Standardization related to Service Life Planning

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Preface

This report is a part of the results in the European WoodWisdom-Net project WoodExter (see more in section 6, Acknowledgements).

This state-of-the-art report aims at presenting a summary outline of recent developments in standardization activities that are directed towards Service Life Planning and that have a direct influence on the descriptions and evaluations of the durability of exterior wood in constructions.

Summary

Increasing demands from customers of the construction industry, but also from recent developments in the European regulations, necessitate the deployment of more advanced planning methods for constructed assets, including economic and social as well as technical aspects of the performance of a building, taking into account its whole life cycle. Such methods are encompassed by the generic term Service Life Planning.

A major driving force for this process is the Construction Products Directive (CPD), which is anticipated to be strengthened in a pendant transformation to a European Regulation. The standardization committee ISO/TC 59/SC 14 leads a development of a series of standards that describe how the performance of buildings and other constructed assets, including their components, can be assessed in the planning process. It is obvious that all the aspects of performance assessments hinge on design lives and estimates on the actual working lives of the buildings. Estimates and predictions of working lives (or service lives) are, in turn, dependent on reliable data for several influencing factors, where inherent material properties often are a key factor.

Consequently, there is a dire need to develop, in the field of wood durability, ways to express the properties of wood-based materials in a way that can conveniently feed into larger systems for service life planning. Current activities towards this end within CEN and the results of the pre- and co-normative work performed in the Task Force of COST Action E 37 are also summarized in this report.

Sammanfattning (summary in Swedish)

Ökande krav från byggindustrins kunder, men också genom den pågående utvecklingen inom europeiska direktiv och regler inom byggsektorn, gör det nödvändigt att börja tillämpa mera avancerade planeringsinstrument vid projektering och uppförande av byggnadsverk. Sådan metodik innefattas i det allmänna begreppet Service Life Planning (på svenska Livslängdsplanering), vilket inte bara täcker in tekniska aspekter på en byggnads prestanda utan även ekonomiska och sociala aspekter.

En mycket väsentlig drivkraft för denna process är Byggproduktdirektivet (Construction Products Directive, CPD), som förväntas få ökad betydelse genom att transformeras från ett direktiv till en europeisk förordning. Standardiseringskommittén ISO/TC 59/SC 14 leder utvecklingen av en serie standarder som beskriver hur prestanda för byggnader och konstruktioner, inklusive deras ingående komponenter, kan utvärderas och redovisas, sett i ett livscykelperspektiv. Uppenbart är alla sådana utvärderingar avhängiga av projekterade livslängder och bedömningar av faktiska brukstider för byggnadsverken.

Livslängdsbedömningar är i sin tur beroende av tillförlitliga data för ett antal ingående parametrar, där inneboende materialegenskaper ofta spelar en avgörande roll.

Det finns följaktligen ett starkt behov av att utveckla bättre metoder inom området beständighet hos träprodukter för att kunna uttrycka materialens och produkternas egenskaper på ett sätt som passar in i mera övergripande system för livslängdsplanering. Den aktuella utvecklingen inom CEN och resultaten av det prenormativa arbetet som utförts i COST Action E 37 Task Force sammanfattas också i denna rapport.

Service Life Planning

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.[1] For a long time, the international organisations CIB and RILEM have been leading this development, and it has made imprints in the standardization work nationally, regionally, and globally through ISO.

Service Life Planning should be integrated into the design process of constructions, but it is also applicable to existing buildings and other construction works.

Major driving forces for the establishment of Service Life Planning methodology and routines are the concern for building owners' abilities to forecast and control the costs throughout the design life of a building or construction. It also has decisive influence on the reliability of constructed assets, and thereby on health and safety aspects concerning the users.

[1] ISO 15686-1: Buildings and constructed assets — Service life planning — Part 1: General principles

The Construction Products Directive (CPD), its importance and future development

The Construction Products Directive

The objective of the Construction Products Directive (89/106/EEC) from 1988, referred to hereafter as the CPD, is to ensure free circulation and use of construction products in the Internal Market. It covers a very large field; the number of construction products available on the European market is estimated to 40-50.000.

Construction products are intermediate products intended to be incorporated in construction works. The concepts of safety or general interest thus apply to construction products only to the extent to which they contribute to the fulfilment of the requirements of the works in which they are to be incorporated.

The awareness about the CPD is gradually growing in the building industry and in the industry manufacturing building products. Being a Directive, it does not have the full impact of a EU regulation or other legally binding instruments, and it gives a certain amount of freedom for national interpretations in its implementation.

At the core of the CPD are the six Essential Requirements, which must be fulfilled during the working life of construction works. These are:

- Mechanical resistance and stability
- Safety in case of fire
- Hygiene, health and the environment
- Safety in use
- Protection against noise
- Energy economy and heat retention

Subject to normal maintenance, these requirements must be satisfied for an economically reasonable working life.

Each Essential Requirement may give rise to the establishment of classes in the technical specifications, and these classes can be of either regulatory or technical nature. Classes can refer to the product as whole or to individual characteristics or combinations of characteristics. It is stated, though, in Guidance Paper E that “as the Member States are responsible for the design and execution of construction works and harmonisation of these aspects is not currently foreseen, it is considered that the need for the establishment of classes of essential requirements at a European level will be limited”. In addition to **classes of product performance levels**, it may be necessary to establish **threshold levels**, i.e. levels of performance below which a product cannot in any circumstances be considered fit for a particular use.[2]

The Essential Requirements concerns construction products in general. They are mirrored by a similar set of requirements, Basic Works Requirements (BWR), that applies to buildings and constructions as whole entities.

One of the most salient features of the CPD is the terminology that it introduces, some of which has a background in general construction engineering practice but has not been part

[2] Levels and classes in the Construction Products Directive: Guidance Paper E, 2002

of the common vernacular among researchers in the field of wood durability. Selected examples of terms that are central to the understanding of the CPD are the following[3]:

- *Working life (works)*: the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements. (see also Figure 1)
- *Working life (product)*: the period of time during which the performance of a product will be maintained at a level that enables a properly designed and executed works to fulfil the Essential Requirements (i.e. the essential characteristics of a product meet or exceed minimum acceptable values, without incurring major costs for repair or replacement). The working life of a product depends upon its inherent durability and normal maintenance. A clear distinction has to be made between the assumed economically reasonable working life for a product (also called: design working life), which underlies the assessment of durability in technical specifications, and the actual working life of a product in a works. The latter depends on many factors beyond the control of the producer, such as design, location of use (exposure), installation, use and maintenance. **The assumed working life can thus not be interpreted as being a guarantee given by the producer.**
- *Economically reasonable working life*: presumes that all relevant aspects are taken into account, such as: costs of design, construction and use; costs arising from hindrance of use; risks and consequences of failure of the works during its working life and costs of insurance covering these risks; planned partial renewal; costs of inspections, maintenance, care and repair; costs of operation and administration; disposal; environmental aspects.
- *Durability of a product:* the ability of a product to maintain its required performance over a given or long time, under the influence of foreseeable actions. Subject to normal maintenance, a product shall enable a properly designed and executed works to fulfil the Essential Requirements for an economically reasonable period of time (working life of the product).
- *Foreseeable actions*: potential degradation factors that may affect the compliance of the works with the essential requirements. They include, for example, temperature, humidity, water, UV radiation, abrasion, chemical attack, biological attack, corrosion, weathering, frost, freeze-thaw and fatigue (i.e. actions related to “normal” agents that could be expected to act on the works or parts thereof).

It can be noted that the above definition of ”durability” is directly linked to expectations (required performance), and in that differs from the meaning commonly understood by the term among actors in the field of wood construction and durability, where it is generally taken as equivalent to ”resistance to deterioration”. The CPD definition implies that a product that deteriorates within as short time as, say, two years may still be regarded as durable if its design working life is shorter than that. The latter interpretation, however, presupposes that only a product with a long life can be regarded as durable, and this is then assessed by comparison to other products (or materials). This apparent conflict of views is not fully resolved by Guidance Paper F, which gives the following, almost simplistic statement in the first clause of its scope: “Durability is the property of lasting for a given or long time without breaking or getting weaker.”

[3] Durability and the Construction Products Directive: Guidance Paper F, 2004

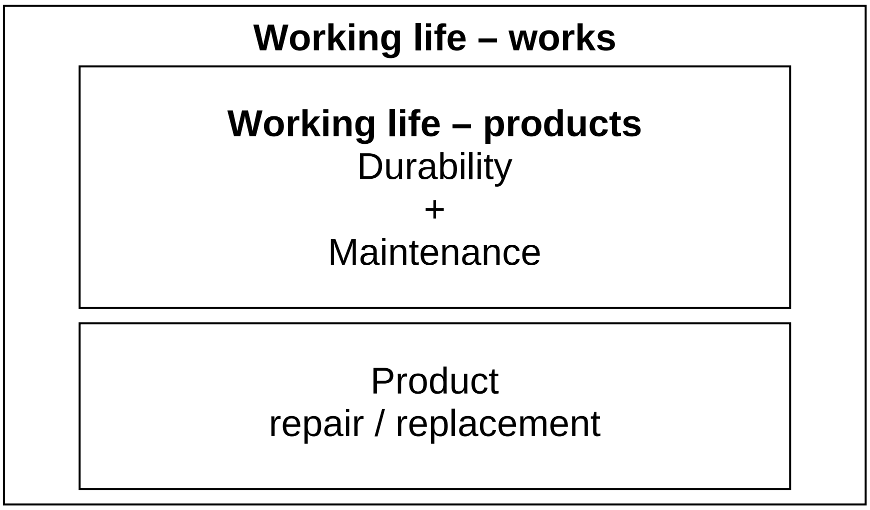

Figure 1. The relationship of the two aspects of Working life (from Guidance Paper F).

The durability of construction products may be verified using performance-based methods, descriptive solutions or a combination of the two. Both types of verifications are valid in European Technical Approvals (ETA). The alternative of performance-based assessments encompasses a score of different approaches, each with their merits and weaknesses:

- *Natural weathering/ageing testing*: Allows product comparisons and may give direct indications of durability.
- *Accelerated weathering/ageing testing*: Similar to the above, but with the normal ageing processes speeded up in order to reduce the duration of the test.
- *"Torture testing"*: The product is subjected to test conditions that are much more severe than those ever encountered during normal use.

Evidently, already at the level of natural ageing tests, care must be taken to ensure that the influencing exposure conditions are fitted as well as possible to those encountered in actual use in construction works. There are always deviations which should be taken into account when assessing the validity of the test results, and it must always be borne in mind that any extrapolations to other possible in-service conditions are connected with the introduction of a source of uncertainty. For accelerated tests, the same sort of caution must be applied, but even more rigorously. Here, it is further necessary to ensure that the degradation mechanisms are the same as those encountered in actual use. Otherwise the test can not be regarded as a valid accelerated analogue to a natural ageing test. For "torture tests", the same applies but to an even higher degree, and such testing schemes are not practicable for all kinds of products and all kinds of degradation.

In addition, a distinction can be made between a) direct testing (generally a preferred alternative), where the achievement of a certain level of performance is recognised as directly transferrable to an acceptable level of durability, and b) indirect testing, which includes the measurement of "proxy" characteristics that can be correlated to actual performance (e.g. hardness for abrasion resistance or water uptake for wood decay susceptibility).

The experience-based descriptive route to product assessments and approvals is only open for well-known construction products for which experience has been gained over a long period of time. The description can cover the product as such, but also related measures that are known to deliver adequate durability for a given product under assumed conditions (e.g. specifications of protective coatings, recommendations on installation, or specified maintenance requirements).

The implementation of the CPD has varied among the Member States. Even if the basis for European Technical Approvals (ETA) of products remain the same, the need for CE marking has been viewed differently. With reference to traditional voluntariness, Sweden, Finland, UK, Ireland, and Portugal have not prescribed compulsory CE marking of construction products as other Member States has done. This has been identified as an important weakness in the current CPD.

The Construction Products Regulation

In October 2005, the Commission launched a three year rolling programme for simplify-cation as part of its Better Regulation: Simplification Strategy[4]. The aim is to make legislation less burdensome, easier to apply and thus more effective, while also preserv-ing EU policy objectives. This includes considering whether the approach originally chosen is the most effective one for meeting the objectives of the legislation. Simplifica-tion of the CPD is one of the initiatives under this Strategy, with the aim being “to clarify and reduce the administrative burden of the CPD, in particular for SMEs, through increased flexibility in the formulation and use of technical specifications, lighter certification rules, and the elimination of the implementation obstacles that so far have hampered the creation of a full internal market for construction products”[5].

A revision process of the CPD has already progressed for some time, and the intentions are now to transform the Directive into a Regulation, i.e. CPR. The Commission has presented a proposal for a new Regulation to the European Council, and the Parliament has already confirmed their readiness to support the process in a first voting session. The time necessary for further progression is, however, uncertain at the moment, and if it is not approved during the mandate period of the present Parliament it may take more than two more years before a CPR can eventually be launched.

In the proposed Regulation, the New Legal Framework, as defined by the package on the internal market for goods[6], is followed in areas such as the criteria for notification of bodies carrying out third party tasks in the process of attestation of declared performance, or market surveillance provisions. This is expected to strengthen the whole system of CE marking for construction products.

In this context, the meaning of the CE marking defined in this proposal is specific for construction products: it attests that the information accompanying the product has been obtained in accordance with the proposed Regulation and, therefore, must be considered accurate and reliable. Products provided with a CE marking shall therefore be freely marketable on the Internal Market, without national markings or further national testing.

Since the first harmonised European standard was published in 2000, more than 325 of those have been launched by CEN and CENELEC, as well as more than 1500 auxiliary

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[4] European Commission (2005):COM (2005) 535 final: Communication of the Commission to the European Parliament, The Council, the European Economic and Social Committee and the Committee
of the Regions – Implementing the Community Lisbon Programme: A Strategy for Simplification of the
Regulatory Environment, Brussels.
[5] EC MEMO/05/394 and MEMO/06/426
[6] COM(2007) 36 final

standards (for testing etc.). The European Organisation for Technical Approvals, EOTA, has also worked out more than a thousand technical approvals for more complex or innovative products, which enables them to be CE marked.

Other specific requirements for construction products, which necessitate deviation from the New Legal Framework, include the systems of attestation of declared performance; the modules proposed in the New Legal Framework could not be applied without substantial adaptation for this sector. However, some slight modifications are proposed to the systems currently in force under the CPD.

In short, the objective of the Regulation is not to define the safety of the products, nor is it to harmonise the various national building codes in the Member States, but to ensure that reliable information is presented in relation to performances of the products. This is achieved by providing a common technical language to be used by manufacturers when placing products on the market and by public authorities when defining the technical requirements of works which influence, either directly or indirectly, the products to be used in those works. This common technical language is set out in the harmonised technical specifications (harmonised European standards (hEN) and European Assessment Documents (EAD)) developed under this Regulation.

The basic works requirements (BWR) are proposed to comprise the national and European regulatory requirements for construction works. The common technical language of the harmonised technical specifications is to provide the necessary tools for describing and assessing the required characteristics of the construction products; its use should therefore enable the national authorities to carry out all the necessary checks on the products in question, as well as the constructors to utilise them in the most appropriate and efficient manner. When the performances of products are set out by Member States authorities or declared by manufacturers, this is to be done through this common technical language.

The new Regulation proposal contains an important change in its clearer distinction between the requirements for the construction works, i.e. the BWR, and the Essential Requirements, which is the term reserved for properties of products.

A seventh BWR “Sustainable use of natural resources” has been added to the previous list of six. It is not entirely clear if the list of Essential Requirements also will be amended by this seventh requirement. The Commission has set priorities regarding the contents of this BWR #7:

a) Recyclability of the construction works, their materials and parts after demolition.
b) Durability of the construction works.
c) Use of environmentally compatible raw and secondary materials in the construction works.

Depending on the details, yet to be published, in the requirement, all of the above-mentioned three priorities will to varying degrees have an impact on durability considerations in Service Life Planning methodology.

The proposal also contains an expansion and strengthening of the third requirement “Hygiene, health and the environment”. The changes in BWR #3 and #7 were strongly supported in a letter in September 2007 to the commission from the Environmental Protection Agencies of 17 European states, “Promoting Eco-efficient Innovation in the Construction Sector” (referred to as the Zagreb statement), which was sent as a contribution to the revision of the CPD.

Service Life Planning work in ISO

ISO/TC 59

The standard series ISO 15686 has been developed during more than a decade by the Technical Committee ISO/TC 59, *Building construction*, Sub-committee SC 14, *Design life*.

The general name of the standard is Building and constructed assets — Service life planning, and it consists of the following ten parts (parts 4 and 10 are yet on a draft stage, whereas the rest have been published, and parts 1 and 2 are presently subject to revision):

Part 1 General principles

Part 2 Service life prediction principles

Part 3 Performance audits and reviews

Part 4 Data requirements

Part 5 Life cycle costing

Part 6 Guidelines 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

Part 9 Guidance on assessment of service life data

Part 10 Performance standards in building — Using functionality as key Indicator of value during the service life

From the point of view of durability in service life design methodology, particular attention should be given to Parts 1, 2, 7, 8, 9, and 10.

Figure 2 illustrates scenarios in the development of a building's performance (2) from delivery through to the maintenance and operation phase. In a broader sense, this graph is also applicable to individual components. A deviation (4) in performance from the client's expectations and requirements (3) will often occur at the time of delivery, partly due to building failures or damages during fabrication (5). The expectation/achievement gap is increased further due to the continuous rise in new requirements and upgrading, business development, etc.
After the delivery, performance will decrease during operation, if left with no maintenance. When limit states (6) are reached, this is amended through various proactive and reactive corrective actions, i.e. maintenance or repair, in order to keep up with required performance. When further repair is no longer judged as justifiable or otherwise desired the original performance may be restored by replacement (7). At the time of renewal there is a potential for filling the expectation/achievement gap by a development upgrading (8).

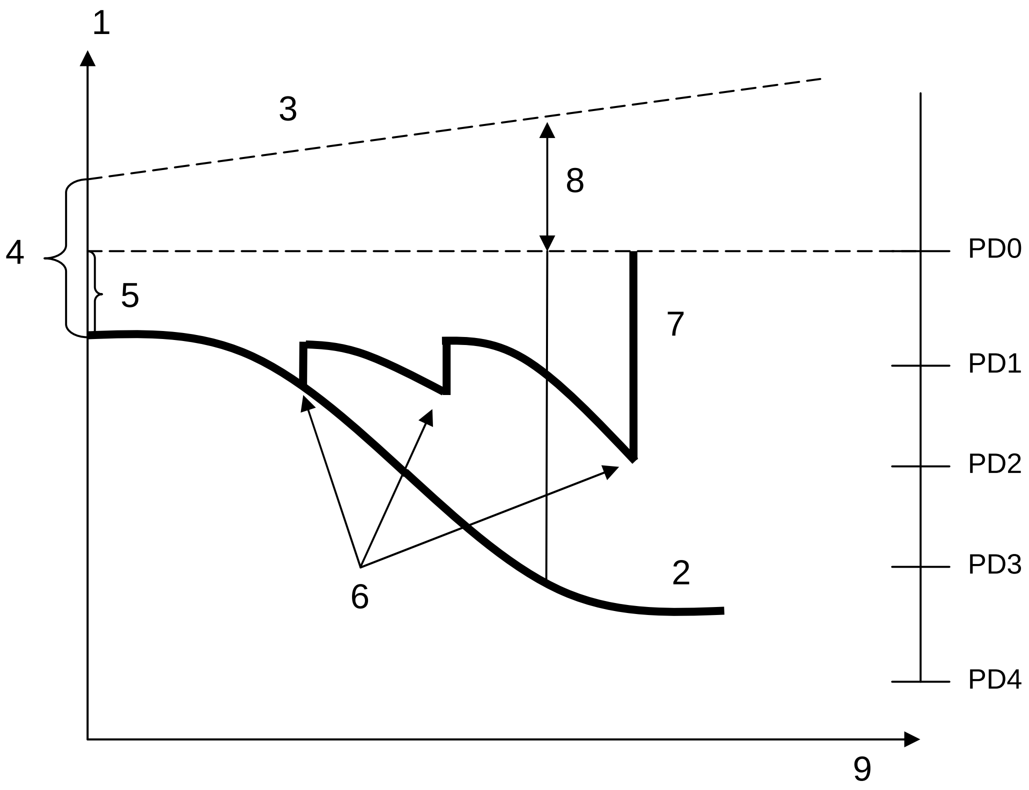

Figure 2. The building performance cycle with performance degrees PD (adapted from ISO 15686-7). The upper (jagged) curve represents the performance for a building, a part thereof, or a component where an acceptable performance is regained with regular maintenance and ultimately by replacement.

Legend:

1 Quality/function
2 Performance without maintenance
3 Original and increasing expectations
4 Expectation/achievement gap
5 Construction failure gap
6 Limit states
7 Replacement
8 Development upgrading
9 Operation and management over time

A basic concept brought forward in these standards is the tool for service life prediction called the Factor Method. In its earliest form it was expressed as a simple mathematical function, a multiplication of a number of factors by a reference service life (RSL), which then produces an estimated service life (ESL).

ESL = RSL × A × B × C × D × E × F × G

The signification of the factors is tabulated below. Shortly after the first emergence of this equation it was realised that this deterministic approach of a simple mathematical operation is unable to make provisions for the large and sometimes unpredictable variations in some of these parameters. It also fails to recognize that several factors may in practice be interdependent, and in later parts of this standard series a more sophisticated use of stochastic variables was proposed, following the work of *i.a*. Aarseth and Hovde[7].

A = Quality of components (also referred to as inherent performance), e.g. natural durability, preservative treatment, coatings
B = Design level e.g. protection by design
C = Work execution e.g. site management. joints, gaps
D = Indoor environment e.g. temp., RH, condensation
E = Outdoor Environment e.g. climate, driving rain, shadow
F = In use conditions e.g. wear, mechanical impacts
G = Maintenance level e.g. quality and frequency of revisions, repainting

In a more generalised form, therefore, the relationship should preferably be written as an undefined function:

ESL = **RSL * f(A,B,C,D,E,F,G)**

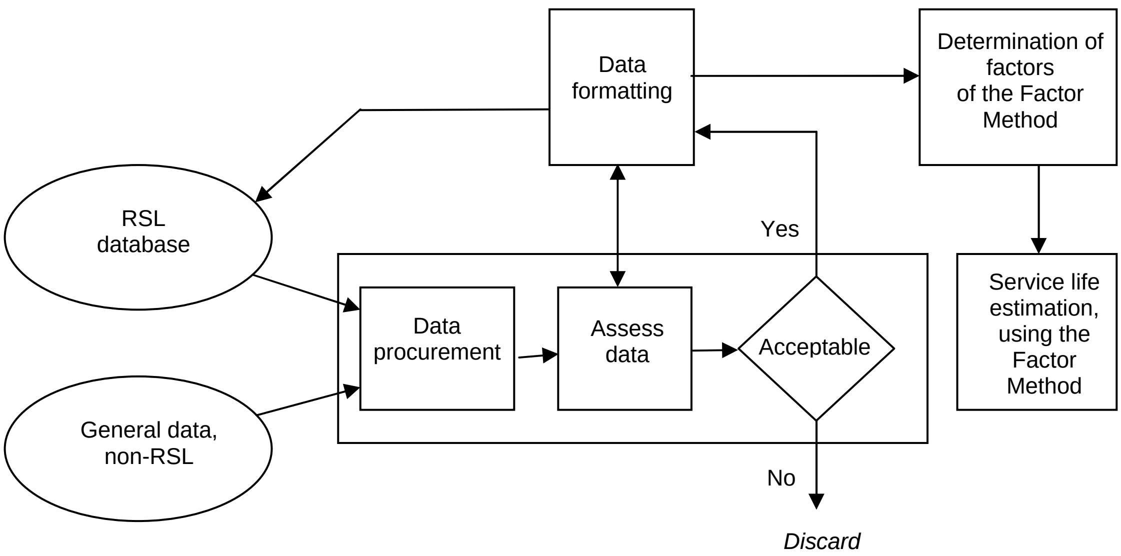

Figure 3. Provision and selection of RSL data, and use of specific data for service life estimations (adapted from ISO 15686-8).

For a standardized and harmonised treatment of service life estimations it is of utmost importance that the reference service life (RSL) data is generally available and accepted, transparent, and formatted in a consistent manner. Figure 3 outlines schematically how RSL data and other more general indata are provided and utilised, in conjunction with data specific for a particular assembly or component, to produce service life estimates.

The Factor Method has not found much use, due to the lack of reliable criteria for the input data. There is an evident need for further development, which was pointed out in a state-of-the-art report on the Factor Method[8], and the development needs below were listed:

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[7] Aarseth, L.-I., Hovde, P.J (1999). A stochastic approach to the factor method for estimating service life. 8th International Conference on Durability of Building Materials and Components, Vancouver, Canada

[8] Hovde, P J, (2004). Performance Based methods for Service Life Prediction, Part A: Factor methods for service life prediction. CIB Report: Publication 294

- Determination and collection of data for the reference service life (RSL) and the individual factors.
- Development of sound engineering methods that combine the benefits of more sophisticated probabilistic methods and simple deterministic methods, i.e. describe the factors as stochastic variables.
- Practical use of the method in case studies of specific building materials, components or buildings.
- Application of methods in life cycle assessment of building materials and components and environmental evaluation methods for buildings.
- Application of the methods in integrated life cycle design and design for durability of buildings.

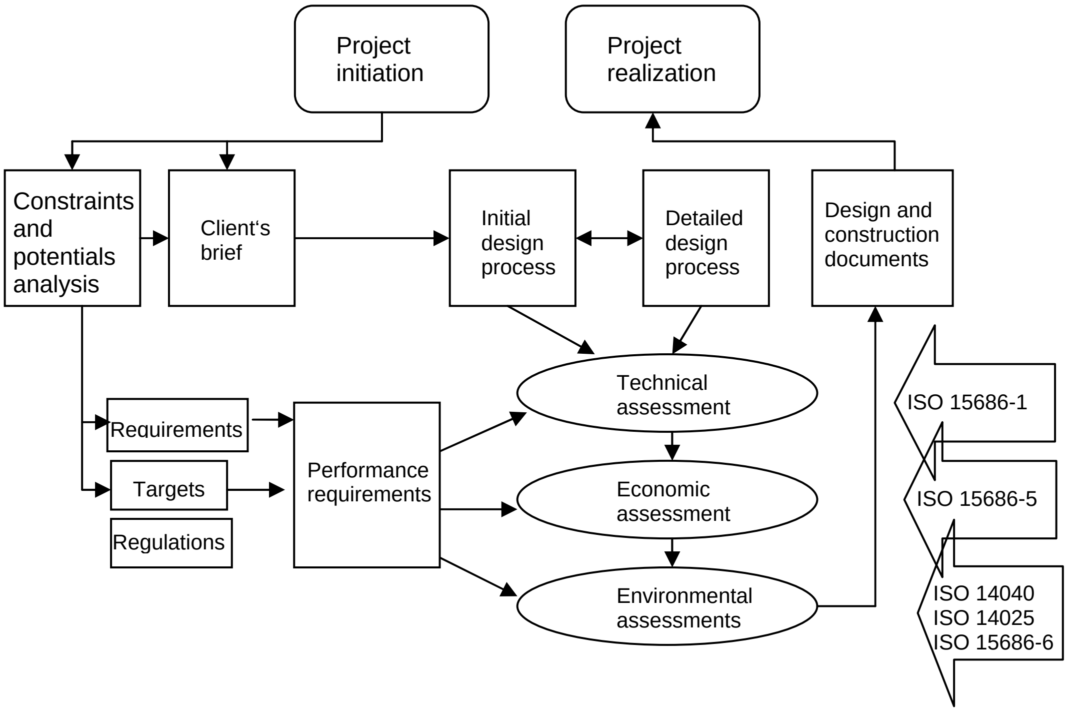

Figure 4. Technical, economic and environmental assessment in Service Life Planning (adapted from ISO 15686-6)

Service Life Planning, as described in the ISO 15686 standards, is an extensive and far-reaching area which includes economical and environmental considerations and a number of technical areas. Figure 4 indicates some of the information flow paths in the project planning of a constructed asset, described in more detail in ISO 15686-6.

There exists, as already mentioned, a considerable resistance to the adoption of the Factor Method for Service Life Prediction. This partly reflects a scientific suspiciousness towards the original presentation of the method as a multiplicative exercise with parameters that are very different in nature, but it can also be understood as a reaction to the degree of complexity of the method when probabilistic measures are introduced. The credibility of the method must probably be evidenced by full-scale application and auditing before it can become widely used.

Similarly, the whole conceptual framework of Service Life Planning is not easy to penerate, and even if many of the functions involved are indeed used already in the construction industry, the full adoption of the presented methodology may require major shifts in working modes. It is fair to say that the ISO 15686 standards do not quite meet the desirable trait of a standard to be easily read and understood, and other user groups, e.g. many product manufacturers, can be expected to perceive the standards as cumbersome.

Hopefully, ongoing and forthcoming revisions will not only produce new versions with a fully coherent and consistent terminology and with clear and unambiguous method descriptions but also documents that are easy to read.

Related work in CEN

To our knowledge, there is only one Technical Committee within CEN which is directly focusing on service life planning issues as a central part of its scope, and that is TC 350 "Sustainability for Construction Works". It is discussed in a separate paragraph below.

Apart from the work performed within CEN/TC 350, as described below, some of the development has been made in another body sorting under CEN, but linked to the Construction Sector Network and not directly sorting under the standardization organisation of CEN. This Task Group Service Life Prediction was instrumental in working out the Guidance Paper F "Durability and the Construction Products Directive", which is an important aid for the interpretation of the CPD. This guidance document will presumably be revised in conjunction with the foreseen replacement of the CPD by a CPR, but the responsibility for handling these matters has now been transferred to ISO/TC 59, and the Task Group will not be discussed further in this report.

It is very likely that many, but probably not all, of the TCs relating to the construction sector have acknowledged the need to incorporate considerations on sustainability and service life planning issues in their work. However, such considerations may in many cases be limited to general statements in their business plans or to minor features in their standard documents. With few exceptions, no active work on standards that deal with these issues as a central part of the scope has been found among the CEN TCs.

CEN/TC 319 "Maintenance" is presently developing a standard prEN 15331, entitled "Criteria for design, management and control of maintenance services for buildings", which certainly touches the field of Service Life Planning.

CEN/TC 38 "Durability of wood and wood-based products" is one of the oldest TCs, and through its focus on durability it is automatically linked to service life planning, even if this term has not until recently been visible in the business plan and scope of the TC and its working groups. The performance in service of building components of wood has always been the targeted goal in this TC, but this has mainly been expressed in the standards as relative measures of resistance to biodeterioration, and not as expected service lives in years. The suite of produced standards, with EN335, EN350, EN351, and EN460 as the most centrally important, have worked fairly well for a number of years but it is now seen as less adequate in delivering information that complies with the needs of users. By forming a new WG 28 "Performance Classification" TC 38 is now adapting its work to better accommodate the service life planning concepts and to align with work going on elsewhere. This development is further described in the section "Pre- and co-normative work in COST Action E 37" below and will therefore not be repeated here.

The work of CEN/TC 351 "Construction products: Assessment of release of dangerous substances" is directed towards the area covered by *i.a.* the Biocidal Products Directive and REACH. Its scope, however, is relatively distant from the issues discussed here, and it can therefore be left out of further consideration in this overview[9]. It may suffice to note that indicators, criteria and developed standards will in a longer perspective have some influence on the stock of materials available on the market for construction products and may in that have some influence on service life design options.

CEPMC (the Council of European Producers of Materials for Construction) has been actively engaged in a number of issues regarding the regulatory work for e.g. CE-marking. A group on durability has worked on policies in the implementation of the CPD but it is currently inactive. However, it is expected to become reactivated with the move from the Construction Products Directive (CPD) to the Construction Products Regulations (CPR).

CEN/TC 350

An executive summary[10] of the CEN committee TC 350 "Sustainability for Construction Works" gives the scope of the committee thus:

"The TC 350 shall be responsible for the development of voluntary horizontal standardised methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products.

The standards will be generally applicable (horizontal) and relevant for the assessment of integrated performance of buildings over its life cycle.

The standards will describe a harmonized methodology for assessment of environmental performance of buildings and life cycle cost performance of buildings as well as the quantifiable performance aspects of health and comfort of buildings."

A central part of the work is to develop quantitative sustainability performance indicators[11], based on a life cycle approach. In that, due attention is given to the needs and directions of relevant European Commission policies related to the construction sector (CPD/CPR, Green Public Procurement, Lead Market Initiative, Eco-design, Eco-label, Energy-label, European Platform on LCA).

The standards presently registered as Work Items in TC 350 are the following:

* Environmental product declarations -
    prEN 15804 - Product category rules
    - Methodology and data for generic data
* Description of the building life cycle
* Integrated assessment of building performance -
    prEN 15643-1 - Part 1: General Framework
    prEN 15643-2 - Part 2: Framework for the assessment of environmental performance
    prEN 15643-3 - Part 3: Framework for the assessment of social performance
    prEN 15643-3 - Part 4: Framework for the assessment of economic performance

[9] TC 351 Business plan. Available at http://www.cen.eu/CENORM/Sectors/TechnicalCommitteesWorkshops/CENTechnicalCommittees
[10] TC 350 Executive summary. Source as in Footnote 9
[11] TC 350 Business plan. Source as in Footnote 9

* Assessment of environmental performance of buildings - Calculation methods

* Environmental product declarations communication format –
  - Business to Business
  - Business to Consumer

The draft of prEN 15804 provides category rules for Type III environmental product declarations (EPD) for buildings, building products and services. The objective is to ensure that the LCA-based data for EPD are consistent, comparable, verifiable and scientifically based. Since the life cycle must be defined, it is essential to include information on service lives, including reference service lives RSL.

The standard series EN 15643 outlines how the environmental, social, and economic performance assessments can be integrated and provides the necessary principles and requirements therefore. The drafts of parts 1 and 2 have reached a further approval stage than the following parts.

In short, the developed methods for sustainability assessments shall be based on a performance-based approach, and they extend to the areas of environmental, social and economic performance. There is a close relationship between the work of this committee and that of ISO/TC 59/ SC 17 “Building Construction – Sustainability in Building Construction”, and all of the production is aligned with the international framework developed by these ISO standards.

It can be concluded that the field covered by TC 350 on the issue of sustainability is very large, and that not all of its aspects have a direct bearing on service life design issues. However, Service Life Prediction methodology is a prerequisite for service life design methodology, where it is incorporated. Similarly, service life design methodology influences the sustainability assessments of the performance of construction works and products, particularly regarding the aspects of environmental and economical performance. At the same time it is influenced in return by the chosen indicators for these assessments and by their definitions. Consequently, there is every reason to keep a close contact with the development in TC 350 and to maintain a good working relationship as far as possible.

Pre- and co-normative work in COST Action E 37

The Task Force Performance Classification (TFPC) was established at the COST Action E37 workshop in Ljubljana in June 2004. The aim of the Task Force was to outline principles for a performance-based classification of wood durability, in particular in utilising the natural durability of untreated wood and for modified wood products, traditional and non-traditional treatments and non-biocidal measures for wood protection.

The COST Action ended in September 2008, and the TFPC has submitted a final report for inclusion in the overall documentation of the Action. The report is available on the COST E 37 web page (www.bfafh.de/cost37.htm).

The standards related to the durability of wood and wood-based products, and not least those produced by CEN/TC 38 "Durability of wood and wood-based materials", were of primary interest to the studies of the TFPC. Moreover, one of the reasons for starting the TFPC was the shared view that the present suite of standards was insufficient to deliver fully adequate performance-based data. It was even stated in the Memorandum of Understanding for the COST Action that "for very many of these systems [*novel wood protection techniques*], current traditional testing and specification measures for both biological and physical durability are no longer suitable". Therefore, one of the foremost goals of the Task Force was to address the way durability is treated in the field of standardization. It was conceived that well-founded proposals on how to amalgamate modern and material-independent methods of service life prediction and service life design with traditional wood assessment methods would be of direct use to e.g. TC 38.

A rather generic list of requirements for standards (shown below) was contemplated, and a more detailed analysis of a number of the most frequently used standards for durability assessments and classifications showed that they often have shortcomings in several respects.

Requirements for successful and truly useful standards are that they should be:

- Reliable
- Predictable
- Reproducible
- Repeatable
- Consistent (inter- and intra-)
- Easy to use
- Easy to understand
- Widely applicable
- Well correlated to practical product performance

An underlying philosophy of the TFPC work is that any system of predicting the performance over time with regards to degradative processes must have the requirements of the actual users as its first priority. Users are here defined in a broad sense, to encompass users of engineering models, design models and standards, as well as users of buildings and other constructed assets. Hence are included also architects and other professional groups involved in design and construction, maintainers of buildings, valuers and insurers, building owners, manufacturers of building products, and final end-users of buildings.

Early in the process, the TFPC summarized some leading principles in a position paper:

- Assessments of durability of construction products, and their ensuing classification, must be adapted primarily to the needs of the end user and existing legislation.
- Test data must be produced with the aim that they shall fit into well-functioning prediction tools.
- Well-documented data from in-service experiences have the highest priority as a basis for service life predictions, followed by field tests and then lab tests. Lab tests give faster answers and are therefore particularly useful, but they must be devised to give maximum correspondence with performance in service. Furthermore, for comparative predictions of service life, we need test methods with applicability to a wide range of materials and products.
- Tests that give results directly on the property of primary interest are generally to be preferred to tests where another characteristic is used as a proxy. Tests of the latter kind must be justified by an analysis of the correlation between the measured variable and the one truly responsible for the performance of the product. An example is measurements of mass loss where strength loss is of primary interest.
- We must seek to understand the external factors affecting the field tests, particularly in use class 3 situations [*above-ground exposure*], where they are less well understood than in use class 4 [*exposure in ground contact*], and in representative in-service conditions. Yet we know that it is seldom easy to find clear correlateions between climatic conditions and the incidence of decay.
- A critical reinterpretation of existing lab test data in the light of later findings in field tests is encouraged whenever possible, as well as critical studies of field test data with other evaluation criteria.
- For test methods and schemes, simplicity and limitations of cost must be sought, without compromising with the demands for scientific rigour.

The TFPC recognizes the use of Reference Service Lives (RSL) as a basis for estimations of expected service lives (ESL). The estimates are not necessarily reached by use of the Factor Method as it is expressed in ISO 15686, but the basic features of the concept can and should be used. In order to effect the development of a range of performance classes, the scientific community must cooperate with major user groups and stakeholders and define a range of Reference Products that can be evaluated under Reference Service Conditions. Results from tests of any commodities, construction products and components will then be held up against agreed reference service lives, and this can form the foundation for a range of Performance Classes. During this development, already existing Use Classes must be taken into account. If necessary, they should be adapted to suit a forthcoming system for performance classification. As an input to the Factor A (Quality of components) of the Factor Method, it may be useful to define a range of Durability Classes that can feed into the assessments.

Interactions with standardization bodies

Above all, contacts were maintained with CEN/TC 38 throughout the whole action period of the TFPC. In November 2005, TC 38 took a resolution in which it “asks WG 21 to establish a Task Group to address these issues as required by the Construction Products Directive and the wider wood using community. As a first step, CEN/TC 38 asks the

COST E37 WG 2 Task Force to continue its work with the aim of proposing a road map outlining how service life prediction might be addressed within CEN/TC 38 standards".[12]

It took nearly a year until the Task Group Service Life Prediction (TGSLP) could be realised within CEN/TC 38/WG 21, but it has since then worked closely together with the TFPC, in meetings that in practice have consistently been joint.

The TGSLP established a formal liaison with ISO/TC 59/SC 14, and it has produced three documents directed to this sub-committee.

1. After studies of the standard series ISO 15686 it was concluded that these standards failed to take heed of some particular requirements of wood and wood-based materials that are related to the inherent natural variability of the material and to the peculiar dependence on biological degradative influences. A tabulated set of comments[13] was then sent to ISO for consideration in the continued drafting and revision of these standards.
2. In a liaison document[14], the TGSLP further pointed out some aspects that must be taken into account for wood and wood-based products. The document further gave a first outline of the ideas for moving forward towards a performance-based classification of durability that would gear into the current Service Life Prediction methodologies, and it sought the agreement and advice from ISO/TC 59/SC 14.
3. The ideas of the foregoing liaison document were somewhat extended and formed into a draft informative annex[15] for consideration by ISO as a contribution to relevant parts of ISO 15686.

In November 2008, CEN/TC 38 further manifested its keen interest in the ongoing development by creating a new working group, WG 28 "Performance Classification" with instructions to produce "guidance on the determination of end use performance of wood products : utilisation and improvement of existing test methods to estimate service life, in order to give input to the harmonised product standards dealing with the durability requirement of the CPD and future CPR".[16] This WG has started by drafting its work plan, which includes making a gap analysis of existing standards in the field concerning their ability to inform on service life. It will furthermore look for ways to establish performance-based classifications of durability for the purpose of satisfying market and regulatory needs.

Both the COST E 37 Task Force and the CEN/TC 38/WG 21 Task Group have now ended their missions, and the liaison to ISO/TC 59/SC 14 has been transferred to WG 28.

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[12] CEN/TC 38/N 1633 Resolutions taken during the 41st meeting of CEN/TC38 held in Paris 17/18 November 2005

[13] CEN/TC38/WG21/TGSLP/N11 (also registered as CEN/TC38/WG21/ N141 and CEN/TC38/N1710) Table with comments on ISO 15686

[14] CEN/TC38/WG21/TGSLP/N17 (also registered as CEN/TC38/WG21/ N144 and CEN/TC38/N1715) Liaison document to ISO/TC59/SC14

[15] CEN/TC38/WG21/TGSLP/N26 (also registered as CEN/TC38/WG21/ N148)

[16] CEN TC 38/N1740 Resolutions taken during the 44th meeting of CEN/TC38 held in La Plaine Saint-Denis 19/20 November 2008

Foreseen actions in order to make durability information useful for SLP models

1. Data from durability tests need be captured in a format that plugs directly into the models and schemes for service life design and service life planning. This calls for a close cooperation of developers of engineering and service life design models with experts in the field of wood durability and in particular with CEN/TC 38.
2. More experience of real product service lives must be gathered and documented in ways that make the information useful in models.
3. Since the Working Life concept is intimately linked with the Essential Requirements of the CPD, and thus with acceptable levels of performance, there is much work to be done in order to establish limit states and end points.
4. Moisture risk in constructions needs to be understood to translate durability information of wood to durability of wood in specific construction applications. For some applications this means that the links should be strengthened to expertise in building physics and moisture safety design.
5. Further developed descriptions and models of the climatic factors are needed, including an increased understanding of the importance, variations and interrelationship of the climate on macro-, meso- and microlevels.
6. An independent and authoritative reference database of product performance and durability data (biological durability, coating longevity, wear resistance, creep, weather resistance etc.) would be very useful.
7. CEN/TC 38 needs to agree how their test methods can be used and develop refinements to assist with point 1.

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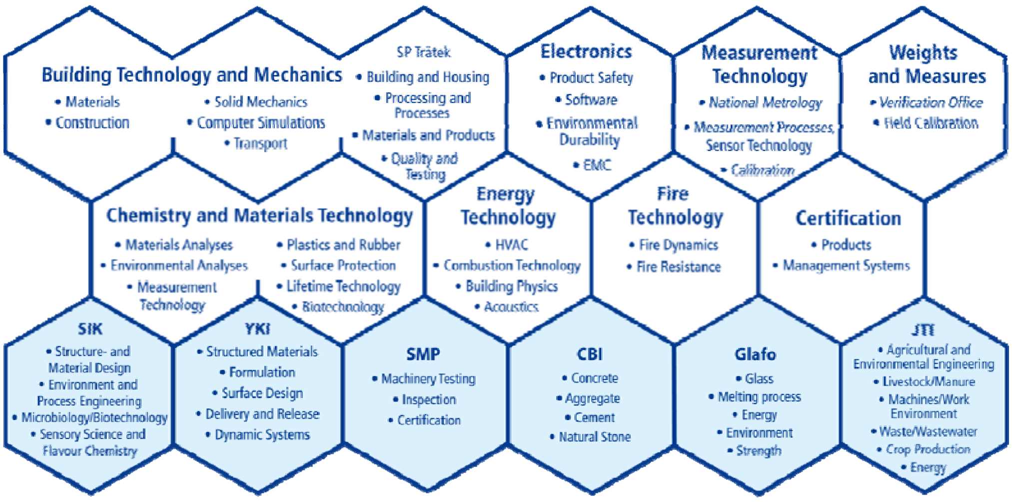

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