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Buildings and constructed assets — Service-life planning —

Part 8: Reference service life and service-life estimation

Bâtiments et biens immobiliers construits — Prévision de la durée de vie —
Partie 8: Durée de vie documentée et estimation de la durée de vie

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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.

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 15686-8 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*

— *Part 3: Performance audits and reviews*

— *Part 5: Life-cycle costing*

— *Part 6: Procedures for considering environmental impacts*

— *Part 7: Performance evaluation for feedback of service-life data from practice*

— *Part 8: Reference service life and service-life estimation*

The following parts are in preparation:

— *Part 9: Guidance on assessment of service-life data*

— *Part 10: Levels of functional requirements and levels of serviceability — Principles, measurement and use*

Introduction

Typically, a person working with service-life planning of a design object is faced with the problem of estimating the service life of its components. Even if there are certain reference service life (RSL) data of a component available from various actual sources, such RSL data, as found, can rarely be used satisfactorily. This is because the in-use conditions specific to the design object usually are different from the reference in-use conditions, i.e. the in-use conditions under which the RSL data are valid.

Accordingly, in order to determine an appropriate estimated service life (ESL), it is necessary to modify the RSL by taking into account the differences between the object-specific in-use conditions and the reference in-use conditions. The factor method described in this part of ISO 15686 provides one systematic way of carrying out such a modification. It is necessary that any possible alternative method of determining the ESL from the RSL also be based on similar information on in-use conditions.

When applying the factor method, basically an ESL is estimated by multiplying an RSL value by a modifying number representing a combination of factor categories, each of which reflects a particular difference between the object-specific and reference in-use conditions. Several strategies at various levels of sophistication to determine this modifying number are described herein.

Beyond the knowledge of the RSL itself, it is necessary to have available detailed information of the reference in-use conditions as well as the object-specific in-use conditions in order to apply the factor method and allow an estimation of the modification. It is necessary that the reference in-use conditions be provided together with the RSL, while the object-specific in-use conditions are determined from the knowledge of the design object and the location of the site.

An RSL and the appurtenant reference in-use conditions, together with additional required or useful information concerning the RSL, form a set of RSL data. It is necessary that a set of RSL data be formatted into an RSL data record.

This part of ISO 15686 provides guidance on RSL issues and a means of determining the ESL through application of the factor method. The guidance for reference service life is structured into discussions regarding

— provision of RSL data utilizing existing general data (see 5.2);

— selection of RSL data or general data (see 5.3);

— formatting of general data into RSL data records (see 5.4).

Manufacturers of building and construction products are usually in possession of considerable knowledge concerning the service life and durability of their products. However, such information is only occasionally made public, typically in product declarations, other documents, company websites and/or databases. Use of this part of ISO 15686 is expected to motivate manufacturers to compile their knowledge and provide service-life data following the guidelines and requirements stated.

Buildings and constructed assets — Service-life planning —

Part 8:
Reference service life and service-life estimation

1 Scope

This part of ISO 15686 provides guidance on the provision, selection and formatting of reference service-life data and on the application of these data for the purposes of calculating estimated service life using the factor method.

This part of ISO 15686 does not give guidance on how to estimate the modification part or the values of factors A to G, using given reference in-use conditions and the object-specific in-use conditions.

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 15686-1:2000, *Buildings and constructed assets — Service life planning — Part 1: General principles*

ISO 15686-2:2001, *Buildings and constructed assets — Service life planning — Part 2: Service-life prediction procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1, ISO 15686-1 and ISO 15686-2 and the following apply.

3.1
data record
set of **reference service-life data** (3.8) compiled into a prescribed format

3.2
factor category
category of **in-use conditions** (3.5) that are considered in the determination of an ESL from an RSL

EXAMPLE 1 Inherent performance level, design level, work execution level, indoor environment, outdoor environment, usage conditions and maintenance level

EXAMPLE 2 In-use conditions, such as temperature and moisture level, can be considered under the factor category, outdoor environment, in determining factor E.

NOTE Factor categories are used in the factor method to determine the factors A to G, and can be applicable in a similar way in any feasible alternative method.

3.3
general data
data of any format related to service life, as opposed to **reference service-life data** (3.8)

3.4
degradation
process whereby an action on an item causes a deterioration of one or more properties

NOTE Properties affected may be, for example, physical, mechanical or electrical.

3.5
in-use condition
any circumstance that can impact the performance of a building or a constructed asset, or a part thereof under normal use

NOTE In order to encompass all of the seven factors and their related **factor categories** (3.2), this definition is an extended version of the definition given in ISO 15686-2:2001, 3.3.5 (thus being in accordance with ISO 15686-1:2000, 3.1.2, where "in-use condition" is referred to as influencing any of the seven factors of the factor method).

3.6
in-use condition grading
act of applying collective judgment of all qualitative information of an **in-use condition** (3.5) within a **factor category** (3.2)

3.7
in-use condition grade
designation representing a qualitative description of an **in-use condition** (3.5)

NOTE 1 An in-use condition grade is the outcome of the **in-use condition grading** (3.6).

NOTE 2 In-use condition grades are designated qualitatively in terms of not available, very high/very mild, high/mild, normal, low/severe, very low/very severe and not applicable.

NOTE 3 In-use condition grades are designated numerically using numbers in the range from 0 to 5, with 3 representing a "normal" condition.

3.8
reference service-life data
RSL data
information that includes the reference service life and any qualitative or quantitative data describing the validity of the reference service life

EXAMPLE Typical data describing the validity of the RSL include the description of the component for which they apply, the **reference in-use condition(s)** (3.9) under which they apply, and their quality.

NOTE 1 The RSL data are reported in a **data record** (3.1).

NOTE 2 "Service life" and "reference service life" will be defined in the future ISO 15686-9.

3.9
reference in-use condition
in-use condition (3.5) under which the **RSL data** (3.8) are valid

NOTE The reference in-use conditions can be based upon information gathered through testing or from recorded performance and actual service-life data of a component.

3.10
usage condition
factor category (3.2) of **in-use conditions** (3.5) that considers the influence on performance due to the use of a building/constructed asset or any human activity adjacent to a building/constructed asset

NOTE In this part of ISO 15686, the **factor category** (3.2) relating to factor F is designated “usage conditions” rather than “in-use condition” as used elsewhere in order to distinguish the factor category from the concept “in-use condition”.

4 Abbreviated terms

DL design life

ESL estimated service life

RSL reference service life

UV ultra-violet

5 Reference service-life

5.1 Reference service-life data

It is generally necessary to determine an ESL for a design object by modifying some form of RSL applicable to such a design object. Since the RSL is normally generated under conditions different from the in-use conditions to which the design object is subjected, i.e. the object-specific in-use conditions, it is essential to provide as much information as possible on the conditions under which the RSL is generated. Therefore, jointly with the RSL, the reference in-use conditions should, as far as possible, be included when providing RSL data.

NOTE 1 The discussion on factor categories provides guidance on where and when information of in-use conditions should be provided.

RSL data are formatted into an RSL data record that contains the RSL value and the appurtenant reference in-use conditions as well as additional information on critical properties, performance requirements and data quality.

NOTE 2 RSL data does not include the actual values of the factors A to G but the information needed to estimate these factors.

Currently, there is a limited number of systematic studies on service-life prediction and there is an urgent need for data. For the provision of RSL data, the capturing of existing general data of any kind is acceptable.

For the generation of new data, the methodology as described in ISO 15686-2 should be used.

5.2 Provision of reference service-life data

5.2.1 General

It is intended that 5.2 assist providers of RSL data in

a) finding sources of existing general data;

b) assessing such data in terms of RSL data.

The discussion on provision of RSL data is intended for the various providers of data, such as

— manufacturers of building and construction products;

— test laboratories;

— national assessment bodies and technical approval organizations;

— database holders;

— other data providers.

The discussion on formatting general data as RSL data provides guidance to the providers of data on how to structure and format general data into RSL data. The process of providing RSL data is outlined in Figure 1.

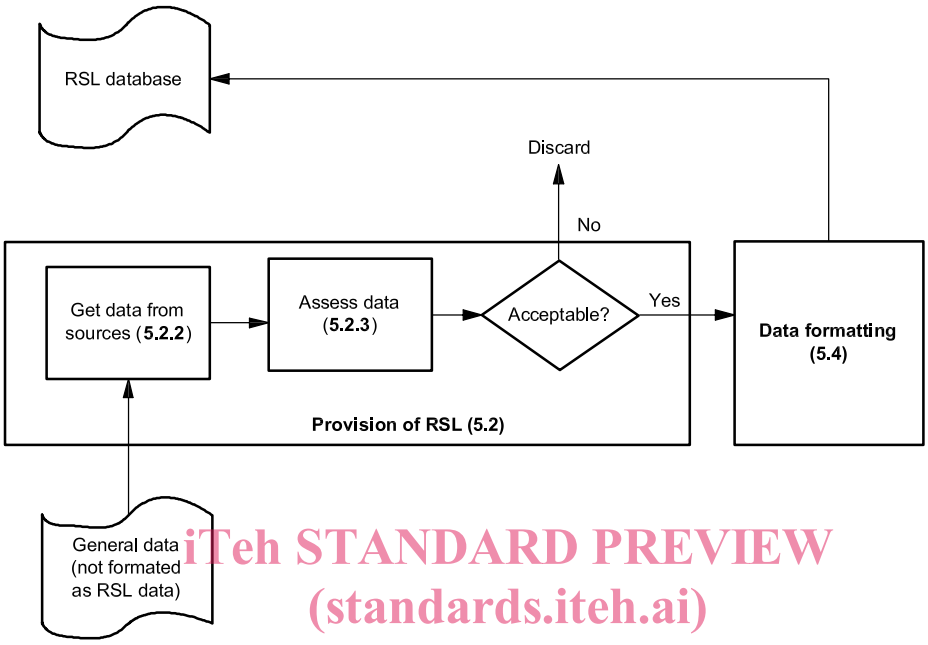

Figure 1 — The process of providing RSL data

5.2.2 Data sources

Manufacturers of building and construction products can have in-house information concerning the service life and durability of their products. Occasionally, manufacturers' data are made public in a product's declarations, other documents, company websites and/or databases.

Several other possible sources of data should be employed. National building codes can list typical service lives of components, and boards of agreement and technical approval bodies in governing states can provide assessments of service lives in their certificates or reports of national product evaluation services. Other sources of information are databases, published tables based on empirical time-to-failure assessments and judgements of experienced professionals. More scattered empirical knowledge from previous experience and observations of similar constructions or materials in similar in-use conditions should also be used.

NOTE The vast amount of existing data of scattered quality constitutes an important source of information, especially if data generated based on ISO 15686-2 are not available.

5.2.3 Data evaluation

RSL data should contain at least a general description of the material or component and data on service life, in an indicated outdoor (or indoor) environment, and should preferably encompass all relevant information concerning the generation of the service-life data. The following types of data are of particular importance:

— in-use conditions structured according to all corresponding factor categories;

— critical properties;

— performance requirements.

This set of data should form part of an RSL data record.

NOTE For instructions and details on how to structure and format general data into an RSL data record, see 5.4.

5.3 Selection of data

5.3.1 General

It is intended that 5.3 assist users of RSL data in

a) finding service-life data;

b) assessing the appropriateness of using these data as RSL data.

The discussion on selection of data is intended for the various users of data, such as

— clients;

— owners and developers;

— professional advisors;

— constructors, suppliers;

— assessors and underwriters;

— managers of existing constructed assets;

— other users of such data.

The discussion on formatting general data as RSL data provides guidance to the users of data on how to interpret selected RSL data. The process of selecting RSL data is outlined in Figure 2.

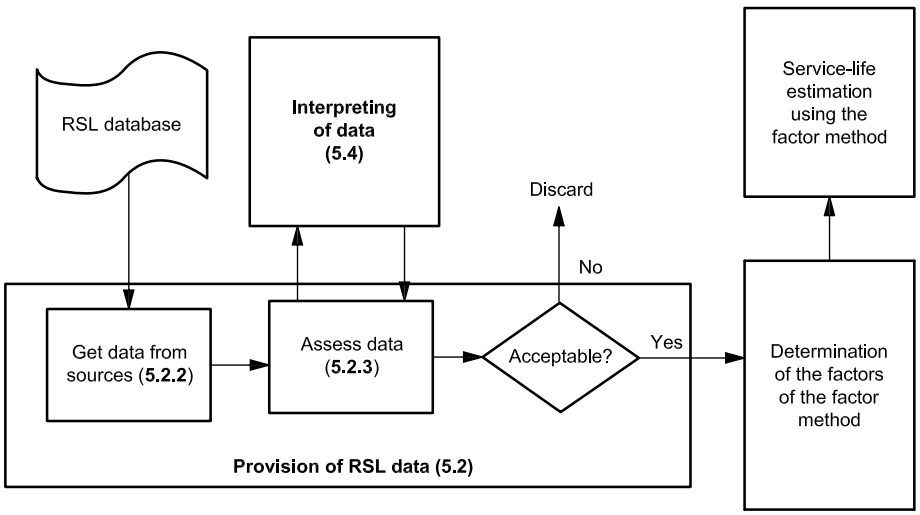

Figure 2 — Process of selecting RSL data

As an alternative to selecting RSL data, users of data may select general data, in which case the data are then structured and formatted as RSL data. Discussions on formatting general data as RSL data provide guidance to users of data on how to carry this out. The process of selection of general data is outlined in Figure 3.

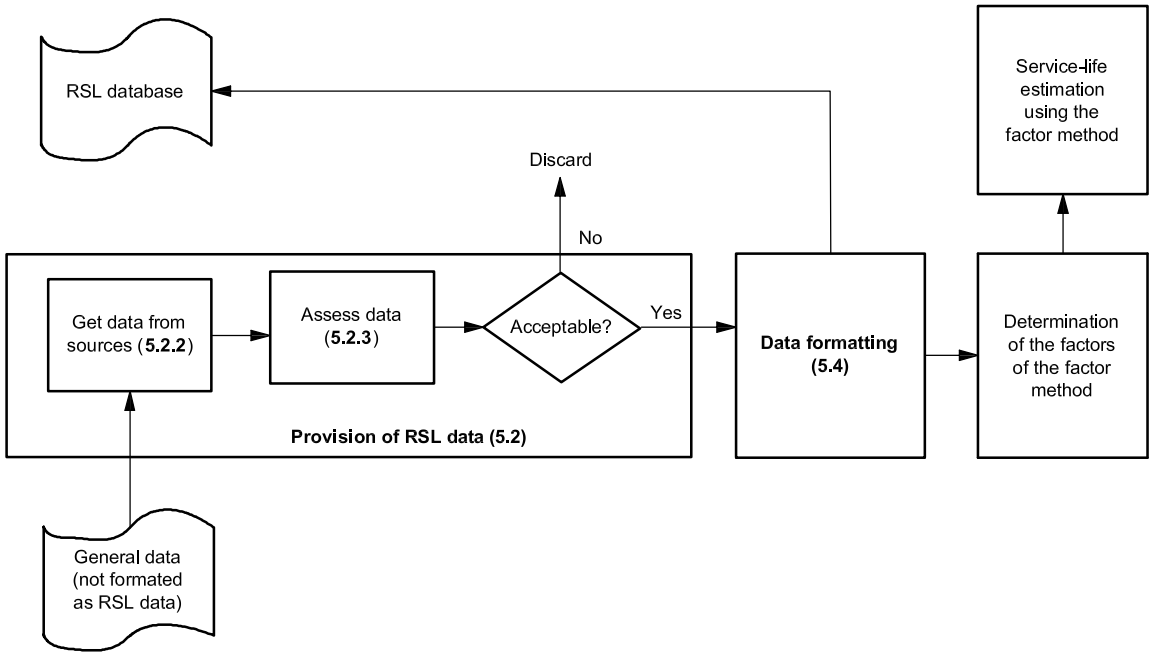

Figure 3 — Process of selecting general data

The normal route of selecting data is expected to become selection of RSL data, in which case the process of Figure 2 is appropriate. However, it is necessary initially for many users of data to resort to general data as the only available source of information, in which case the process of Figure 3 is required.

5.3.2 Data sources

Databases providing RSL data records have the advantage that the data are given in a format ready for that purpose.

NOTE 1 For instructions on how to interpret RSL data records, see 5.4.

NOTE 2 The availability of databases providing RSL data records will be limited in the initial phase following publication of this part of ISO 15686. It is expected that such databases will become more extensively established as general use of this part of ISO 15686 becomes more widespread.

This does not imply that RSL data records should always be selected even if available. When general data on service life, other than RSL data records, are of higher quality or more appropriate for the object-specific in-use conditions, these should be used.

NOTE 3 Possible sources of general data on service life are indicated in 5.2.2.

5.3.3 Data evaluation

5.3.3.1 General

If the data found are not given as RSL data records, data should first be assessed in accordance with 5.2.3.

It should be ensured that data are appropriate to use for the object of the service-life planning process. Caution should be taken where the critical properties deemed to degrade in the object-specific in-use conditions are not all encompassed by data. This can result in a critical property being excluded, which can then possibly become the terminal critical property. For a building element, data on the weakest part is sufficient when this can be identified, e.g. from experience.

5.3.3.2 Rejection of data

Data should be rejected when

— the degradation agents that are deemed to be significant for the expected degradation process(es) are not all encompassed,

— any one of the degradation agents excluded is known or believed to be a part of the object-specific in-use conditions,

— the performance requirement(s) assumed differ(s) significantly from that specified for the object and the RSL cannot be modified accurately enough in accordance with these difference(s).

5.3.3.3 Similarity of in-use conditions

Data based on reference in-use conditions similar to the object-specific in-use conditions should always be sought. Such data

— keep the modifying factors as close to unity as possible, thus minimizing the probability of error in the ESL due to uncertainty in the way mechanisms of degradation are taken into account by the modifications;

— minimize the probability that a critical property not encompassed by data becomes the terminal critical property.

To judge which reference in-use conditions are most similar to or deviate the least from, the object-specific in-use conditions, consideration should be given only to the in-use conditions or degradation agents known to, or believed to, have the greatest impact on the service life.

5.3.3.4 Consideration of data quality

For the final choice of data, the data quality should be considered. A higher-quality grade of data can justify the use of such data, even though it might have been generated at more deviating in-use conditions.

5.3.3.5 Form of data

If the data selected are not given as RSL data records, such formatting should be carried out in accordance with 5.4. The purpose of this is threefold.

a) Having all the RSL data in the same format facilitates the systematic work of the service-life planning, particularly when it comes to comparison with alternative data.

b) A common data format facilitates the structuring of the documentation of the service-life planning, and assists when possible future revisions occur.

c) The reporting of data used in the form of RSL data records prepares the basis to create or expand individual and third-party databases of RSL data.

5.4 Formatting general data as reference service-life data

5.4.1 General

It is intended that 5.4 assist

— providers of general data in the structuring and formatting of data into an RSL data record,

— users of RSL data in reading formatted data,

— users of data on how to structure and format selected general data into an RSL data record.