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Sustainability and Performance of Projects

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Abstract
The construction sector is of such a vital importance to our societies that most other industrial sectors fade in comparison. The last decade there is an expresssed trend towards developing sustainable construction practices. Performance based standards and performance tests are tools in this context. Standardisation is often one of the better ways of entering research results onto the market. The paper gives an overview of the current activities on Sustainable Construction and Performance-Based Standards and accounts for present and planned standardisation. Implementation of the above is summarized in Europe for the last three years. Conclusively performance analysis is considered crucial R&D area for the future implementation.

Keywords
Sustainable Construction, Performance Standards and Codes

1. Introduction

Project planners and policy makers need performance measurement tools to demonstrate that funds are contributing to policy goals and priorities. Predicting what will happen with an investment is the hallmark of planning and evaluating. In construction projects, it is essential to measure performance to determine whether planned improvements in the efficiency and quality of facilities are being achieved, and to learn lessons for future projects. Performance measurement is the activity of checking actual performance against targets throughout the life of the project, during construction and through the operational life of the completed facility. It includes:

- external benchmarking – assessing the client's performance against other major purchasers of construction through participation in a number of benchmarking initiatives such as the Clients' Charter, the European Construction Institute, the Business Excellence Model and Construction Best Practice Programme
- a framework for performance measurement – including primary core performance measures that compare performance of the client's projects with that of the construction industry as a whole, covering measures such as time predictability, cost predictability, number of defects, accident frequency and client satisfaction (service and product).

- secondary measures that compare different projects in the client organisation, including the number of changes to project requirements, final cost against initial estimate and end-user satisfaction tertiary measures that are project specific and relate to the achievement of targets to improve the performance of the project – for example, reductions in construction cost, lower maintenance and operational costs.

To measure construction effectiveness, the client needs to accumulate reliable data on quality, cost (design, construction and in-use costs) and time taken to deliver, together with data on health and safety, and sustainability deriving from sustainable development concepts.

On the other hand sustainable development in construction projects means achieving four objectives at the same time: effective protection of the environment; prudent use of natural resources; social progress which recognises the needs of everyone; and maintenance of high and stable levels of economic growth and employment. Projects and the way they operate have a fundamental impact on the environment, consume large quantities of resources, involve large numbers of workers, and represent a large proportion of economic activity, so decisions made during all stages of the construction process are vital for maximising sustainability.

Sustainable construction aims for no environmental burden by considering a projects' total economic and environmental impact and performance, from design, construction, operations and maintenance, and projects' reuse or disposal.

In these terms the paper deals with developed sustainable construction practices and performance based standards and tests in construction. In the next paragraphs after a comparison between the green and Sustainable Construction Methods an overview of International standards is presented. Some of the characteristic examples as an implementation of the projects in terms of these issues is following. Finally the study conclusions are summarized.

1.1 Green vs Sustainale Construction Methods

The last decade there is an expresssed trend towards developing sustainable construction practices. A debate amongst professionals and academics concerning the difference between green and sustainable construction practices. This debate is significant because the distinction between the two concepts is critical in structuring environmental assessment methods. This is in contrast to the broader concept of sustainability which is meant to encompass the principles outlined in Agenda 21 (Bordeau 1999).

Criticism of green construction is sometimes voiced on the premise that simply making individual construction green is too narrow and that green construction and assessment methods must be viewed as components of sustainable development. Conversely, it can be argued that even though the majority of green environmental assessment methods are voluntary in their application, they stimulate market demand for construction with improved environmental performance.

The 'green v sustainable' debate illustrates that establishing a vision of sustainable development and then implementing that vision is indeed a complex and often contentious process (Bordeau et al 1998).

The main issues and stakes of Sustainable Construction are described environmental impacts such as urban impacts, resource consumption (land, energy, materials, water), the manufacturing of products, environmental loads, and social, health and economic aspects. As one of the major initiatives coming out of the Rio Summit,. Agenda 21 emphasises the importance of developing an institutional framework for standards and codes. In doing so international organizatoins produced an Agenda 21 on Sustainable

Construction with the purpose to give direction for and point to actions to be taken to reaching the goal of sustainable development and an enviromnetally sound construction industry (Sjostrom 2001). The Agenda 21 for Sustainable Construction brings to attention the concepts of sustainable development and sustainable construction, the construction industry concerns and its impacts, to the background of international agreements such as the Kyoto and Rio summits.

1.2 International Standards

In Agenda 21 the creation of international standards for the environmental assessment of clean technologies, waste management, water resources management and buildings was the main concern. The latter is another important development at a time when reliable and independent environmental information about building materials and components is in high demand. The Green Building Challenge is a leading edge international competition striving to engage industry and government in an attempt to develop international standardised 'building environmental assessment methods'. The goal is to develop practical international standards to assess construction across a broad range of considerations. Maastricht was the site of the 2000 competition, where roughly 20 national teams participated and over 30 building assessment projects were presented.

The Building Research Establishment (BRE), one of the UK's leading centres of expertise on building and construction, has also been active in developing standardised environmental assessment methods or 'Environmental Profiles'. According to BRE, these profiles are designed to enable architects, contractual specification writers and clients to make informed decisions about construction materials and components by developing a method for providing independent 'level playing field' information about the relative environmental impacts of different design options (Mc Innis 1999).

Some of these standards for building codes are summirized in the work of Sjostrom (2001).The first part of the proposed standard on General Principles for Service Life Planning (ISO/TC59/SC14 Part 1, 1998) has been described by Browne and Soronis (1996). It gives guidance for building designers on the service life planning of buildings. The Part 1 is planned to be released as an ISO Standard in December 1999. The Part 2 of the standard on Service Life Prediction Principles (ISO/TC59/SC14 Part 2, 1998) is almost in the same phase as Part 1 and should reach the status of ISO standard in mid 2000. Further standards focus on Auditing, Maintenance, Life Cycle Costing and Data Formats. A work item for guidelines for the inclusion of LCA-aspects in the standard has been proposed, and in addition work is planned on the Characterisation of Degradation Environments and on Condition Assessment of Buildings. Folliente (1998) describes the vision of standards that on a longer perspective need to be developed. The standardisation activities are strongly supported by the work in CIB and RILEM and ISO TC59/SC14 is seen as a prime customer to CIB W80/RILEM 175-SLM. F Buildings: Service Life Planning - General Principles DIS Jan. 1999, ISO standard Dec. 1999 F Buildings: Service Life Planning - Prediction Principles DIS Dec. 1999, ISO standard mid 2000 F Buildings: Service Life Planning - Data Requirements WD April 1999, CD March 2000 F Buildings: Service Life Planning - Auditing CD March 1999, ISO standard mid 2001 F Buildings: Service Life Planning - Life Cycle Costing and Whole Life Assessment WD April 1999, CD March 2000 Durability standards and pre-normative research needs (Folliente 1998).

The advantages of prescriptive codes are that they provide a simple, easy to understand, easily monitored, cook-book approach, and for the majority of construction buildings they provide the least costly method of ensuring that an acceptable level of health and safety, etc. are achieved without placing an undue burden of proof upon the contractor in meeting the required performance. However, its inherent inflexibility stifles innovation, leading to a poor match between true user requirements and the building, and perhaps poor value for money (Brandon 1996).

The PBB concept is simple: the basis of all building activities should be the performance of the building in use rather than the prescription of how the building is to be constructed. PBB considers the performance requirements throughout the design

2. Implementation

Agenda 21 has been widely adopted by governments around the world at the national, regional and local levels and by community-based organisations and partnerships. A category concerns the management of the organism via the Systems of Environmental Management (Bordeau 1998). In Europe (Eutropa 2002) is the creation of the Environmental Management Systems NETwork (EMSNET) comprising Academic Institutions, research centres and laboratories, governmental and non-governmental organisations, consulting companies and private enterprises, in order to support and promote the development of the Environmental Management Systems (EMAS) in Greece. In the other category belong the environmental tools that create and the promote in the market products or services friendly to the environment (eg European Eco-label**)** (Pollington, 1998). The present work presents these environmental and mainly the new regulation of EMAS (Europa 2002). Specifically in Greece the General Secretariat of Research and Technology carried out a study on Environmentally sound technologies in the country "Progress of research and technology, economic and social impacts". The Ministry of Development plans to establish a "Centre for New Energy Technologies" to promote innovative environmentally sound energy technologies, to support transfer of technology, to improve the capacity for the development and management of technologies and to develop networks with other organizations at the national and international levels. Lack of human capacity, information and financial resources are considered the main obstacles towards the transfer of environmentally sound technologies. In Austria the EMAS projects deal with the treatment of wastewater and clean technologies. In Belgium projects deal with Water management is the main environmental sector addressed by the approved projects (one project relates to ground water protection and the other to wastewater treatment). One project deals with waste management (packaging and plastics sector), and the other one with integrated production policy (eco-design, eco-efficiency, green financial products). In Denmark the treatment of storm-waters, the other will develop an innovative method for the treatment of endocrine disrupters in wastewater. In Estonia a life cycle assessment methodology by examining the impact of electricity generation from oil-rich sedimentary rock on the environmental performance of products. In Finland Water management, and more specifically ground water protection and wastewater treatment at a municipal level, In France projects deal with waste management, whereas the other two focus on wastewater treatment and integrated environmental management respectively. In Germany Clean technologies is the main sector addressed. In Greece projects deal with waste management water management (ground water protection), clean technologies, and the reduction of emission of gases having a greenhouse effect), and on the area of integrated production policy (eco-labelling, and the greening of procurements by local authorities). In Hungary water management (at the scale of the river basin, and the rehabilitation of a flood plain), impact of economic activities (sustainable tourism) and waste management (hazardous or problematic waste). In Ireland an innovative approach to the processing of animal slurry. In Italy projects focus on the Eco-Management and Audit Scheme (EMAS), while two projects have been approved for each of the following three sectors: eco-labelling, clean technologies and land-use planning. Finally, one proposal which deals with the impact of economic activities was also approved. In Latvia an innovative method for composting biodegradable municipal waste. The beneficiary is the national Waste Management Association and the project will be carried out in partnership with several local authorities and the University of Latvia.In Netherlands clean technologies, and the reduction of the emission of gases having a greenhouse effect, as well as sustainable tourism on water management (three for wastewater treatment, one for ground water protection and one on filtering urban water).In Portugal Integrated environmental management (EMAS etc.) clean technologies, water and waste management. In Romania water management at the scale of the river basin In Slovakia emission of gases having a greenhouse effect, and was presented by a non-governmental organisation..In Slovenia projects focuse on

energy savings in the central heating sector. In Spain projects concern clean technologies, coastal and urban environment. Sweden the projects concern clean technologies, waste and water management. Finally in the United Kingdom deal with Waste management projects.

Conclusions

Performance analysis is considered crucial R&D area for the future implementation of the standards. Performance based construction based on non-prescriptive performance specifications that lead to sustainability, and specify outputs rather than products is increasingly becoming a necessity.
The advantages of the internationally accepted standards and codes that they provide a simple, easy to understand, easily monitored, cook-book approach, and for the majority of construction they provide the least costly method of ensuring that an acceptable level of health and safety and sustainability. are achieved without placing an undue burden of proof upon the contractor in meeting the required performance. A systematic and internationally accepted methodology for preparing requirements lists for important types of construction products is an urgent need.
They act as regulations to Government procurement provide an exhaustive list of the evidence procurement authorities can request as proof of technical capacity. And sustainability matters. Where relevant to the subject of the contract, contracting authorities can ask for evidence of a track record specific knowledge or experience, an environmental performance record, description of technical facilities and measures for ensuring quality, statement of tools, plant and technical equipment, and an indication of environmental management measures relevant to the execution of the contract including the requirement to use best-practice environmental management practices during construction. Leading to implementation of Sustainable development and performance based standards and codes.

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