

SUSTAINABLE CONSTRUCTION IN ISO/TC59

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Summary

This paper introduces the ongoing work within the International Organisation of Standardization (ISO) regarding Sustainability in Construction.

This wide and holistic concept is now shared worldwide through the consensual idea of a strong concern for the long time consequences of our actual activities. One can easily overview what it means specifically for the building sector. But as it is addressed for the first time with the view angle of standardization, thus before being addressed on a general point of view, the theme must be carried out with caution, considering several requirements.

The group of experts in charge of that Sub-Committee is developing documents on several specific topics like environmental declarations of products, sustainability indicators and assessment of environmental building performance, but a major effort is directed on the establishment of a consensual document on the general principles, and to obtain a harmonized approach within the different groups on a common background.

This documents aims at elaborating a framework based on well-established aspects of the sustainability (the three spheres of environmental, economic and social aspects), of the building cycle, and of the construction works typology. It is carefully drafted taking into account the different national and/or domain of activity concerns, It builds upon a basic detailed discussion towards a large consensus on terminology.

Finally, a key aspect of this prospective and innovative standardization work is the constant concern for open links with other working groups and networks, either horizontal, like ISO/TC207 on environmental management, or sectorial, like ISO/TC59/SC14 on service life planning, or EU thematic networks like PeBBu on performance based building.

The main expectation of the experts in charge of that work is to reach a well accepted harmonized document, respecting itself the sustainability principles in its process and future dissemination conditions, and recognized by a worldwide circle of countries. The document is intended to be used as a basis for an open discussion on what standardization can deliver in the field of sustainable development.

1. Introduction

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies. The work of preparing international standards is normally carried out through ISO technical committees (TCs), where each member body of ISO has the right to be represented. ISO TC59 addresses *Building Construction*, subcommittee (SC) 17 works on the thematic field of *sustainability in building construction*. SC 17 is currently structured in 4 working groups (WGs) in order to establish ISO documents on general principles, terminology, sustainability indicators, environmental declaration and methodologies for assessment of environmental building performance.

SC17 is the first ISO committee that expressly carries the wording *sustainability* in its title. However, the work of SC17 is strongly related to other committees' work, namely TC59/SC14 on *Design Life*, TC207 on environmental management and the recently established CEN BT/WG174 on *integrated environmental performance of buildings*.

While the established ISO standards in the ISO 9000 and the ISO 14000 series have a management approach focusing on organizations, TC59/SC17 as well as SC14 rather focus on the *construction works*, meaning the building or other civil engineering works. The scope of SC17 encompasses the three spheres of

sustainability (economic, environmental and social aspects of sustainability) seen over the complete life cycle of a building or civil engineering works.

While the concept of sustainable development, as established in (Brundtland 1987), is clearly the basis for the development of international standards on sustainability in building construction, an ISO technical committee will not succeed in establishing standards including a political agenda. Standards can identify and harmonize the approaches that can facilitate successful addressing of concerns and targets, and can enable various stakeholders to succeed in their communication of information. Other bodies, either governmental or non-governmental, must set the political agenda. As an example, the international council for research and innovation in building and construction (CIB) has, in an international process, developed the CIB agenda 21 on sustainable construction (CIB 1999). The ISO work relates to such documents.

This paper aims to present the current status of the discussions ongoing in SC17/WG1 on sustainability in building construction - general principles (ISO AWI 15392).

2. Scope

Subcommittee 17 is developing several ISO documents, technical reports (TRs) and full international standards, related to sustainability in building construction. The standard on general principles has several main goals:

1. to identify and establish a concept for addressing sustainability aspects in relation to building construction
2. to establish a rationale for other standard documents that are currently under development in ISO/TC59/SC17
3. to identify the link to other international standardization projects
4. to identify fields of concern that are not yet addressed in standardization
5. to clarify which of the above fields are ready for standardization, and which may better be addressed by non-normative documents.

One key concern of the work in ISO/TC59/SC17 is that while the various work items must be allowed to develop at their own pace, and while their topics show different degrees of maturity, the standards under development must function as separate items, but equally as parts of a larger context. For this it is essential to lay out the rationale of sustainability in building construction, and to identify the role the various standards play, whether developed within TC59 or in other committees.

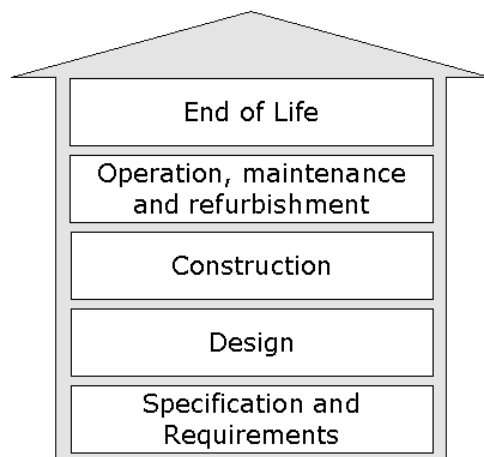


Figure 1 Primary Life Cycle Stages of Construction Works

From the very beginning it has been maintained as obvious, that the standards must encompass the entire life cycle of a construction works (see figure 1), and that it must consider the three primary aspects of sustainability. These three spheres, economic, environmental and social aspects, are inevitably linked to each other; they are interdependent and need to be balanced. Meanwhile they must be considered equally. Notwithstanding that they may be given different importance by various stakeholders, the standards must treat them as clearly equally important.

When addressing building construction, it is evident, that the focus cannot be restricted onto buildings alone. The standards developed under TC59 *Building Construction* should aim to be equally valid for buildings as for other construction works. Further, of interest in the field of sustainability in building construction are the buildings as well as the parts of which they consist, and the context into which they are built. Addressing sustainability has a strong link to functionality and performance aspects. Functionality is not restricted to the product or the building at hand, but relates to the building as part of infrastructure and as an item providing human activities with a service, performance relates to the expectations of users. This consideration can be illustrated as in figure 2.

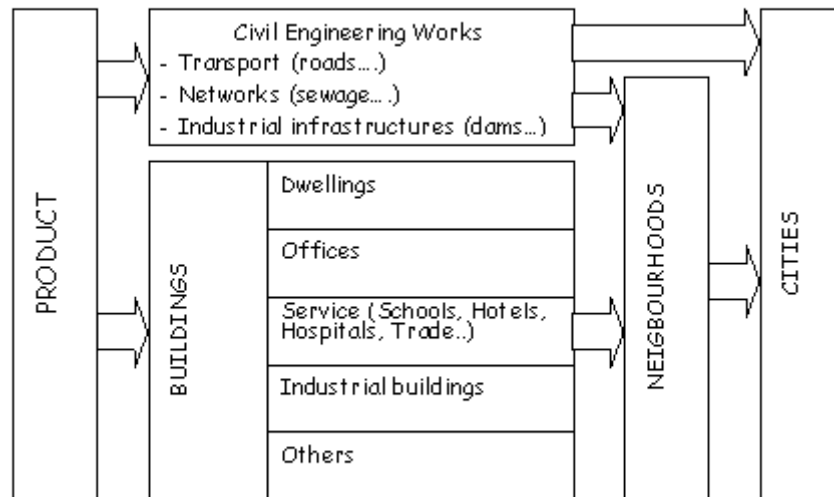


Figure 2 Objects addressed by ISO/TC59/SC17/WG1

While figure 2 illustrates the products as addressed by the general principles document, this does not mean, that all standards developed under SC17 necessarily must address all of these. Rather, they all have their own scope definition; meanwhile these different scopes can be identified as part of the scope of the general principles standard. With this, they are compatible to each other. Structured according to the sustainability aspects addressed, and to the object of concern, the current work items can be located as in figure 3 below.

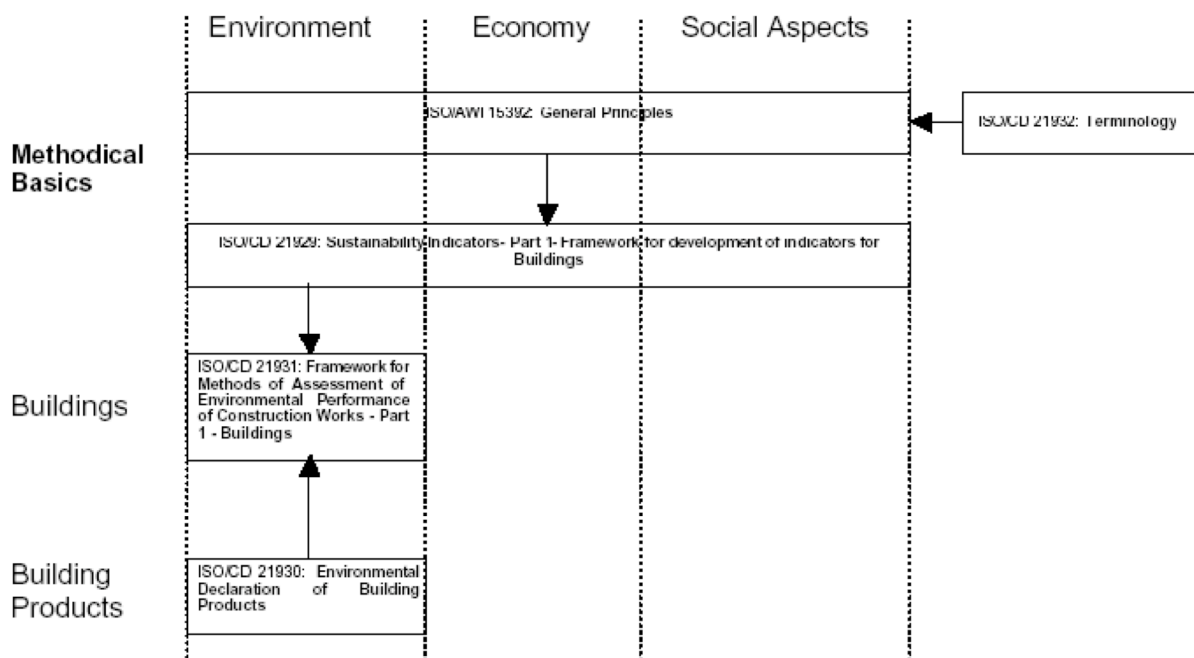


Figure 3 Scope of Work Items under ISO/TC59/SC17

3. Approach for Standardization

3.1 General

In general, the approach for standardization of sustainability in building construction must include a consideration of:

1. the three spheres of sustainability
2. the spatial and temporal relevance of construction works and their life cycles
3. the products of the building and construction sector, including the service provided by these products and their supply chain (see figure 2)
4. the involved process management and organization activities, targeted to construction works (from specification of requirements, through planning, production, construction and operation into deconstruction, see figure 1)
5. the various perspectives of concern that are directed towards aspects of buildings.

When the above mentioned have been clarified to their content, a strategy for sustainability in building construction can be derived. Such strategies can only partly be subject of international standardization, as their detailed content and interpretation will vary due to regional and cultural diversity. Meanwhile, the development of standards appears essential for means and assessment systems (see below), while for concepts, principles and objectives, the generation of other forms of guidance, and the establishment of common understanding, appears more appropriate.

The rationale from the concept of sustainable development to standardization follows:

- Concepts, as established ideas for characterizing and implementing sustainability in construction works
- Principles, as guidance elements to be followed for applying sustainability in construction works, where the concept of principles is global, but the application conditions involve specific regional values, social, cultural and economic priorities, etc.
- Objectives, as the goals to be reached when applying sustainability in construction works
- Means, as tools to be used when trying to reach the objectives – while applying the principles
- Indicators, as measurement systems displaying and communicating elements of performance
- Assessment systems, as expression of the efficiency of the means addressing the objectives.

3.2 Object of concern in SC 17

SC17 clearly focuses on sustainability aspects of construction works. The central object of concern is the life cycle of the building, as seen from relevant perspectives of concern, and with its influence on relevant sustainability aspects. As the specific interests and concerns of stakeholders will lead to variations in the selection of aspects of interest as well as their relative importance, the standards establish concepts on *how* to address items of concern, rather than stipulating in detail *what* to consider.

Integrated planning tools, that enable planners and other relevant stakeholders to consider aspects of sustainability already in early design stages, are playing a key role. Such planning tools may well be the context within which tools, which are developed on the basis of the standards on sustainability in building construction, will come to application. Integrated planning tools incorporate:

- Multi-attribute decision making
- Integrated consideration of quantitative and qualitative information
- Holistic consideration of spheres of sustainability
- Life cycle of the building
 - Service life and performance requirements
 - Life cycle cost assessment
 - Life cycle environmental assessment
 - Inclusion of use-phase concerns in project planning
- Product and process view
- Stakeholders' perspectives
- Urban planning

The ultimate task of standardization efforts is to establish harmonized routines that enable fair, justifiable and repeatable planning and assessment results, and that equip the various stakeholders to communicate relevant information. Information must be communicated in harmonized ways in order to avoid arising of new technical barriers to trade.

Where the standard on general principles lays out the general concept of standardization in the field of sustainability in building construction, the standard on environmental declaration clearly focuses on the provision of product related environmental information. As the object of concern in SC17 is the building, not building products, the environmental declarations are intended to be applied in assessments of entire buildings. Meanwhile it is very well recognized, that the environmental declarations play a singular role at the same time. Due to the declaration of information on product level, but with the intention to communicate information for application in building design context, the demand to include service life and life performance aspects into the declarations is at hand.

4. Link to Service Life and Performance Concepts

4.1 Service Life Planning

One of the guiding ideas behind establishing a concept and International Standards for service life planning (SLP) was to enable planners to design buildings that meet or exceed established performance requirements throughout the service life of that building. The service life of a building is defined with reference to performance requirements (ISO 15686-1)(ISO 15686-6). Meanwhile, the service lives of a building and its components can not be regarded as being independent of each other, as buildings require a certain performance from materials and components in order to be able to meet performance requirements expressed at the building level. At the same time however, materials, components and systems that are part of a building usually themselves require provisions by the building, in especially concerning serviceability. Such interrelationships and the topic of aggregation and disaggregation of performance requirements are discussed in (Trinius & Sjöström, 2005).

4.2 Performance Based Building

The international council for research and innovation in building and construction (CIB) began work on the subject of building performance in the 1970es. The "performance approach" was described as "first and foremost, the practice of thinking and working in terms of ends rather than means. It is concerned with what a building is required to do, and not with prescribing how is it to be constructed" (CIB 1982). Over the years, CIB has started numerous working groups addressing performance-based building.

The link of building assessment to performance based building originates from the situation that fair comparisons between different design options must be made on a comparable functional unit. But for comparative assessments of design options, the context is a still evolving (and hence not entirely determined) design, which means that the exact context of the application of the design options is not yet known, and that often a proper functional unit may not be possible to be determined. Further, in case of assessments in the design stage, it appears most important that the design options meet the same performance requirements rather than having the exact same functional unit (Trinius 2005a).

The performance approach can, for the context of sustainability in building construction, provide the basis to relate assessment references, and perform as an anchor for the establishment of use-phase and service life scenarios. Further, a clear description of performance requirements first enables a designer to provide the client with a building that responds to these requirements. If expressed clearly and unambiguously, performance requirements can assist in the evaluation of tenders as well as underlie design choices.

4.3 Integration of Performance Concept, Service Life and Sustainability

Sustainability assertions of construction products and entire buildings must consider aspects from the entire life cycle of the assessed object. Therefore, service life and performance throughout the service life are key aspects of concern. As assessments of a building design are supposed to reflect the current design rather than a fictitious combination of default-situation assessments of components, the manufacturers alone cannot provide the information needed for these assessments. However, information from the manufacturers constitutes the point of departure for the generation of case specific assessments (Trinius, 2005b).

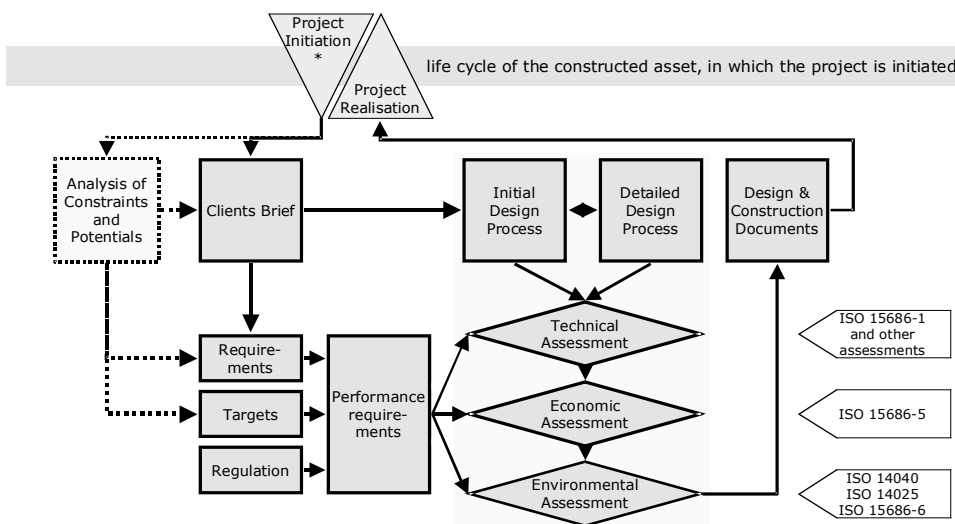
4.4 Products, Buildings and Aspects of Sustainability

Service Life Planning as well as Performance Based Building must rely on information that is being made available to building designers and to other interested parties. In current building assessment methods, assessments are frequently based on generic databases on materials and their environmental properties. While this may be regarded as a pragmatic simplification enabling the consideration of environmental aspects, it means at the same time that designers' and developers' efforts to improve their products and designs, are neglected to a large extent, when such tools are applied. As manufacturers may be held reliable

for the information they provide, they will need to be in charge also for the updating of information, which is a feature seldom found in generic databases.

While manufacturers can provide information concerning their specific products to the market, they face tremendous difficulties to establish information that incorporated the application and use-phase of their products. Given that a product as one or at maximum a few typical applications, default scenarios can be established, and information for application in line with such scenarios can be generated and provided. Inclusion of service life information in product declarations requires standardized approaches, as discussed in (Sjöström et al 2005). The transparent communication of scenarios is then a central item that can enable a designer to verify whether the provided scenario sufficiently well coincides with the situation at hand in the current design. Models are being developed and published e.g. in ISO 15686 concerning the influence of different exposure environments on the service life of materials and components. The performance requirements posed to the building and its parts play an additional important role in this context. ISO 15686-6 establishes a routine for the integration of environmental aspects into the concept of service life planning (ISO 15686-6). The procedure establishes a concept that allows the parallel consideration of technical/functional, economic and environmental aspects. Further, it relates to established performance requirements, see figure 4. The conceptual reasoning behind the ISO 15686-6 approach is presented in (Trinius 2005a)

While environmental and economic aspects can be related to the processes applied throughout the life cycle of the building, difficulties of a larger magnitude are at hand for other aspects of sustainability, such as aspects related to health and comfort of people using the buildings or requiring the services provided by the buildings.



* Project may be initiated at any point in the life cycle of the building

Figure 4 Technical, Economic and Environmental Assessment related to Performance Requirements (ISO 15686-6) Scope of Work Items under ISO/TC59/SC17

5 Conclusions

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After the consideration of chapter 3 above, it appears evident, that a mere listing and aggregation of product related performance aspects and impacts is clearly not enough of a basis to express sustainability aspects of buildings.

Meanwhile, existing concepts and approaches under development utilize information from the product level. To allow consideration of information related to the application phase of such products, full life cycle information may rely on scenarios. However, it cannot be expected that product manufacturers can identify scenarios that meet the exact conditions of a certain building / project. In order to adapt product related information and in order to relate it to performance requirements that are usually expressed for functional systems or entire buildings, such scenarios must be communicated in transparent ways. Additionally, guidance for adaptation of scenarios must be provided.

The international standards that are currently under development address sustainability in building construction. Meanwhile, the focus is directed primarily on environmental and economic aspects, as these appear to be the most mature items for international agreement. The standards are based on modular approaches; these shall also enable the later refinement of the modules and the development of additional modules for thematic fields that are not yet addressed.

First steps are being taken concerning health and comfort aspects. Other sustainability aspects, and especially value statement involving sustainability aspects, are deeply related to political agendas and to value judgments of involved stakeholders. While international standards may concern the approaches, they will not succeed in setting the agendas themselves.

Placing this paper in the section on environmental ethics primarily was chosen to provide a basis for discussion of the role standardization can play – as part of the development of an international agenda for sustainability in building construction, not as the sole element providing the solution.

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