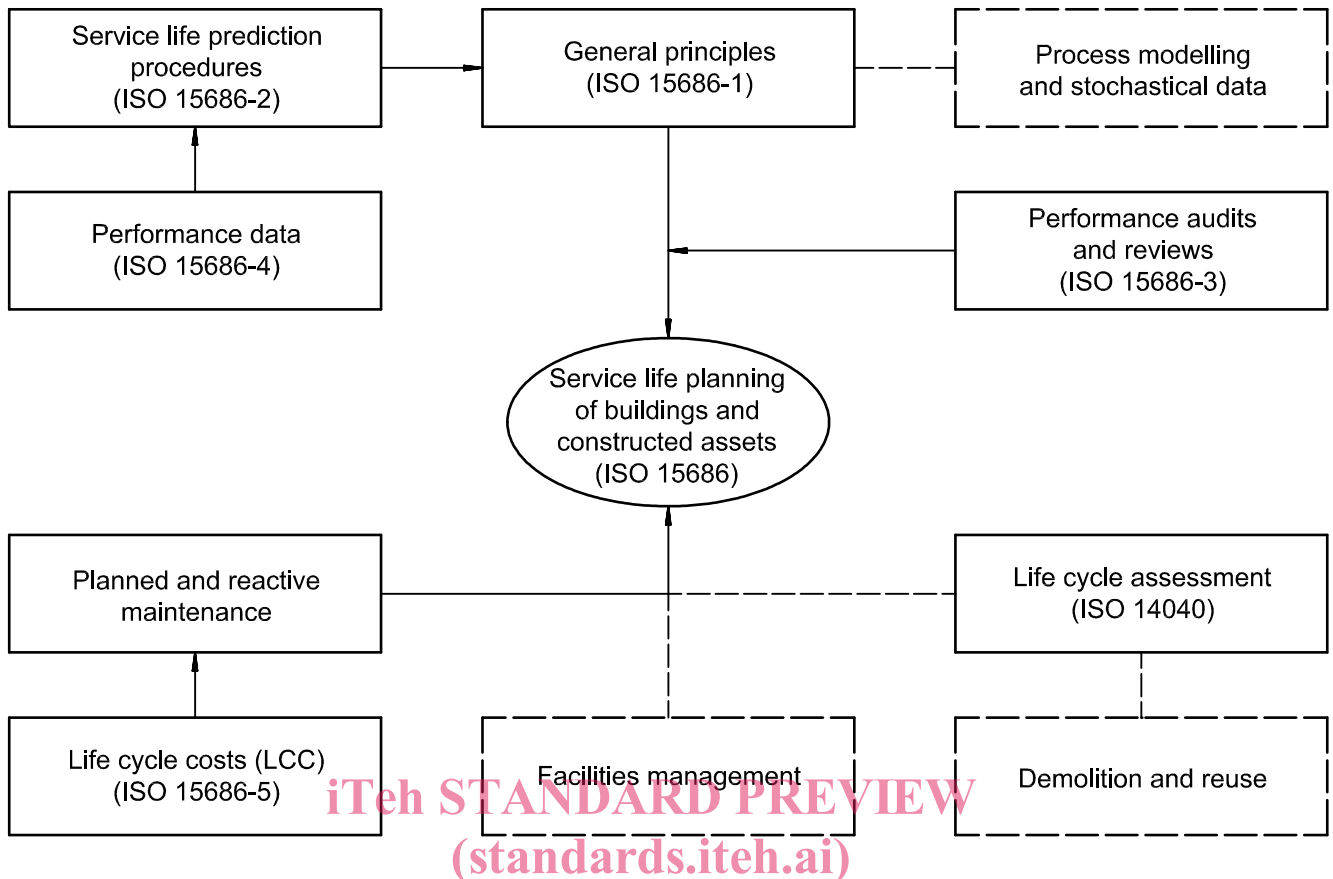


Figure 1 — Inputs and influences on service life planning of buildings

This part of ISO 15686 deals with the general principles, issues and data needed to forecast service lives, and gives a method of estimating the service life of components or assemblies for use in specific building projects. It can be used as a stand-alone document.

Part 2 of ISO 15686 describes a generic methodology for testing the performance over time of components and assemblies to provide a service life prediction. Wherever possible the reference service life used in producing an estimated service life should be derived from service life predictions as described in ISO 15686-2. Some guidance may also be given on values to assign to factors. It is anticipated that materials specialists and test houses who need to interpret or design performance tests will be the major users of ISO 15686-2.

Part 3 of ISO 15686 will describe the approach and procedure to be applied to prebriefing, briefing design, construction and, where required, the life care management and disposal of buildings and constructed assets to provide a reasonable assurance that the measures necessary to achieve performance over time will be implemented.

Part 4 of ISO 15686 will describe the range of data requirements that will allow the service life to be determined.

Part 5 of ISO 15686 will provide guidance on assessment of the life cycle costs of a building.

Additional parts are being considered.

Figure 2 shows the main topics covered in this part of ISO 15686, and where they are covered. Issues briefly introduced here, such as the calculation of costs over time (see clause 10), and quality control and reliability of estimates and forecasts (in clause 6), will be developed in later parts of ISO 15686. In the long term it is expected that a consistent application of service life planning will encourage the gathering of useful data and allow the development of computer-integrated knowledge systems for building design and maintenance.

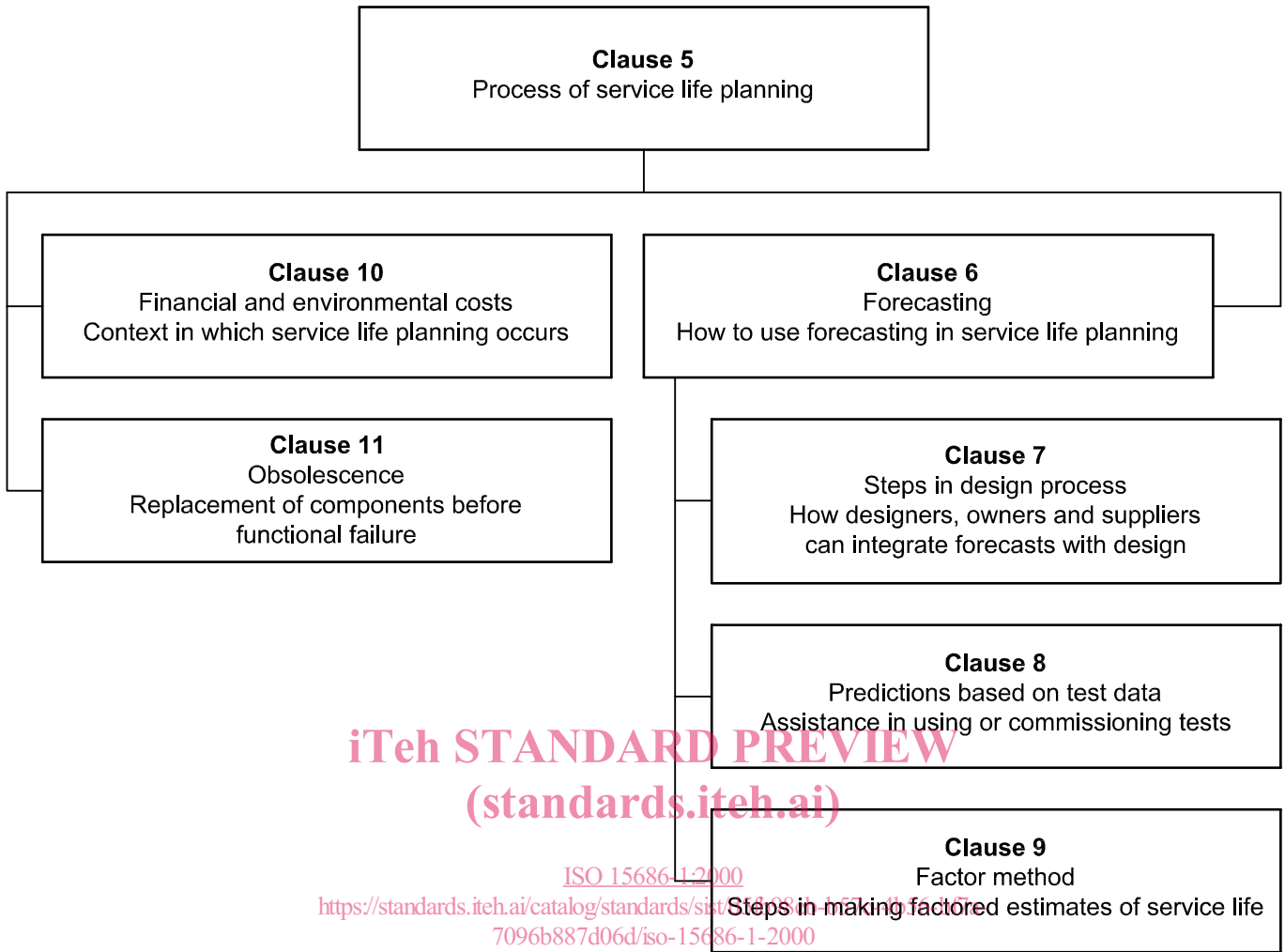


Figure 2 — Overview of this part of ISO 15686

Although not dealt with in any detail in this part of ISO 15686, the issues of performance of buildings and safety are clearly linked. When assessing future performance, priority should be given to ensuring performance at all times continues to meet national building legislative requirements for safety. It should also be noted that many local building codes already require inaccessible components or assemblies to remain functional throughout the service life of the building. In the European Community, the Construction Products Directive includes a requirement that the "essential requirements" of construction products should be retained for an "economically reasonable working life", if necessary by maintenance.

Service life planning can be applied to both new and existing buildings. However, in existing buildings the assessment of components and detailing will apply principally to the residual service life of items that are already installed. The selection of components and detailing will only apply to repairs and new work.

The informative annexes to this part of ISO 15686 are intended to provide supplementary information and to illustrate the use of methods described in the normative clauses. The range of climatic conditions and building techniques throughout the world requires that separate factors for service life planning are developed for specific circumstances. It may be necessary to have factors that apply regionally within countries and to modify these figures to take account of locality and micro-climate.

NOTE The factor method of forecasting service life is an empirical means of methodically estimating the effect on service life of variables, using the information available. It therefore is not as precise or objective as a prediction based on scientific observations of performance over time, but it will frequently be the only means of taking all relevant factors into account within the project timescale. National development will highlight any difficulties with applying this methodology, which is innovative, and it will be reviewed in future versions of this International Standard.

The approach to service life planning adopted in this International Standard is based on the work of CIB and RILEM, and on practical studies in many countries, in particular standards published in the UK, Japan, Canada and the USA.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 15686-1:2000

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

Buildings and constructed assets — Service life planning —

Part 1: General principles

1 Scope

This part of ISO 15686 describes the principles and procedures that apply to design when planning the service life of buildings and constructed assets. It is important that the design stage includes systematic consideration of local conditions to ensure, with a high degree of probability, that the service life will be no less than the design life.

This part of ISO 15686 is applicable to both new constructions and the refurbishment of existing structures. However, additional considerations may apply to existing buildings.

NOTE 1 In historic buildings even new work may be ruled by the need to preserve authenticity and certain options may not be available or advisable. They are therefore excluded from specific consideration within this part of ISO 15686.

NOTE 2 The skill and expertise of the person or organization undertaking the service life planning will be crucial to the reliability of the planning. Ideally a team of people who have the necessary skills in service life forecasting, design, construction and maintenance management will be represented within the project team. Familiarity with in-use conditions and construction conditions for the type of project will be of great assistance in determining typical conditions. Familiarity with the area will assist in identifying environmental factors which may not occur to strangers to the area. It is particularly important to consider local agents. These may include agents of degradation (e.g. emissions from a local power station).

NOTE 3 Wherever the term “buildings” is used in the text it should be read as “buildings and constructed assets”. Constructed assets covers everything that is constructed or results from construction operations.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 15686. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15686 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6707-1:1989, *Building and civil engineering — Vocabulary — Part 1: General terms*.

3 Terms and definitions

For the purposes of this part of ISO 15686, the terms and definitions given in ISO 6707-1 (some of which are repeated below for convenience) and the following apply. The following list is ordered by concepts, for the assistance of users of this part of ISO 15686. An alphabetical index of terms is included.

3.1 Service life and performance

3.1.1

service life

period of time after installation during which a building or its parts meets or exceeds the performance requirements

3.1.2

reference service life

service life that a building or parts of a building would expect (or is predicted to have) in a certain set (reference set) of in-use conditions

3.1.3

estimated service life

service life that a building or parts of a building would be expected to have in a set of specific in-use conditions, calculated by adjusting the reference in-use conditions in terms of materials, design, environment, use and maintenance

3.1.4

design life

intended service life (deprecated)

expected service life (deprecated)

service life intended by the designer

EXAMPLE As stated by the designer to the client to support specification decisions.

3.1.5

predicted service life

service life predicted from recorded performance over time

EXAMPLE As found in service life models or ageing tests.

3.1.6

forecast service life

service life based on either predicted service life or estimated service life

3.1.7

service life planning

service life design (deprecated)

preparation of the brief and design for the building and its parts to achieve the desired design life, for example in order to reduce the costs of building ownership and facilitate maintenance and refurbishment

3.1.8

residual service life

service life remaining at a certain moment of consideration

3.2 Degradation and exposure

3.2.1

ageing test

combination of ageing exposure and performance evaluation used to assess changes in critical properties for the purpose of service life prediction

3.2.2

(degradation) agent

whatever acts on a building or its parts to adversely affect its performance

EXAMPLES Person, water, load, heat.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 15686-1:2000

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

3.2.3**degradation mechanism**

chemical, mechanical or physical path of reaction that leads to adverse changes in a critical property of a building product

3.2.4**degradation**

deterioration (deprecated)

changes over time in the composition, microstructure and properties of a component or material which reduce its performance

3.2.5**durability**

capability of a building or its parts to perform its required function over a specified period of time under the influence of the agents anticipated in service

NOTE

Durability is not an inherent property of a material or component, although the term is sometimes erroneously used as such.

3.2.6**exposure in experimental buildings**

long-term exposure of items in special buildings where the conditions may be monitored and in some cases controlled

3.2.7**field exposure**

long-term exposure of items at special locations with known environmental conditions (agents)

3.2.8**long term *in-situ* exposure**

long-term exposure of items deliberately incorporated in buildings

3.2.9**short-term in-use exposure**

short-term exposure in which the intensities of agents are at levels expected in service

3.2.10**ageing**

degradation due to long-term influence of agents related to use

3.3 Performance**3.3.1****failure**

loss of the ability of a building or its parts to perform a specified function

3.3.2**performance evaluation**

evaluation of critical properties on the basis of measurement and inspection

3.3.3**performance****performance in use**

qualitative level of a critical property at any point of time considered

3.3.4**performance requirement****performance criterion**

minimum acceptable level of a critical property

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 15686-1:2000
<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

3.3.5

performance characteristic

property that is expected to be associated with a material quantity, being a measure of an initial property or a magnitude of that quantity

3.3.6

performance over time

description of how a critical property varies with time

3.3.7

property

inherent or acquired attribute of an item

3.3.8

property measurement test

test to determine the value of a property

3.3.9

critical property

essential property (deprecated)

property of a building or a building part that has an acceptable value if its required function is to be fulfilled

3.3.10

condition

level of critical properties of a building or its parts, determining its ability to perform

3.3.11

defect

fault, or deviation from the intended level of performance of a building or its parts

3.3.12

obsolescence

loss of ability of an item to perform satisfactorily due to changes in performance requirements

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

3.4 Parts of buildings

3.4.1

building

construction works that has the provision of shelter for its occupants or contents as one of its main purposes and is usually enclosed and designed to stand permanently in one place

3.4.2

(building) product

Item manufactured or processed for incorporation in construction works

3.4.3

(building) assembly

set of components used together

3.4.4

(building) component

product manufactured as a distinct unit to serve a specific function or functions

[ISO 6707-1]

3.4.5

(building) material

substance that can be used to form products or construction works

[ISO 6707-1]

3.4.6**(building) sub-component**

manufactured product forming part of a component

3.5 Maintenance activities**3.5.1****repair**

return of a building or its parts to an acceptable condition by the renewal, replacement or mending of worn, damaged or degraded parts

NOTE Based on definition given in ISO 6707-1 but “degraded” used rather than “decayed”.

3.5.2**maintenance**

combination of all technical and associated administrative actions during the service life to retain a building or its parts in a state in which it can perform its required functions

3.5.3**refurbishment**

rehabilitation (deprecated)

renovation (deprecated)

modification and improvements to an existing building or its parts to bring it up to an acceptable condition

3.5.4**restoration**

actions to bring an item to its original appearance or state

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.6 Acts and actors

[ISO 15686-1:2000](https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000)

3.6.1**brief**

<https://standards.iteh.ai/catalog/standards/sist/d5fb98eb-b57c-4b56-bf7a-7096b887d06d/iso-15686-1-2000>

working document which specifies at any point in time the relevant needs and aims of a construction project, resources to be provided by the client, the details of the project and any appropriate design requirements within which all subsequent briefing (when needed) and designing can take place

3.6.2**client**

person or organization that requires a building to be provided, altered or extended and is responsible for initiating and approving the brief

3.6.3**constructor**

contractor (deprecated)

person or organization that undertakes construction work

3.6.4**designer**

person or organization responsible for stating the form and specification of a building or parts of a building

3.6.5**manufacturer**

person or organization that manufactures buildings or parts of buildings

3.6.6**supplier**

person or organization that supplies buildings or parts of buildings. The supplier may also be the manufacturer