Performance Based Building

PeBBu

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LIFE PERFORMANCE OF CONSTRUCTION MATERIALS & COMPONENTS

PeBBu Domain 1 Final Report

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LIFE PERFORMANCE OF CONSTRUCTION MATERIALS & COMPONENTS

PeBBu DOMAIN 1

FINAL DOMAIN REPORT

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Performance Based Building Network (PeBBu) is a thematic network funded under the European Commission's (EU) 5th framework – Competitive and Sustainable Growth and has been operational from October 2001 till September 2005. This project has been managed by CIBdf, The Netherlands. The PeBBu Network has been facilitating in enhancing the existing performance based building research and activities by networking with the main European stakeholders and other international stakeholders. The network has also been producing synergistic results for dissemination and adaptation of performance based building and construction. More than 70 organisations worldwide have been participating in the PeBBu Network.

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FOREWORD

Domain 1 is felt as having been a successful thematic network, successful to its objectives, and successful in the means to establish and deepen a network of researchers active in the field of service life planning.

As the context of the work on service life planning is currently expanding and to be integrated into the work related to sustainability in building construction, the field is not dissolving, but facing a shift in importance. Where earlier more strongly related to highly specialized research tasks, the issues addressed are getting broader. At the same time, it becomes clearer to other groups and networks, that the work carried out on the subjects of durability, service life and life performance is essential when working on i.e. life cycle assessment, life cycle costing and sustainability assertions of buildings and their parts.

For the future of acting on service life, this gives a very bright perspective – meanwhile it must be ensured that the market actors are fully involved and fully understanding the need to act. This is very much on the way and needs strengthening. Service life planning needs to be put into practice, at least with the current development of political agendas relating to sustainability and long-term performance.

Leading this domain has offered many possibilities to develop the perspective on service life. The influence the network has had on its members and on its surroundings can be read from e.g. successful workshops and from the openness of other thematic fields to embrace the work performed.

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EXECUTIVE SUMMARY

PeBBu Domain 1 on Life Performance of Construction Materials and Components succeeded to establish a well-functioning platform to develop and discuss topics related to the thematic domain. A core success factor was that D1 operated very centrally within ongoing international standardization work, and with pre- and co-normative research projects. With the main objectives being to work for the establishment and the anchoring of an agreed international research and development agenda in its thematic domain, to relate to the work namely of ISO/TC59/SC14 and to develop the there-specified methodologies and to bring these to the attention and application of actors in the building and construction sector.

In brief, D1 has:

- contributed to international standardization and to international research projects and networks,
- discussed the application of service life information in the context of product declarations intensely mainly involving the perspectives of provision and application of provided information
- developed education and training material
- contributed to the international research community with numerous contributions on international conferences and workshops, as well as through publications in scientific journals.

D1 has strived to position itself at the gap between research and application of innovation, which has led to the conduction of interesting workshops with participants from "both sides". Where the dialogue at times has been difficult, the discussions have been fruitful and efficient in the meaning to generate understanding for the thematic field of life performance of materials and components.

Due to these discussions and the success in establishing a dialogue, it is assumed that PeBBu D1 managed to play a significant role on the route to bring Performance-based building, and especially the consideration of service life aspects in the planning process, into practice. This process is however by no means completed with the end of the project, but the contacts for a continued development and a continued dialogue are in place, which is a precondition for future exploitation of the D1 results as well as for the thematic field as such.

PeBBu domain 1 addresses issues in a thematic field, where performance based building, service life, life performance and environmental declaration of products draw attention to each other. As can be seen in the recent development of international standards, service life and performance requirements gain a significant position as part of sustainability assertions of buildings and building products.

Domain 1 aims to identify aspects of practical application of the ISO standards series 15686 on service life planning, as these standards provide the methodological basis to identify service life, and to provide the market with service life information. As service life per se relates to performance requirements and performance over time, and as sustainability in building construction relates to fitness for purpose, performance based building fulfils a central hot spot of concern in relation to building sustainability.

D1 addresses stakeholders' concerns when involving service life – both concerning the provision of information as the adaptation of information to a specific building design. Hence, concerns of manufacturers as well as designers and other relevant stakeholders are dealt with. Issues of concern for further R&D as well as feedback and input to ongoing international standardisation, are identified by D1. With the direct link to the durability and service life research community and the involved standardisation bodies, the thematic network plays an important role in promoting performance-based building.

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Life Performance of Materials and Components

CHAPTER 1

1 Life Performance of Materials and Components

1.1 Scope and Objectives

Additional to the overall objectives for the PeBBu Network, specific objectives for all PeBBu domains were:

- to programme and coordinate international R&D that falls within the domain's scope in order to ensure internationally accepted prioritizing of such R&D, maximal stimulus of international collaboration and maximal compatibility of results of such R&D
- to establish relationships with other international experts' or stakeholders' networks that have overlapping scope and objectives

Additional to the common PeBBu objectives, domain 1 on life performance of construction materials and components is to foster the further development of the performance concept in the domain, for a better concern and assessment of the performance over time, and to anchor this development with sector stakeholders, which are more and more demanding information, tools and data for service life prediction.

This focused in particular on:

- The further development of the Factorial approach as regards
  - (i) theoretical and engineering approaches,
  - (ii) basic knowledge base of different factors,
  - (iii) development of pedagogic application examples and
  - (iv) test-training of practitioners.
- The exploration and description of the conditions and prerequisites for reference life (performance) data for classes of building materials and components with account of sub-sectorial industry structure

Domain 1 thus provides guidelines of pre-standardisation support type on (life) performance of materials and products.

1.2 State of the Art

Since 1993, international standardisation in the field of service life planning is undertaken. The main purpose of standardisation efforts in ISO/TC59/SC14 "Design Life" is to identify routines that support the design of buildings that meet identified performance requirements, throughout their design life. By directing the work to this thematic field, also demands originating e.g. from the European Construction Products Directive (CPD) [1] are addressed. The methodology obviously is equally worthy for other regions. For Europe meanwhile, the CPD can be identified as a very significant driver for standardization and harmonization, as products fulfilling the six essential requirements of the CPD are eligible for CE marking. One of the routes to CE marking is based on an assessment of the product, including an evaluation of its durability in order to obtain a reasonable working life, as required in the CPD. Especially for the evaluation of new and innovative products, where no experience-based information is available, the European Organization of Technical Approvals (EOTA) has developed general guidance based on the service life prediction concepts [2], as expressed in ISO 15686-2 [3].

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" [4]. Over the years, CIB has started a number of working groups addressing performance-based building, with the EU funded thematic network PeBBu, addressing performance-based building in 6 scientific domains, 4 regional platforms and 3 user platforms, being a prime present activity.

PeBBu Domain 1 on life performance of construction materials, components and systems specifically relates to the ISO 15686 standards. The link between the ISO standards and Performance Based Building has long-since been understood as evident, and has been elaborated and discussed at hand of the CPD in e.g. [5]. Domain 1 intends to exemplify these standards with the goal to enable wider provision of information needed for the process of service life planning, as well as enabling a wider application of service life information in project planning and building design. While focussing building materials and components, the context of functional application of materials and components deserves consideration. Consequently, D1 also addresses systems. The topic of sustainable construction provides the contextual frame and the philosophical reason for acting on the topic of service life. This involves the development of methodologies to identify reference service lives and estimated service lives, also in terms of service life declarations. These methodologies provide important input especially to environmental product declarations of building materials and components (see for instance [6]) and equally evident, to the assessment of environmental performance of buildings. Both items are addressed in ISO/TC59/SC17 and in CEN/TC 350.

PeBBu strives to identify current practice in the building sector, both to identify the potential for improvement and to provide feedback of experience and practical information into the process of formulating standards. Based on the requirements posed by the standards and the experience and practice in the building sector, thematic fields for future attention and research can be identified. The derivation and communication of performance requirements and performance information are to be named expressly. Developing standards in the field of EPD (environmental product declaration) and sustainable construction show modular structures, where scenarios for service life and life performance have significant influence on the declared information [6].

Innovation in the building sector may be described as either supply-driven or demand-driven. In the first case, the provider of innovative solutions will seek to convince key market actors to recognize and apply the innovative products. In the latter case, the suppliers of products are to develop solutions that meet the requirements originating from the innovation demand. In both cases the communication of life performance or service life aspects is an essential element of information. For innovative solutions, information on long-term performance and service life will not be available. Such information hence must be estimated, e.g. in accordance to the EOTA guidelines and the ISO 15686 standards.

Where service life information is communicated between various stakeholders of the building sector, it has to be assured, that a common understanding, also of the underlying scenarios for which information has been provided, as well is communicated and understood by all parties participating in the communication. A harmonized approach to service life declaration may be very helpful. [7]

PeBBu D1 investigated to what extent actors in building construction already today are informed about the ISO standards, to what extend they make use of service life information and apply the performance based building concept. A general conclusion is that the concepts appear to be well known, but there still is a significant lack of experience and feedback from examples, where the concepts have been applied systematically and successfully. The question whether performance based building in practice leads to innovative solutions, and concerning which performance aspects these innovative solutions are beneficial and in that case to whom they are beneficial, remains to be investigated and documented. Such documentation, as part of the developed training material [8] and presented as successful examples, is supposed to take the role as a key driver to motivate for the application of the performance concept.

Motivation of actors to enable and apply performance information is regarded as the main obstacle to more frequent application of the performance concept in building construction.

However, the availability of information and the number of examples of application is rising, all while the development of tools for the application of service life planning has taken up momentum. From this, in combination with the general awareness of the usefulness of the concepts of performance based building and service life planning, it can be assumed that the development of tools, and the integration into standards relating to building sustainability, will spur the application of the concepts.

The communication of service life information within the construction sector sets high requirements concerning transparency of the information. A declaration of service life can only reflect one or a few scenarios for product application. Therefore, designers for instance, may need to perform or initiate a process of modification of declared information, all in order to obtain information that is relevant to the situation in a specific building context. The primary source of information will still be the manufacturers, while recognizing that information provided by them only can be based on reference scenarios. Such scenarios must be available for scrutiny by those applying the provided information. [7]

1.3 Application of Service Life Information in Project Planning and Design

The process of designing, planning, coordinating and constructing a building involves a wide spectrum of building professionals. While these professionals work cohesively together to address the needs of the client, the groups are often established for singular projects only. This situation introduces difficulties related to the facilitation of experience, as well as to the consideration of demands of interested parties and stakeholders [9]. Meanwhile, the degree to which demands of interested parties are being met is developing into an increasingly important success factor.

Where the success of a design and construction project will be evaluated at hand of the existing building or in terms of the evaluation of a tender, the involved design processes need to foresee how the detailed specific decisions that need to be taken relate to the resulting performance of the entire building or its functional components. Relating design decisions to performance criteria means to shift the concern from short-term concerns (direct cost, installation and construction process, etc) to equally involve long term concerns, such as service life, life performance, durability, life cycle cost, maintainability etc. Decisions on material level need to be analysed towards their performance in the current application and use context. This ultimately means, that the design decisions need to bridge system level shifts from the material level to the building level as well as the temporal perspective from design/manufacture/construction to the building use phase. The actors involved in the design process need to match the performance expected to be provided by the design solution with the performance requirements posed to the building or relevant parts thereof.

Prescriptive standards may or may not be shaped to include a common appreciation of the above mentioned. Performance based planning processes need to establish the rationale for each project and for its specific conditions. This may encourage innovative solutions, but at the same time may bear a larger risk of failure. Therefore, a crucial set of requests towards the performance approach needs consideration, mainly related to communication of transparent and verifiable information and assumptions between involved parties.

In this context, performance requirements may be established for a wide field of interests, such as:

- Safety
- Investment costs
- Long-term costs

- Initial environmental impact
- Long-term environmental impact
- Maintainability
- Long-term functionality / fitness for purpose / adaptability
- Optimization of operation

The scope of issues for which performance requirements can be drawn solely depends on the interests of key players involved in or related to the project.

The overall performance of a building relies on the performance of its materials and components. Therefore, how can the performance of materials and components be assessed in advance to ensure the building performs as required? PeBBu domain 1 aims to address methods for estimating service life, also for novel building materials and components, where the information based upon which a service life estimation can be performed, is different from the situation for known materials in known applications.

Under the PeBBu programme, D1 contributes to the

- further development of the factor method (system to estimate the service life when there is limited knowledge of long-term performance of components),
- provision of input to the development of an international suite of standards,
- preparation of training sessions for both practitioners and academics.

As the link between life performance and service life has been understood as evident, PeBBu Domain 1 expressly relates to ISO 15686. Assessments of buildings or of designs, need to address service life, and need to address life performance aspects. This is established e.g. in ISO 15686-6 "Procedure for considering Environmental Impact" illustrating the link between service life planning and environmental life cycle assessment. The developed procedure allows for the comparative assessment of two or more design options. The assessments are supposed to be case-specific and to be regarded as valid only for the design problem at hand. With this restriction in the validity of results, project specific performance references can be applied as assessment reference. While Fig 1 is modified from ISO 15686 and illustrates how performance references can be applied for as assessment references in environmental, economic and technical assessments, Fig 2 offers a more generic explanation of the positioning of performance-based building in relation to environmental and economic assessment of buildings or of design options. This positioning is reflected also in the discussions in the standardisation committees addressing sustainability of construction works, ISO/TC59/SC17 and CEN TC350.

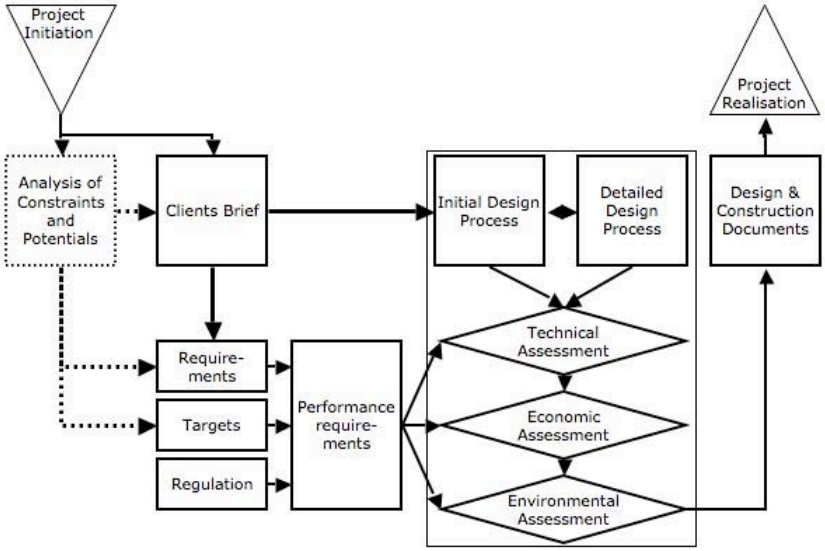

Fig 1 (modified from ISO 15686-6 [10]): Integrated parallel assessment of design option performance in relation to performance requirements [11]

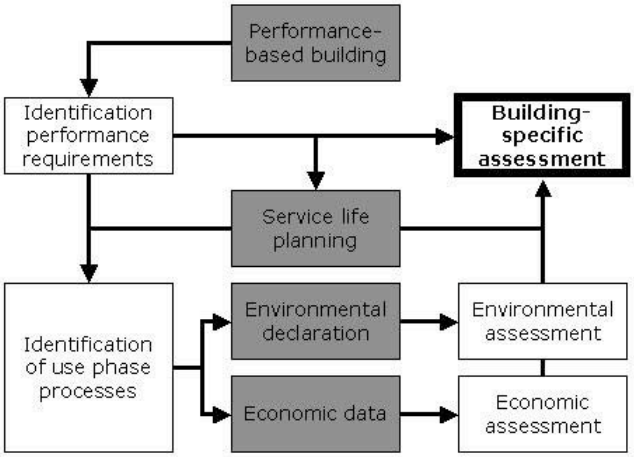

Fig 2 (Trinius): Interrelation between Performance based Building, Service Life Planning, Environmental declaration and assessment [12]

The current development of internationally harmonised standards follows to large extent a modular approach that allows the inclusion of use phase (and thereby service life) scenarios that can be adapted to better reflect the situation in which a material, component or system is to be applied. The ISO 15686 standards on service life planning can be applied in order to generate information for such adaptable modules and scenarios. With the relative ease to adapt scenarios and modules as a positive aspect, also the negative potential to include information based on scenarios that are not in line with each other, or service life information that is based on performance requirements that do not sufficiently well reflect the situation at hand, is rising.

For the process of identification and adaptation of service life information to the planning situation at hand, ISO 15686 identifies two core concepts, one being the establishment of a reference service life and the other being the identification of an estimated service life. Where the earlier must be based on testing, exposure or experience, the latter is a modification of a given reference service life that shall allow the planner to establish a reasonable estimate for a material, component or system as part of a specific building design. As both, the reference service life and the process of adaptation in order to establish an estimated service life are forming the basis for the generation of information, PeBBu Domain 1 sets its focus onto these aspects of service life planning methodology. With this in specific focus, PeBBu D1 addresses demands in co-normative research and development, where the target is to provide information that is needed in everyday application of the standards.

To enable correct interpretation of service life information, it has to be ensured that not only a declared service life is communicated, but that crucial information concerning underlying scenarios is as well provided. A harmonized approach to service life declaration may be very helpful.

As stated in section 2.1 *Scope and Objectives*, "The communication of service life information within the construction sector sets high requirements concerning transparency of the information. A declaration of service life can only reflect one or a few scenarios for product application. Therefore, designers for instance, may need to perform or initiate a process of modification of declared information, all in order to obtain information that is relevant to the situation in a specific building context. The primary source of information will still be the manufacturers, while recognizing that information provided by them only can be based on reference scenarios. Such scenarios must be available for scrutiny by those applying the provided information."

Figure 3 illustrates the modules related to service life that are included in an environmental declaration of construction products [7]. In case the scenario descriptions do not sufficiently well coincide with the actual situation in the building and its given application, some or all of these scenarios may need to be adapted. The route from a product EPD to a building EPD or a building assessment is, together with the positioning of service life estimation, indicated in figure 3.

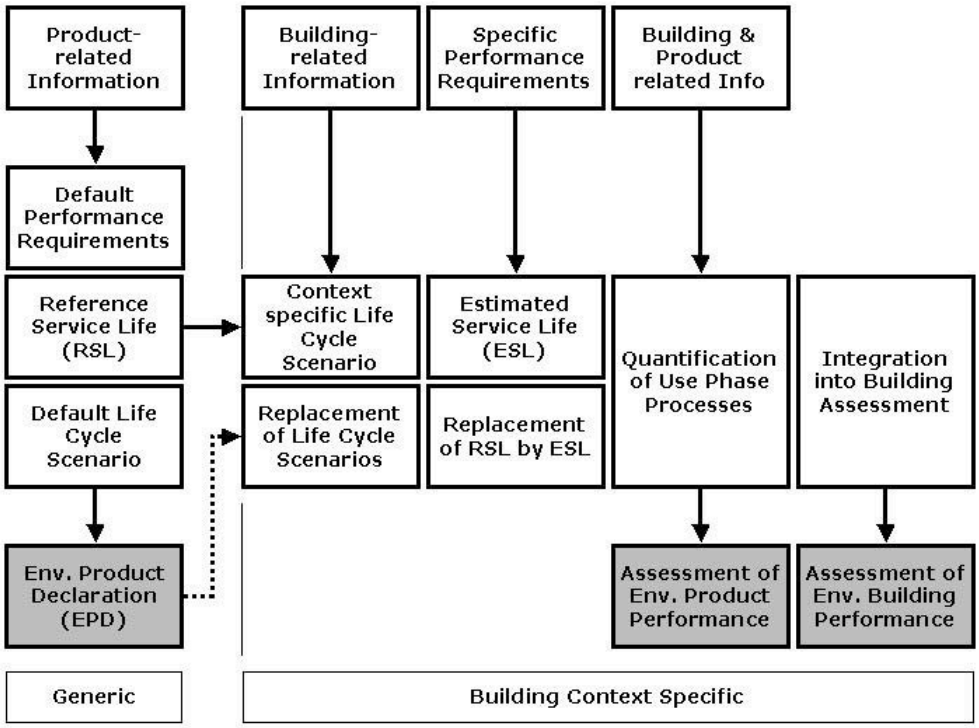

Fig 3 [7]: EPD including default scenarios and reference service life for communication of generic product information – replacement of reference case with project specific information to obtain building context specific performance information.

NOTE that "generic" here refers to the inclusion of a generic scenario for a building life cycle, not to the product system considered in the EPD!

1.4 Origin and Provision of Service Life Information

In the context of environmental product declaration (EPD) stakeholders are vividly discussing possibilities and constraints to the provision of information including service life. Core problem is that those providing products to the market are not informed in detail about the future application and therefore neither can be held responsible for service life information provided. Building designers, who are the first actors with information about the building itself and the detailed application conditions of products, would need detailed information to adapt to the specific condition [13]. Figure 4 illustrates this. In order to enable communication and preparation of valuable performance information, it is a precondition that information is communicated together with detailed information concerning the scenarios for which provided information is valid.

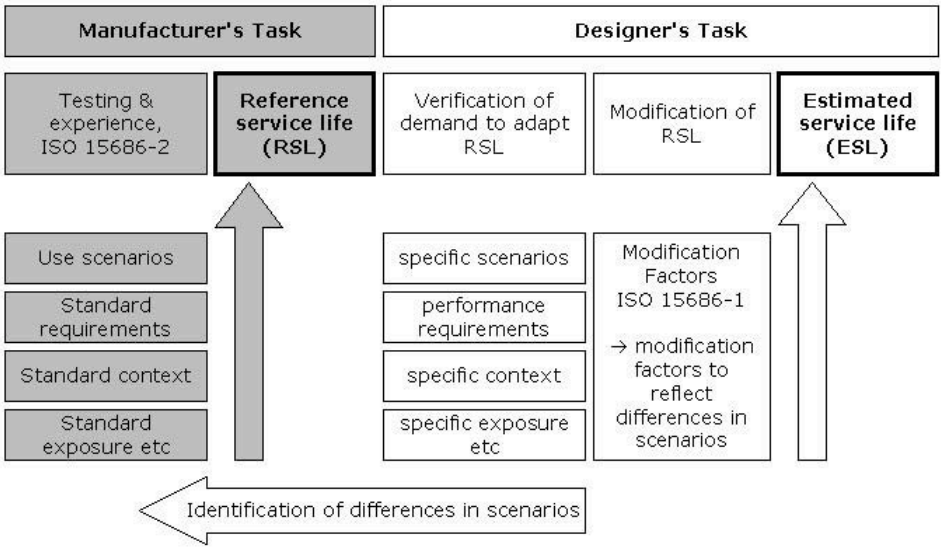

Fig 4 [7]: In relation to Fig 3, the most reasonable sources for information on generic product performance and building specific considerations.

1.4.1 Methodologies and Concepts for provision of service life information

1.4.1.1 Reference Service Life

"Reference Service Life" is the "period in years that the component or assembly can normally be expected to last" [14]. Reference Service Life, by this, relates to "durability" ("capability of a building or a building part to perform its required function over a specified period of time under the influence of the agents anticipated in service" [14]). Durability in turn relates to required function (performance requirements) and the "influence of agents anticipated in service" relates both to environmental conditions and use conditions and their impacts on the product. Consequently, reference service life form an essential part of information when addressing performance based building.

With the increasing success of introducing "long term concern" in design and planning processes, the demand of information concerning the full life cycle of construction products is rising. At the very basis of the description and quantification of processes related to a product's life cycle is, besides information about production processes and end-of-life processes, a reliable representation of the product's use phase. When applying environmental life cycle assessment (LCA), life cycle costing (LCC), maintenance planning or service life planning to buildings and their components, a central piece of information required is a reasonable assumption for the service life of a material, product or component.

The primary and the most reasonable source of information concerning reference service life is the manufacturer of the product. As the manufacturer however is generally not informed about the detailed in-use conditions (i.e. how the product is applied in what kind of building and exposed to exactly which stressors), he can only provide information representing a restricted number of general application situations and very limited scenarios. Resulting from this restriction at the provision of information, it is

evidently clear, that the reference service life is no more than a point of reference, with validity for situations coinciding with the assumptions made for the determination of the reference service life. A given reference service life should not be read as a warrantee of any sort, but suggestive.

Reference service life needs to be communicated to other market actors in transparent means. This communication can be seen as part of other "life cycle information" items, such as environmental product declarations, technical specifications, etc.

1.4.1.2 Service Life Declaration

When aiming to provide the market actors with information related to service life of products, the above described reference service life needs to be communicated in harmonized manners. A harmonized format would allow eased application of the information, and should also contain the description of those scenarios for which the specified service life is given. Such scenarios may refer to the built-in situation and application of the product, maintenance and care, requirements concerning the construction and fitting procedures, as well as exposure to use related and environmental stressors. This results in a declaration not solely of a service life of a certain number of years, but may be read as a order of magnitude, given that the current application situation does not significantly deviate from what is specified in the scenarios, assumptions and preconditions described in the additional information.

The user of the information can verify whether the current application situation coincides with the reference included in the provided in the declaration, and can, where necessary, adapt the declared reference service life, see 2.4.1.5 service life estimation.

1.4.1.3 EOTA (ETAs)

In Europe, the members of the European Organisation for Technical Approvals, EOTA, issues European Technical Approvals for products as one of the two possible routes for CE marking them. This is done on the basis of an assessment of the product that includes the evaluation of its durability in order to obtain a reasonable economical working life, as required by the CPD. The durability evaluation is performed according to general EOTA guidance developed on the basis of the service life prediction concepts as expressed in ISO 15686-2.

An ETA is a favourable assessment of the fitness of a product for an intended use, based on the fulfilment of the essential requirements for building works for which the product is used. An ETA is placed at the same level as a harmonised European standard: it must be followed by an attestation of conformity under a given system before the CE marking can be affixed to the product.

The ETA route is intended for products where the state of the art does not or not yet permit to produce a product standard, to allow also these products to come to the market and to overcome their barriers to trade. Products for which an ETA can be granted are specified in Article 8 of the CPD. [15]

1.4.1.4 FMEA

Developed in the sixties for the aeronautical domain, Failure Modes and Effects Analysis (FMEA) or Failure Modes Effects and Criticality Analysis (FMECA) is a risk analysis method that has stood the test of time and is presently used in the space, nuclear, chemical and automobile industries. [16] gives a description of how to apply this method to the building domain.

The primary objectives of the adaptation to the building domain, was to apply the method to evaluate the service life of building products, and to evaluate and forecast failures of building products. The FMEA approach is initiated through a system analysis in which a risk analysis is combined with a data fusion process.

The application of a qualitative failure mode analysis with the combination of a quantitative criticality analysis results in the presentation of an event-driven failure tree, being a visualisation of the linkages between degradation scenarios for different components seen over their service lives. The method provides a risk assessment of failure of a building product, which can be applied as decision support in design and management processes. [16]

1.4.1.5 Service Life Estimation and Estimated Service Life

Service life data is used to ensure that the design life (for a component or the building) is met by the current design. Provision of service life information is therefore a crucial aspect when deciding among design options. As the service life estimation is a rather complicated task, it will most likely only be performed for some critical components, where criticality may refer to a manifold of aspects.

The process of adapting a given reference service life to the specific conditions of product application is called service life estimation. During this process, the reference service life is modified into an estimated service life.

Care must be taken to avoid that the inherent quality of given RSL values is not diminished by less qualified and unverifiable estimation procedures. The goal of service life estimation is not to replace RSL values or to determine other values, but to adapt, where necessary and relevant, in order to better reflect the current (intended) in-use conditions. The RSL as declared or provided by a producer can only reflect a limited set of reference conditions and scenarios.

In the design process, the need to evaluate the service life of products is a great challenge, as the results will depend on both material properties and the environment in which the material is placed or used. A practical solution has to be based on a good knowledge in the field, but also on a sound working strategy, to ensure that different design scenarios can be compared in a standardised or structured way. [17]

1.4.1.6 Factor Method

The factor method is a promising working tool for such an evaluation and comparison, but us as such, still more of a methodology, than a tool. Examples of the use of the method are still very limited, and the method as such, is much discussed by researchers. The method is useful to estimate the service life of products, based on a known reference service life and a number of modifying factors. These factors in turn depend on the conditional differences between the specific project and the reference in-use conditions. Applied as a structure rather than as a calculation model, the method should enable involved parties to address reference service life and a specific application in a systemic way. [17].

1.4.2 The Questionnaire

Provision of the market with information concerning durability and service life of materials, components and systems is a precondition for other actors to properly include long-term performance into their decision-making.

With the ISO and CEN standards being under development, and with the assumption of these standards to be fully developed and in place within a 2 to 4 year period of development, it was felt essential to gain a rough picture of the market awareness of issues related to durability and service life.

A questionnaire aimed at producers of construction materials and components was developed and distributed through the network. As the issue of durability and service life is not the every-day-business of

the sector, the return rate of the questionnaire was rather low, exact figures are not available, as the distribution took place un-centralised through the network.

The questions addressed how the producers address durability of their products, whether they express durability in terms of service life, and whether they communicate durability or service life to their customers. Further, they were asked about their awareness of the ISO 15686 standard series. In order to gain an indication whether their addressing of durability and service life is related to the size and "internationality" of companies, the export-rate, number of employees, significance of domestic market was also included in the questionnaire.

The questionnaire to producers is appended in Annex x.2

1.4.3 Analysis and Conclusions from the Survey

Given the rather small number of received answers, a total of 12 questionnaires was returned in a sufficient format to be included in the analysis, the "results" can only be interpreted as a directional indication.

On this basis, a link between the export rate and the addressing of service life and durability aspects could not be confirmed. Despite the relative novelty of ISO 15686 and the status of ongoing development of its parts, a surprisingly large share of the answers indicated awareness with the issues, even though not being aware of the standards. This means that market actors are active in the thematic field already, and given the further development of the standards, these will find application cases with already experienced producers.

Among those answering the questionnaires, ALL producers who indicated that they perform durability testing also indicated that they are communicating that information, at least case-by-case. All those, who said that they freely communicate durability information, apply (at least) laboratory testing.

Surprisingly high was the number of producers who handle durability information in terms of "service life". "Surprisingly", as the character of information in service life (years) is very different from the character of information on durability (see section 2.4.1). The move from durability information to service life information involves many aspects that often lie outside the control of manufacturers, and is an often-disputed item in the current discussion about the applicability of the standards.

As a generic trend, it can be read from the answers, that there are actors in the market, who have the means and who are willing to incorporate durability and service life in their product development, and in their marketing activities. The further development of the ISO standards and the CEN activities, may therefore fall well into place and may be applied in an already active environment, hence spurring the momentum of the generation and implementation of service life information related to construction materials and products.

However, all the above statements must be interpreted outmost carefully, as the small number of answers most probably originates only from companies aware with the subject. The indicated shares (see figure x) should not be generalized as being valid for the building and construction sector!

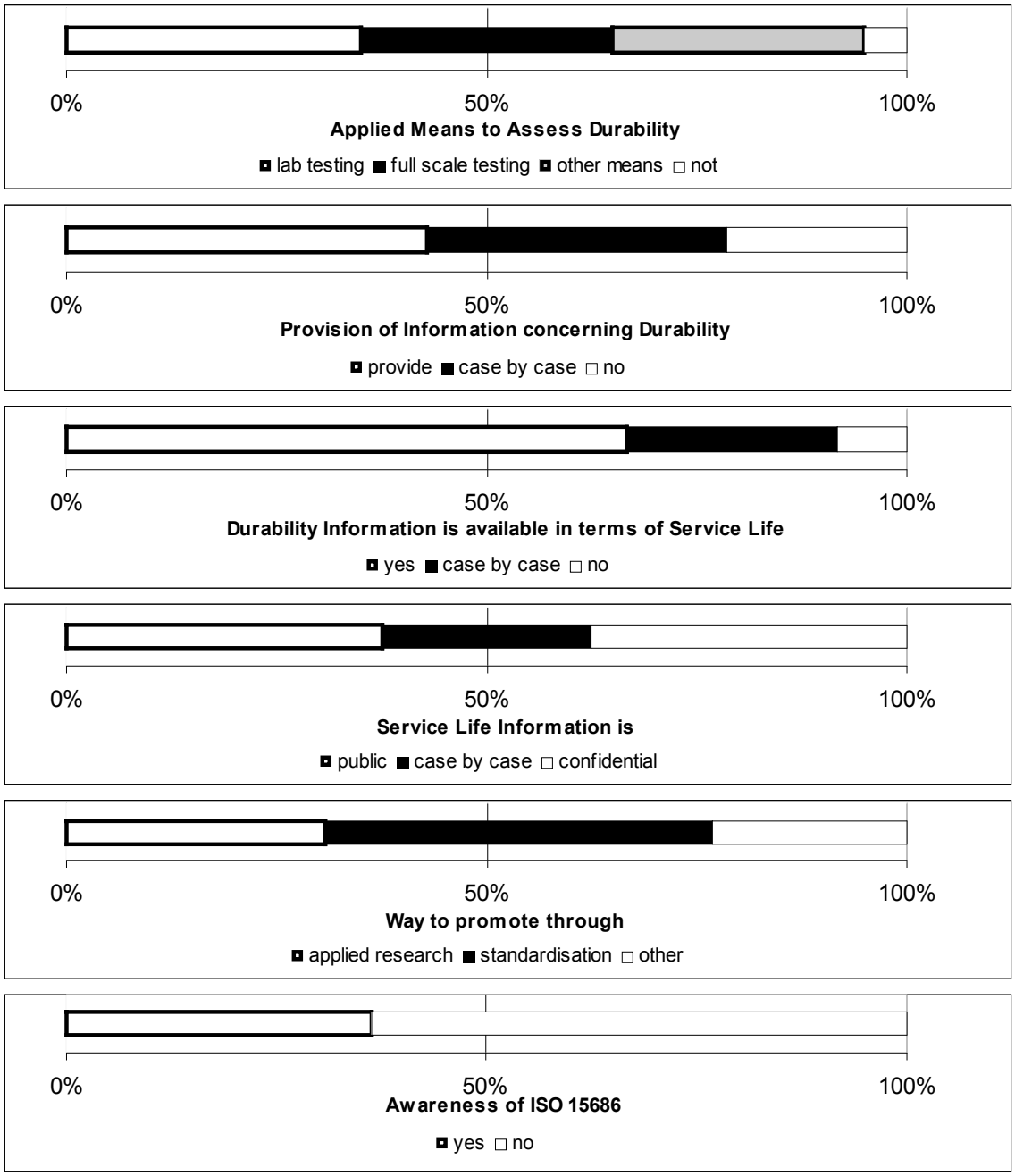

Fig x – Trends read from the answers of material and component manufacturers / producers

1.5 Workshops of Domain 1

1.5.1 Domain 1 workshops

Four workshops have been held along the duration of the PeBBu network: Gävle (Sweden) in September 2003, Budapest (Hungary) in March 2003, Manchester (UK) in January 2004 and Porto (Portugal) in November 2004. Minutes of each meeting are available in the annexes.

More than 20 (up to 28) experts from 12 to 16 countries attended each workshop, and it can be noticed positively (because it is not always the case in networks) that a core group of the same 15 persons from

12 countries attended at least 3 of the 4 workshops. This continuity permitted a progress in the content and motivation of the workshops. The progress can be summarised as such: If one can admit that the first workshop was mainly a "monologue", offering to the domain leaders an opportunity for presenting and explaining the service life concern approach, the two next workshops have been marked by the fact that at least one half of the attendance was from NAS countries: it was a result of the location for the Budapest workshop, but the same ratio occurred in Manchester. Finally while in Manchester a large part of the attendance was still observing, the 4th workshop in Porto resulted in a very fruitful open discussion.

Regarding the content of the workshops, they have been quite beneficial from 3 points of view:

- The workshops permitted an educational dissemination of the service life concern approach, but also in the same time a profitable confrontation of that conceptual approach to a large panel of experts (mainly material scientists, from universities and research centres, plus some industry representatives from the construction products sector), and the reactions from the less aware participants will be very useful for a better explanation and application guidance of the methodological process.
- The workshops helped in elaborating the questionnaire and organising the survey on the provision of the market with information concerning durability and service life of materials (§ 2.4.2 and 2.4.3).
- The workshop helped also for a better knowledge on how service life is comprehended in the different countries represented. If the survey through the questionnaire revealed that the construction product manufacturers were not yet in a pro-active attitude, the round table in the last workshop in Porto showed how research was progressing in several countries, and highlighted the necessity of a collaborative follow up in this field after the end of the network.

It took at least two years for reaching a good understanding within the group of experts, and to begin quite fruitful exchanges. Now the network of experts in the field of life performance of products is alive, but the official network period ends: It should be very useful to find the ways and means for a continuation of that network.

1.5.2 Workshops with Domain 1 participation

To achieve the objective of Domain 1 to relate to international standardisation, workshops of D1 with relevant standardisation groups have been, and are continually to be, held. These joint workshops involve PeBBu Domain 1, CEN (task force Durability and TC350), ISO (TC50/SC14 and SC17) and their liaison organisations. A first workshop was held in November 2004 focussing the subject of durability and service life declaration on the product level, and hence involved strong participation from EOTA and CEPMC. A second workshop is under preparation for November 2005. For the future, the intention is to continue this very fruitful forum for discussion between researcher, standardisation organisms and industrial suppliers and users of service life information. The membership will be adapted to the activities in international standardisation, is open to involve new participants from new research and development projects, and will continue to invite concerned stakeholders and actors.

The workshop in November 2004 has been judged as being very fruitful, and the large number of participants has indicated that there is a large interest for the subject field. Success in bringing together different views on the subject is a precondition for success of the further development of service life and durability issues, and to convince the market to embrace the subject.

1.6 Key Success Factors for Domain 1

Prior to establishing an R&D agenda, key success factors to achieve the objectives, namely to enable communication and application of information related to service life and life performance, have been identified. These key success factors, as well as the emerging R&D agenda, have been discussed with related international groups, as the thematic field relates to work carried out by other international organisations, such as CIB W80, ISO, CEN and the IAI.

Life Performance and Innovation must reflect that:

- Long-term performance and service life are essential elements of information
- No experience is available for innovative (new) solutions / products
- Product performance is not the key item of concern, but an integrated part of system performance
- Performance requirements and life performance (of products) are decisive influential factors for the service life
- Established performance requirements are a promising route to represent "user demands"

Due to the character of "life cycle approaches", service life plays a central role in sustainable construction, as illustrated by the obvious links to:

- Building Performance Assessment
- Environmental Life Cycle Assessment
- Environmental Declaration
- Life Cycle Costing
- Facilities Management
- Technical Approvals
- Industrial Foundation Classes

Preconditions for success are:

- Routines to establish performance requirements from various relevant sources
- Routines to establish life performance declarations
- Transparency standards
- Routines for relating and communicating performance information in design, construction & management processes

International standards in the thematic field are developed by:

- ISO/TC59/SC14 Design Life
- ISO/TC59/SC17 Sustainability in Building Construction
- ISO 16739 Industrial Foundation Classes
- CEN TC 350 Sustainability of Construction Works
- CEN TG Durability

1.7 Research and Development Agenda

PeBBu D1 is carried out in direct thematic interrelation with the following groups:

- ISO TC59 SC14
- ISO TC59 SC17
- CEN TG Durability
- CEN TC 350 (initialized Oct 05)

- WG2 Building Life Cycle

- CIB
  - W60 Performance Concept
  - W80 Service Life Methodologies
  - W106 GIS

The draft R&D Agenda considers the business plans and research agendas of the above-mentioned groups and projects.

1.7.1 Research, Development and Information Topics

- Dissemination and implementation through demo and pilot projects (link to ISO/TC59/SC14 adhoc WG3)
- Research – Development – Innovation – Marketing
- Policy statements that drive market; include research information into decision and design processes
- Putting concepts into practice (SD & sustainable construction)
- The "guidebook dilemma": Sustainable Construction → prescriptive thinking → green building because xyz material used → performance (over time) often not concerned → semi life cycle and additionally system performance not considered → not necessarily sustainable.
- Address topics from the application side, not the research perspective

1.7.2 Research and Development Agenda and Prioritisation

No	Topic	Priority
General R&D Items for PeBBu		
1	Handbooks, Demo projects, Case studies, Application & Experience, Evaluation tools for entire building LC	Precondition for topic no 3
2	Adaptation of information to user demands (simplification)	
3	Dissemination (coordination of D), market creation	1
4	Verification tools	1
5	Communication between actors / Stakeholders / users Services in the construction sector	1
6	Transfer performance requirements, knowledge, verification between different users of information	1
Additional R&D Items specific for D1		
7	Modelling of Performance Demand & Supply (building, functional subsystems, materials)	1
8	Reference Service Life – generic information and guidance for modification	1

9	Standards and Standard Application in Innovation	2

Conclusions

CHAPTER 2

2 CONCLUSIONS

Durability, Service Life and Life Performance of construction materials, products, components, systems and entire buildings are a thematic field of increasing importance. The issues gain attention, as service life and life performance are central items of concern when applying and interpreting sustainable development to the building and construction sector.

International standardisation on service life is going on since the early 1990:ies in ISO/TC59/SC14 "Design Life". The younger ISO/TC59/SC17 "Sustainability in Building Construction" interprets sustainability to the building and construction sector and to buildings and parts of buildings. In that work, much of the work done on the issues of service life is applied. In CEN, the newly established TC 350, entitled "Sustainability of construction works" will apply the ISO standards from SC14 and SC17 and elaborate these reflecting the European conditions and demands.

PeBBu Domain 1 has assumed its role to establish a thematic network that creates a forum for discussion and development of topics related to service life, life performance, and service life declaration. Primarily, the intention was to establish a bi-directional dialogue involving researches and practitioners, and to make the content and conclusions of these dialogues available to internationally harmonized research and development as well as to the ongoing and newly started standardisation efforts.

One key aspect of success of D1 is that this establishment of a bi-directional dialogue has succeeded, and that the created network will continue to exist and will continue to make efforts in maintaining the established dialogue. With that intention, D1 has positioned itself directly at the often-stated gap between research and application, providing both sides a direct link and hence establishing means for mutual benefit. Expressly to be mentioned in this context are the successful and appreciated workshops, even though the discussion of the workshops sometimes are tough, due to the friction between presented positions. Meanwhile, this representation of different positions first makes such workshops worthwhile.

Within the thematic network, another goal has been to establish and expand existing networks, and to bring new members to the research and development actions in the field of service life. Once the standards are in place and ready for application, the demand for knowledge on methodologies related to service life assessment will rise. Preparation for this situation also resulted in the development of material aiming at training efforts directed at practitioners.

Altogether, it is assumed that PeBBu D1 succeeded in raising the awareness, promoting the concept, and preparing the consideration of service life and life performance.

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Annexes

ANNEXES

Annex 1: List of D1 members

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Annex 2: Workshop 1 Minutes - Gävle

Minutes of the 1st Domain 1 Workshop

Venue: Centre for Built Environment, Gävle, Sweden

Date/time: 20 September 2002, 09:00 – 15:30

Participants:

Jack Bramwell, CIBdf
Johan Parthoens, BBRI, Belgium
Robert Copé, CSTB, France
Jérome Lair, CSTB, France
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Svein Haagenrud, NBI, Norway
Per Jernberg, BMG/HiG, Sweden
Martin Erlandsson, IVL, Sweden
Christer Sjöström, BMG/HiG, Sweden, (Chair)

Absent

A C W M Vrouwenvelder, TNO, Netherlands
H Baum, Technion, Israel
S Matthews, BRE, UK

Brief Minutes/Conclusions

Opening

After a welcome address and presentations Jack Bramwell, PeBBu Project Manager, CIBdf, gave an overview of the PeBBu programme.

The issue of Member status or Observer status in the project was discussed. The EC wishes to have signed Observers to the work, as this is a measure of the relative success of project.

- Jack is taking care of this legwork as regards the observers to this Workshop.

Christer (Sjöström) presented briefly the D1 programme.

Per (Jernberg) gave a presentation of the ISO 15686 standards and the Reference Service Life concept.

- There were, after discussions, general agreement on the D1 programme, i.e. the focus on the Factor Method and the Reference Service Life concept.

Draft Workshop Report

The report was discussed on several occasions during the Workshop.

Members, and Observers, were asked to give direct comments to the text, see also below "National Sate-of-the-Art contributions"

- The Report will be amended and re-edited (Christer et al, BMG) after the Workshop after receiving input from the Workshop participants

National State-of-the-Art contributions

The national SotA were discussed. Focus should be on the Factor Method (knowledge of …), the Reference Service Life concept, brief accounting of ongoing relevant R&D, education and training activities, and acting authorities in respective country.

- BMG to produce a Swedish example to be sent out by 5 October 2002.
- National SotA expected from each country by 20 October.

International Questionnaire to building products producers

The Questionnaire was extensively discussed as to whom to be addressed, aims, and design.

Christer will meet with representative of CEPMC at the CEN Construction Sector Network Workshop in Malta, 30 Sept. – 1 Oct. and will discuss the Q. This has been done; positive interest, and a special meeting is scheduled in Brussels in November.

- An Ad Hoc group to come up with a first draft of the Q. was appointed; Christer, Jérome Lair, Johan Parthoens, Steve Matthews
- Members should provide information on suitable addressees in their respective country

Education and training

Christer informed of Swedish plans for an information/training programme connected to the adoption of ISO 15686 as Swedish Standards (SS/ISO). This activity could be used as an example and possibly amended to fit the programme of PeBBu D1. The activity will probably start during the first half year of 2003.

- Christer to keep PeBBu D1 informed and take appropriate action
- Members to consider and scrutinise eventual relevant activities in their home countries; information to be included in the national SotA

International communication

The need of an elaborated Information Dissemination Plan was discussed. Jack pointed out the general PeBBu task to describe the status and needs, transfer of data, relevant models for that e t c, and stressed the importance of information from outside of Europe.

This activity also connects to the Regional Platforms. Christer mentioned that the North European Platform had not yet been formed or started work. Information is still needed on members/participants from the Baltic States.

- Jack to provide information Baltic States members.

Any other business

No additional issues were brought to the attention of the Workshop

Conclusions and future work

It was concluded that the work is roughly on time.

Christer thanked all the participants for very constructive contributions

Next D1 Workshop

- 2nd D1 Workshop will be held 2004 and will be arranged by CSTB, France.

Adjournment

The Workshop was adjourned at approx. 15:30.

Annex 3: Workshop 2 Minutes - Budapest

Minutes of the PeBBu Domain 1 Budapest Workshop Tuesday the 25th of March 2003

Location: EMI (Company for Quality Control and Innovation, Dioszegi ut 37, H-1113 Budapest

Round table presentation

Please refer to the attendance list in appendix.

TO DO	Please, check if your name, institute, address, phone and fax are the correct ones?	ASAP

Scope and objectives of domain 1

PRESENTATION : Scope and objectives of PeBBu Domain 1 "Construction Materials and Components" (C. Sjöström)

Foster development, anchor with sector stakeholders the performance concept in the domain, with specific focus on:

- the Factor Method
- the Reference Service Life

The Draft Domain Report is available (revised version of the post workshop held in Gävle in September 2002) and has been mailed to all D1 Memebers.

Note: this document is a working and living document. Successive amendments and revisions till the end of the project.
Tool dedicated to information gathering: common understanding / Sum up / Spreading information

"Are the two main work items presently in the work programme enough?"
There are other performance aspects (at national and international levels) of materials and components that could be included, e.g. aspects such as environmental declarations. NB that they are not promised in the PeBBu D1 programme but could be added if (some) members wish to take a lead in the work. Do also observe that environmental aspects are inherently included as performance requirements in the Performance over Time thinking, encompassed by the Factor Method.

QUESTION	Do we need/wish to widen the scope of PeBBu D1? If the answer is Yes – volunteers are sought.

Reference Service Life data

PRESENTATION : State of the art and future vision (C. Sjöström / P. Jernberg)

Discussion on "Geoff's diamond" illustrating the relation between ISO 15686 and the various product standards (refer to the report), including the CPD (Construction Product Directive: "Essential requirements should be met during the working life")

"How to handle durability in building product standards?"

Guide on how to implement the ISO 15686 in product standard will likely become a new Work Item in ISO TC59/SC14 and will start as a CEN Task force "Durability in harmonised atandards" chaired by C. Sjöström.

Factor Method: Estimated Service Life = Reference Service Life adjusted by Factors

- Objective is to forecast the SL from the available data but there is a mismatch between the conditions for the collected SL and the problem to be considered.
- Not restricted to a basic multiplication. Reminder on the various parameters that have to be taken into account when assessing the service life.
- More worked out approaches, improving the relevance and the confidence in the method, have been proposed for several products (Refer to the work of Moser, Marteinsson… in the proceedings of DBMC conference for instance)

Two types of problem have to be solved:

- Set of traditional products: seems to be well known but gradual change of the properties over time
- Set of innovative products: seems to be not known but answers could be found with artificial ageing (natural ageing being too long) and by studying similar products.

Discussion on some experience on product durability:

- polycarbonate,
- slates with asbestos (asbestos fibres replaced with worst quality fibres involving new types of failures).

"How to assess the durability of products?"
First, assess the conditions in which it will be used and then:

- either test of the material according to a standard,
- or (for small product area/innovative product) use the EOTA approach.

Note : the EOTA standard uses the ISO 15686 standard principle "Do the best with the available data"

Discussion on HAPM handbook (UK)

Plant fibre reinforced materials

- the behaviour of the product is known for the conditions in which it is generally used.
- but difficulties in assessing/declaring the durability when it is used in other conditions.

Discussions on:

1. Masonry and earthquake
    - Use of probabilistic approach: Risk = Probability x Consequences.
    - Risk linked to decision (Less money/More risk)
    - Questionnaire in Kobe: Do you want to pay more to prevent from some earthquake consequences and to have safer buildings? (answer depends on the time after the last earthquake!)
    - Reliability indexes in the Eurocode 1, but not easy to understand.

2. Minimum quality for the products
    - Key parameters. Example: pitch on roofing is a crucial element since whatever the quality of products is, an insufficient slope will inevitably lead to failure)
    - Influence of the process (Know-how problem). Example: good material/good standard but bad curing (concrete).

- The solution is not only performance based approach but combination of Performance Based Approach and Prescriptive Approach (engineer education/feedback from experience)

PRESENTATION : Operational methods for implementing durability in service life planning frameworks (J. Lair)

National State of the art

Objectives:

- Focusing on materials and products (but not restricted to)
- Information on national standards, Research and Development, training, education…
- Personal point of view (will obviously not cover all the problem)
- Could cover several domains (as it is difficult to restrict to Domain 1)

TO DO	National state of the art reports from the NAS Members	May 15th

PRESENTATION : Israeli state of the art report (H. Baum)

An interesting and worked out example of a national SotA. Several other examples are to be found in the D1 Report.

Questionnaire

Delay in the elaboration of the questionnaire partly due to the cancellation of a meeting between C. Sjöström and the CEPMC.

PRESENTATION : Questionnaire (J. Lair)

A draft version of the questionnaire will be sent to all participants in order to collect comments and amendments.

TO DO	Send the draft version to PeBBu D1 participants	ASAP
TO DO	Comments, amendments, additional questions shoul be sent by PeBBu D1 Members/Observers to C. Sjöström and R. Copé	May 15th
TO DO	Please suggest 2 – 4 companies/organisations in the field of building materials and components in your home country to which the Questionnaire could be addressed.	May 15th

Education, training / Test training of practitioners

Parts 1 and 2 of the ISO 15686 standard have been translated to Swedish.
A guideline on how to use is being elaborated, including examples.

An information and training program will be arranged by SIS (Swedish Standards Institute) during the autumn of 2003. The results and the experience will be presented in Pebbu Domain 1 by C. Sjöström.

International communication

- An article, by the co-leaders, presenting PeBBu Domain 1 will be presented at the ILCDES Conference in Finland December 2003.
- Take the initiative in your own country
- An extra-day for a presentation of PeBBu will be organised in April 2005 in Lyon (France) in conjunction with the 10DBMC conference, the various CIB and ISO working groups. More information will be sent later.

Any Other Business

No additional items were discussed

Adjournment

Christer Sjöström thanked the participants for fruitful discussions and EMI for generous hospitality.

The meeting was adjourned at 16:00

Annex 4: Workshop 3 Minutes - Manchester

PeBBu Domain 1 Life Performance of Construction Materials and Components
Workshop Manchester, Jan 12th, 2004

Workshop Notes

Date
January 12th, 2004
Venue
Manchester Conference Centre

Participants

Name	Organisation	Country	email
Selwyn Tucker	CSIRO	Australia	selwyn.tucker@csiro.au
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Christer Sjöström	KTH	Sweden	christer.sjostrom@hig.se

Agenda

The agenda is appended as a separate file.file://localhost/C/%5CEigene%20Dateien%5CBuro%5CProjects%5Cpebbu%5Cmanchester%20meeting%5CD1%20Agenda%20Manchester%20Jan%202004.doc

Opening

Role call of delegates, see list of participants above

D1 Work Program, Scope and Aim of the Workshop

PeBBu Domain 1 has been drawn up to correspond to the EU Construction Products Directive (CPD) and is directly related to ongoing activities in international research and standardization (links to ISO/TC59/SC14 Service Life Planning of Buildings; the new task ISO/TC98 Design of Structures for Durability; ISO TC59/SC17, and various research activities such as e.g. LIFECON and LIFETIME). Strong

relationships exist also to activities in EOTA (European Organisation for Technical Approvals http://www.eota.be) and to CEN activities.
The focus of D1 is directed on the factor method and reference service life of construction materials and components, as parts of systems or buildings/constructed assets. Due to the character of the thematic field as an item of ongoing research and standardization, caution has to be drawn to the fact of existing differences in the content of terminology and concepts.
Differences are of main concern for EOTA and CEN, and are to be found mainly in the establishment of either service life duration classes or in years and the statement of exposure categories as underlying information for technical approvals.
The essential requirements established in the CPD among others require that buildings are to be subject of an appreciation of their service lives and relevant items of concern occurring during the service life period. This has strengthened the demand for methodologies for service life planning as well as for data feeding the procedures with information, and on the other hand necessitates the dissemination of research results to the broad attention of practitioners.
D1 aims therefore at

- ⇒ ISO, CEN and EOTA activities
- ⇒ contribution to ongoing standardisation
- ⇒ anchoring of standardisation efforts in construction industry
- ⇒ information, education and training of practitioners

While the scope of D1 is primarily directed towards the factor method and reference service life, the scope is not assumed to be too narrow, as the factor method embraces factors of broad concern. The Factor Method as a concept may be applied not only on materials, products or components but also on (building) systems of various kinds. Therefore, the claim is made that all relevant aspects of performance over time are actually covered, meanwhile acknowledging that there may be aspects that are not grasped by the concept of service life planning.
In order to provide practitioners with sufficient aid in the planning and management activities, it is not sufficient to provide the methodological framework and ISO standards, but also durability assessment and service life data for numerous materials, as well as data for the factors of the factor method. It has to be acknowledged that this task can not be fulfilled by research organisations alone, but must be complemented by industry. Research demonstrateshowever, that the concept can be applied and that necessary data is principally available, but scattered and neither formatted nor documented.
In Europe harmonised product standards are to meet the requirements of the CPD, which means that the demand for durability assessment and service life data will be strengthened further. (To correct a misunderstanding that appeared on occasions during the Manchester meetings it has to be underlined that the CPD is in no means a directive that will gain relevance "in the future"; it is since long already in place).
To meet the requirements, it will be necessary to increase the cooperation with industry and industrial organisations, e.g. CEPMC (Council of European Producers of Materials for Construction http://www.cepmc.org), FIEC (European Construction Industry Federation, www.fiec.org) and similar organisations of a national standing..
For practitioners, but also for the coordination between various involved organisations, it is essential that the understanding of "reference service life" as well as the understanding of the factor method is equal. To achieve this, more information efforts appear to be requested.

National State of the Art Reports

Drafts of national state of the art reports primarily covering the D1 work area are included in the D1 Work Report. To establish truly National reports, especially when covering the whole PBB area is an exhaustive task; for completeness also legislative and political issues ought to be covered and the PeBBu goal of the national SotA's has so far appeared unclear.. This has been brought to attention of the PeBBu coordinatorship and a discussion is awaited..
Decision: The present national SotA's appearing in the D1 Work Report might need to be overlooked and amended. Before doing so the results of the discussions within PeBBu needs to be completed.

Questionnaires

A questionnaire has been created and sent to material producers. The goal of the questionnaire was to find out to what extent material producers are familiar with the ISO standards on service life planning and to what extent they themselves know about life performance of their products, and to what extent they may be able to generate and provide such information to practitioners. A secondary effect of the questionnaires is that producers are being made aware of ISO 15686, PeBBu, the CPD,etc.
The questionnaire has so far been sent to about 30 producers, with a return of 11 questionnaires. These still have to be analyzed, but the first main impression is that the answers are rather encouraging.

The intention is that more questionnaires are to be sent out, based on a to-be-revised-questionnaire and that the target is to receive about 4 answers from each participating country. Further, as yet another target audience is the practitioners, a new questionnaire for consultancies is to be developed.
Decision: The present Questionnaire to materials producers is to be revised (February 2004) and sent to all D1 members and observers. Members/Observers to complete issuing the Questionnaire with the goal to reach some four answers per country.

Education and Training

Sweden and France are currently in the process of publishing national guidelines for service life planning. The guidance is based on and supports the ISO standard 15686-1 and is intended to be the basis for information and training efforts in these countries. After a first round of education efforts, the intention is to enable other countries to benefit from these experiences. Also application examples will be included in the guideline documents. The (test) training schemes in Sweden will take place during mid 2004.
Decision: Swedish partner to investigate cost/finance and format of a translation of the Swedish Guide to English. Based on this information, and co-ordination with the French partner, a proposed concept for training/educational activities will be transferred to D1 members/observers by autumn 2004.

D1 and relevant R&D activities in various countries

With the goal of starting a mapping of RTD activities in the PeBBu D1 work area , and by that enabling contribution to the PeBBU international RTD mapping activity various participants gave short presentations of main fields of research – related to the D1 scope.
For details, find the presentation files in the appendices.
Decision: The D1 coordinatorship to propose a format (spring 2004) for accounting of RTD activities

Input from Regional Platforms / International Communication Plan

Ch. Sjöström accounted for some of the comments on the D1 Work Report received from the South Europe, North Europe, and East Europe platforms. The ambition to establish an agreed international communication plan was briefly discussed.
Decision: D1 interaction with the regional platforms to be strengthened. Proposal of a International Communication Plan to be established for discussion at the next D1 Workshop/Meeting

Other Business

⇒ D1 and the new "CPD Task"
The new tasks were presented in more detail at the plenary on 2004-01-13.
The task on CPD includes one part where it links the CPD with PeBBu. As D1 can be stated to have its origin in the essential requirements of the CPD, it is of highest importance that the new task be coordinated with D1. The technical committee is asked to ensure this.
D1 points out that potential misunderstanding in the sense that the CPD is "new" must be avoided.
D1 is interested to investigate in which way it may contribute to future and further development or revised versions of the CPD

⇒ Next meeting
Within D1 the proposal was raised to coordinate the next workshop/meeting in collocation with

the regional conference on sustainable building, which will be held in Warzaw in November 2004. A decision is however not taken yet.

Adjournment of D1 Workshop

The workshop was closed.
Its contents were presented on the plenary session on 2004-02-13, see the appended ppt-file.

Minutes and presentation created by Wolfram Trinius.

Appendices:

1. Agenda
2. Presentations
    a. Israel
    b. Czech Republic
    c. Australia (available on CSIRO homepage…)
    d. D1 workshop plenary presentation

Annex 5: Workshop 4 Minutes - Porto

Minutes of Pebbu D1 Workshop, Porto, Portugal, 2004-11-17

Participants

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Opening of Workshop

The domain chairs Jean-Luc Chevalier and Christer Sjöström opened the meeting.

The participants were asked to sign in and to verify and where necessary update their contact coordinates.

Agenda

The chair presented the Agenda, as circulated prior to the meeting, and explained the content. A main interest of this meeting is the discussion of an R&D Agenda. A brief report of research activities in the participating countries is supposed to be a good introduction to the discussion of the R&D Agenda. The R&D Agenda itself is regarded as a core deliverable of D1, it shall be expressed in a way enabling communication with DG Research, but to also be of use the participating countries.

The Workshop Agenda was adopted as presented.

Objectives of D1

The name of D1 has been changed from "construction materials and components" to "Life Performance of construction materials and products" to highlight the focus on life performance.

Core items of concern in D1 are the Factor Method (FM) as an approach for service life planning of constructed assets, the Reference Service Life (RSL) and procedures for adjusting the RSL to project specific conditions. These issues are also under rapid development in international standardization, and the D1 work connects to and supports this progress.

Workplan and deliverables of D1

For the Workplan please refer to the D1 Work Programme

Specific Deliverables, apart from D1 input to PeBBu generic reporting, are

- the Domain 1 Report. This Report is to be concluded by medio 2005
- an R&D-agenda on the D1 work area. To be discussed further at the meeting and ambition is to produce a final Position Paper by medio 2005
- Processed Questionnaires directed to the materials and products producing industry, and to consultant companies on stakeholder opinions and uptake. Format for reporting to be discussed, but final reports by medio 2005
- Examples of national guide(s) for test training of practitioners on service life planning

Brief sum-up of connection to relevant ongoing standardisation

D1 members are recommended to get access to the ISO 15686 standards and carefully read them.

The following is a brief sum-up of the relevant standardisation and some pre/co-normative R&D-activities:

The FM is described in ISO 15686-1. This standard is under revision; a workshop concerning the revision to be held the following Monday (2004-11-22) in London. As part of the revision, the factor method is moved to part 8 of the standard series ISO 15686. Part 1 will be reduced to general guidance.

Harmonized EN product standards are to contain durability amendments, clarifying how to assess durability of that product. This requirement results from the Construction Products Directive, CPD. CEN Task Group on Durability, chaired by ChS, was started a 2003 with the following tasks:

Task 1: create guidance to product standard committees that still work with 1st generation harmonised product standards, target to have them move towards 2nd generation in order to meet the requirements of the CPD. Guidance paper F to the CPD deals with durability. In CEN work, the GP F is the official reference document. The CEN TG Durability has revised the GP F, which will soon be made publicly available.

Task 2: create a guide for writers of 2nd generation harmonised product standards. This guide should connect to ISO 15686 concept of thinking, with Reference Service Life and Factor Method.

So far, product standards, also the harmonized European, do often not contain any provisions related to durability. A presumption is that durability declaration should be based on state of the art knowledge. This carries a risk of being interpreted as "there is no knowledge, you don't have to do anything". Therefore, it was necessary to formulate the current state of the art in durability assessment.
ISO addresses the basic structure for design for durability of structures, ISO standards focus on the procedures, whereas CEN standards are more detailed and technical for products and materials.

Reference Service Life

The "Reference service life" standard will be released within one year as ISO 15686-8. RSL will broadly continue to be a task of R&D. While research will generate some RSL data, the bulk of RSL-data must be generated by industry, therefore also the format and rules of determination and communication must be clarified, otherwise no comparability. Reference service life, life cycle and durability not to be confused. Durability not to be handled on a material level only, but as a link to the system of the application of a material and product in a component and system.

The EU construction market encompasses roughly 40.000 products. All of these are not subject to hormonised product standards, maybe some 8000. The ambition seems to be that all European product standards are harmonised by 2008.

Estimated Service Life

The estimated service life (ESL) is based on the reference service life, but adjusted to the specific design conditions. Service life planning handles the link between product and system.

Factor Method

Use of factor method is based on the existence of previous data. Service life data is a set of data that includes a duration together with in-use conditions, e.g. external conditions, but also process and surrounding conditions, as how the product is included into a construction.

PeBBu D1 aims e.g. to explore whether the FM is known and used. Activities relate also to training and education. D1 also aims to identify ongoing research related to the factor method and the different factors. There are numerous R&D and market driven activities dealing with these issues, e.g. on the "degradation environment factor".

Questionnaires

- The questionnaire for consultant companies is to be developed before end of 2004 and distributed during January 2005
- Participants are asked to continue the distribution of the questionnaire to material / component producers and to pro-actively work on getting responses

The questionnaire responses are to be analyzed and discussed further. So far not many responses area received on the producers' questionnaire. The results are, however, interesting.

D1 and relation to new PeBBu tasks

Decision Support Tools for Performance Based Building

Pekka Huovila; VTT; Finland, presented state-of-work of the project. The PPT-presentation appears on the PeBBu web-site.

In the discussion reference was made to the recently concluded EU 5FP project LIFECON, which produced an IT/GIS based platform for a Life Management System (LMS). The LMS, developed for life management of concrete infrastructures, includes a decision management module.

CRISP

The new PeBBu task, CRISP - sustainability indicators on product and building level - indicators are organized in systems, four clusters, product, building, urban, process. Way to design, assess, check a PB approach to have a database on performance indicators. CRISP database can be a starting point. Check

which indicators can be used as performance indicators, check for missing performance indicators, identify from which domain these indicators can be elaborated, then finalize a database of performance indicators for people who want to apply a PB approach.

First difficulty is the meaning of "performance indicators". Second problem: synergy between AUS and EU task, led to a delay in order to align with the work in Australia. Comments and suggestions are going to be required in the future. Third: funding. PeBBu funding can potentially finance a minimum adaptation of the CRISP database.

CRISP has a focus on sustainability, PeBBu is not per se focused on sustainability. Structure of database not to be finalized ahead of the Australian development. Final result to be presented at Helsinki Conference mid june 2005.

What is expected from each domain? Contribution to a clear definition of what is a performance indicator of a product. Group is asked to make proposals. What is basic indisputable performance indicator(s) at product level?

CPD

The PeBBu CPD project is presented at the PeBBu Plenary Meeting and the informative PPT appears on the PeBBu homepage.

D1 has a clear connection to the CPD project, as has been earlier expressed.

International Research and R&D Agenda

Elzbieta Syrda, ASM, Poland, presented the ongoing work to establish a European Construction Technology Platform in response to the initiatives taken in running up towards the start of EU 7FP.
The PPT-presentation is attached.

Reports on national R&D activities were briefly presented and discussed. The reports are attached.

It was agreed that the reports could be further up-dated and amended up till end of March 2005

R&D Agenda

PeBBu is concluding after summer 2005. However, a strategic time table is considered more important, e.g. to link to the EU technology platform work.

The aim is to create a list of generic R&D priorities within the Domain work area . Will try to condense from the national reports, and relate to the needs as related to the CPD, and as expressed in SLP, EPD, LCA, LCC etc.

A first structure for a Position Paper , with elaborated examples, will be circulated for comments by the group by end February 2005.

The D1 Report

D1 report to be updated in the beginning of 2005. The Technical Committee will process decisions on publication, e t c.

Education and training

The Swedish guide to practitioners on the use of ISO 15686, with worked examples, will be published by March 2005. A translation to English will also appear in March. The English version may be published as a PeBBu D1 deliverable; this is being explored at the moment of writing these Minutes.

Summary of "to do conclusions"

- D1 members are recommended to get access to the ISO 15686 standards and carefully read them
- Domain 1 Report is to be concluded by medio 2005
- R&D Agenda; a Position Paper to be produced by medio 2005
- The Questionnaire to Consultant companies to developed before end of 2004, distributed January 2005, deadline for answers end of April 2005, processed analysis by June 2005
- Continue distribution of questionnaires to material/component producers; answers by end of April 2005, processed analysis by June 2005
- Guide to practitioners on the use of ISO 15686, based on Swedish example, available by March 2005 (hopefully published)

Adjournment

The Chair thanked the participants for interesting contributions.

The Workshop was adjourned at 5:15 pm.

Annex 6: D1 Questionnaire

Performance Based Building
Domain 1: "Construction materials and components"
QUESTIONNAIRE

DEADLINE OF THE ANSWER 15 SEPTEMBER 2003

Please complete this form and send back by E-mail to the task leaders at the following addresses:

christer.sjostrom@hig.se
r.cope@cstb.fr

Alternatively, fax or mail the answer to one or both of the task leaders:

Name:	Prof. Christer Sjöström	Dr. Robert Copé
Organization:	Centre for Built Environment University of Gävle	Centre Scientifique et Technique du Bâtiment
Street address:	S. Sjötullsgatan 3	24, rue Joseph Fourier
City:	Gävle	Saint-Martin-d'Hères
Zip Code:	SE-801 76	F-38400
Country:	SWEDEN	FRANCE

Name of your company:……...
Address:……..…….
…….
…….
Web address:……

The questionnaire completed by:
Name:……
Title:……...……
Position:……..……
Telephone:……..……
E-mail:……..……..……

Domain 1: "Construction materials and components"
QUESTIONNAIRE

1. How many employees does your company currently have?
☐ Less than 100 employees
☐ 100–500 employees
☐ 500–1500 employees
☐ More than 1500 employees

2. What types of construction products does your company produce?
☐ Bulk materials (adhesives, coatings, etc.)
☐ Components

3. What are the intended uses of your products?
☐ Load bearing elements
☐ Building envelope
☐ Partitions
☐ Fixings
☐ External finishing
☐ Internal finishing
☐ Services
☐ Other non load bearing elements

4. Please, state what the products are in conventional terms (e.g. wooden window frames):
……
……
……
……
……
……
……

5. Are your products mainly designed for your domestic market?
☐ Yes
☐ No

6. How large a part of the production is exported (in percent)?
……

7. Does your company provide information about your product(s) durability?
☐ Yes
☐ No
☐ Case-by-case

8. How does your company assess the durability of its products?

☐ Lab testing
☐ Full-scale testing
☐ Other means
☐ Does not

9. Does your company have information about durability in terms of its products' service lives?

☐ Yes
☐ No
☐ Case-by-case

10. If not "No", are these data public or confidential?

☐ Public
☐ Confidential
☐ Varies from case to case

If you have not answered "No" on question 9 or "Confidential" on question 10, please read through the annex and then answer next question. Otherwise continue to question 12.

11. Could you provide us with the following information concerning durability evaluation?

A –Materials/Component?	☐ Yes	☐ No
B –Methodology?	☐ Yes	☐ No
C –Reference in-use conditions?	☐ Yes	☐ No
D –Degradation agent?	☐ Yes	☐ No
E –Critical properties and performance requirements?	☐ Yes	☐ No
F –Reference Service Life?	☐ Yes	☐ No
G –Data quality?	☐ Yes	☐ No
H –Reliability of data?	☐ Yes	☐ No
I –References?	☐ Yes	☐ No

12. It would be highly appreciated if you would list key durability related references used in your company (standards, codes of practice, in-house procedures, etc.):

a. ……
b. ……
c. ……
d. ……

13. In your view, what is the best way of promoting assessment of durability (choose one)?

☐ Applied research
☐ Standardisation at products' level addressing durability and service life
☐ Other, namely ……

14. Before receiving this Questionnaire and its Annex, were you aware of the ISO 15686 standards?

☐ Yes
☐ No

15. Comments (any comments to the above questions or on the standardisation issue described in the Annex is highly appreciated. Use additional space if necessary)**:**

……
……
……
……
……

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