

# THE CIB WORLD BUILDING CONGRESS 1998

7 - 12 June 1998

Gävle, Sweden

## THE PARALLEL SYMPOSIA - Introduction

### SYMPOSIUM A

MATERIALS AND TECHNOLOGIES  
FOR SUSTAINABLE CONSTRUCTION

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INDOOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT - ARE THEY  
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LEGAL AND PROCUREMENT PRACTICES - RIGHT FOR THE ENVIRONMENT

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MANAGING FOR SUSTAINABILITY - ENDURANCE THROUGH CHANGE

## THE PARALLEL SYMPOSIA

From Tuesday 9th June up to lunchtime on Thursday 11th June four Parallel Symposia will be held.

Following on from the CERF/CIB Symposium on Engineering and Construction for Sustainable Development in the 21st Century Part II scheduled for Monday 8th June 1998, the four Symposia are:

- "Materials and Technologies for Sustainable Construction" in cooperation with RILEM
- "Indoor Environment and Sustainable Development" - Are they Compatible?" in cooperation with ISIAQ and IEA
- "Legal and Procurement Practices - Right for the Environment"
- "Managing for Sustainability - Endurance Through Change"

The combination in one and the same programme of so many alternatives is one characteristic which sets the Gävle Congress apart from its predecessors.

What better way to form an impression of what is to be expected from these Symposia than to cite the introductions by the four respective Symposia Chairs.

Michael Lacasse for Symposium A has opted to write in the past tense as he identifies the areas highlighted in the Symposium.

Gaute Flatheim zeros in on the Indoor Environment's "7 sisters" and their importance in planning, constructing or rehabilitating buildings.

Chris Pollington shows how the range of expertise available in Symposium C makes it an unique component within the overall framework of the Gävle Congress.



Peter Brandon analyses how Symposium D points the way towards an effective system for managing for sustainability.

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**Picture:**

Congress Symposia and Session Chairmen at an Organisers' Meeting in Gävle last March.  
From left to right: David Jaggar, Peter Brandon, Jan Borgbrant, Michael Lacasse and Chris Pollington.



**SYMPOSIUM A**



**MATERIALS AND TECHNOLOGIES  
FOR SUSTAINABLE CONSTRUCTION**

by **Michael A Lacasse**  
**National Research Council Canada**  
**Institute for Research Construction**

**Introduction**

Sustainable development implies the use of natural and physical resources that enables people and communities to provide for their immediate social, economic and cultural wellbeing without compromising the ability of future generations to meet their needs. The construction industry must evidently address certain consequential issues in the process of achieving sustainable development; it consumes considerable natural and physical resources and as such has a significant impact on the environment. Current building design, engineering methods, manufacturing technologies, and construction techniques need to be altered to accommodate requirements for sustainable construction. To help resolve the complexity of the problem, systematic approaches are needed to address regulatory restrictions, lack of innovation and of effective manufacturing technology and as well, the integration of construction technologies.

This symposium has highlighted research undertaken in the development of basic approaches for and dissemination of information on the design, maintenance, reuse or renewal and assessment of materials and technologies for sustainable construction. Contributions have been prepared within four areas including: Performance, Durability and Service Life; Information Technologies; Life Cycle Analysis and Maintenance Management, and Environmental Technologies and Processes. Provided below is a summary of the symposium and brief reviews of some of the more significant contributions within the specific areas mentioned above.

**Summary of the symposium**

**Service life and durability**

In the area of performance, durability and service life of materials, components, assemblies or structures, contributions on the use of innovative materials for the renewal of building systems and structures were offered and design for durability. As well, papers related to predictive models for service life are given and attention is brought to contributions on standards being developed in the area of service life planning and sustainable construction.

The majority of contributions fell in the area of materials; particular emphasis was placed on cementitious materials and the durability and performance of concrete. Recycled concrete and aggregates and the use of industrial waste by-products incorporated in concrete were also prominent. Polymer based

materials were discussed, in particular those dealing with cladding or products used to seal or protect materials.

Although systematic methods for service life prediction have been proposed and some of these implemented for specific materials, overall concepts that link in-service conditions to laboratory evaluations, modelling and field-testing are still being developed. Indeed, new approaches are being sought to relate 'real-life' performance to that obtained from testing, evaluation and modelling. A series of papers focus on this topic, in particular those dealing with stochastic methods and probabilistic approaches to service life design. The significance of durability or performance prediction to the development of performance based codes is reviewed and the interrelationship between product performance and service life is examined.

Standard development in the construction sector is important in that it potentially offers practitioners the means to implement consensus approaches to resolving design and planning issues that otherwise would be left in the research domain. In the area of service life planning of buildings and construction, considerable efforts have recently been made to provide useful standards for assessing and auditing the performance of constructed facilities. These are reported in the current proceedings as well as a proposed standard on sustainable building. The proposed standard would encompass additional information required to integrate approaches to service life planning to include issues related to the environment.

### **Information technologies**

Paramount in making informed decisions about environmental issues related to sustainable construction is the manner in which information is collected, formatted and structured. A series of contributions focused on this area and standard methods were suggested on structuring data for conducting life cycle analysis, assessing the design life of buildings or performing environmental assessment of materials. There is also an increased awareness of the Internet as a useful tool for providing relevant product information; in this instance data formatting is, necessarily, paramount for making information readily available.

Examples were provided on the use of information technologies for life cycle analysis and assessment decision making and, environmental technologies and processes. In particular, software systems for managing the maintenance process as applied to buildings or those offering life cycle simulation were featured.

Special emphasis has focused on IT tools for assessing the conservation state of historically significant buildings as, for example, provided in the Wood-Assess project. The main objectives of this joint European research project was to develop and validate methods and technologies for the proper assessment of the conservation state of wood buildings and for mapping and assessing environmental risk factors on a macro, local and micro-scale. The work consisted of developing three basic items: assessment protocols for a field inspection system; continuous monitoring device (WETCORR) for the collection of temperature and moisture data on the surface and within the wood; and, a system for mapping the 'rotting' index for wood, based on existing climatic data, standards for assessing the level of performance of the cladding and, WETCORR measurements obtained in the field.

A PC-based geographical assessment system was developed that allows for maintenance management of historical buildings made of wood (GISWood).

### **Life cycle analysis**

A series of contributions were made in this session that offered a general overview of the possible effects of sustainable construction. For example, towards understanding socio-economic changes and their implications on sustainable construction. Issues related to building for environmental and economic sustainability were also addressed. The significance of mass and energy flows in existing buildings and its purported significance on sustainable development were reviewed, as were the energy implications of

the transportation of building materials.

Of particular interest were those contributions offering abroad oversight towards reconciling design requirements and environmental needs. Integrating existing methods of design and planning is of singular importance if sustainable construction is to move from the research to practice. In this context, efforts focused on the integration of life cycle design of materials and structures were particularly relevant and revealing. The life cycle of a product or assembly includes the manufacturing, construction, use and maintenance, repair and renewal as well as the demolition, recycling and disposal of these items. In the context of sustainable construction, planners and designers are being asked to consider the effects and implications of each of these stages and their effect on the environment. Hence integrated solutions must also incorporate the means to select, assess and provide insight into the consequence of planning and design options in regards to energy usage, resource depletion, and the creation of environmental hazards over the life cycle of a built facility (e.g. air, water and soil contaminants). Presentations offered in this and related sessions have provided useful examples of the integrated approach in regards to product component and building design, as well as urban renewal.

### **Environmental technologies and processes**

Contributions to this session described projects involved in providing for either collecting or disseminating data on the ramification of selecting different building products on the environment. Environmental assessment methods, systems and protocols advanced by different countries were also addressed. In this session, significant contributions were offered in the area of environmental 'impact' of various materials and components. More specifically, life cycle assessment methods, analytical comparisons and models were described that were used to assess the consequence of specific building design choices on the environment. As well, the environmental 'impact' of buildings in regards to their use of energy was presented. This session also touched on technologies related to the recycling of materials from waste products, expressly for brick masonry and cementitious materials.

### **Summary**

The main themes on which the symposium focused helped address some of the issues related to achieving sustainable construction. Evidently the collectivity of the work suggests that this area is in the incipient stages and minor but nonetheless significant contributions have been made towards resolving these complex problems. Maintaining and sustaining the built environment through information integration, assessment and analysis techniques and the use of specifications as well as service life models for building materials, components and assemblies is likely to be an involved yet compelling challenge in the decades to come.



## **SYMPOSIUM B**



# **INDOOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT - ARE THEY COMPATIBLE?**

**by Gaute Flatheim,  
Flatheim A/S / ISIAO**

"Our" Symposium has three main issues:

- Methods for Reduction of Load, Source Characterisation and Control
- Health Effects, Productivity and Total Economy
- Aspects on Ventilation and Air Conditioning Systems and Recycling of Air Conditioning

## Equipment

Energy or energy reduction has been on the agenda since OPEC increased the oil prices dramatically in the middle of the 70's. Energy saving together with extended use of chemicals in building materials and an overheated economy with extremely high financial costs led to severe problems in kindergartens, schools, housing and other buildings. High energy costs resulted in decreasing amounts of outdoor air while off-gassing became a major problem. A high rate of interest shortened the construction time in the Nordic countries, Europe and USA/Canada, and this caused severe problems for the indoor air quality.

The resulting negative effects on both children and adults inspired Prof. P.O. Fanger to initiate the 3-yearly Indoor Air Conferences, which have now been arranged 7 times around the world.

Other professions - physicians, microbiologists and chemists - inspire building research scientists and people from the building industry to consider the Indoor Environment Quality (IEQ) as a main responsibility for all of us who are engaged in the construction and rehabilitation of buildings.

This Congress will focus on sustainability, and we want to stress the fact that a high indoor environment profile might be obtained without ruthless exploitation of energy or other resources.

### **The seven sisters**

The Indoor Environment's "7 sisters" cover thermal, atmospheric, acoustic, actinic, mechanical, psychosocial and aesthetic environment, and include most factors influencing people's perception of their working conditions and/or well-being in their homes.

The connection between health effects, productivity and Total Economy will occupy scientists and practitioners all over the world for the years to come. It is essential to take all the "7 sisters" into consideration when planning, constructing or rehabilitating buildings.

More than 40 papers will be presented at Symposium B - oral or by posters.



## **SYMPOSIUM C**



### **LEGAL AND PROCUREMENT PRACTICES - RIGHT FOR THE ENVIRONMENT**

**by Christopher Pollington,  
Deputy Secretary General CIB**

The opportunity to tap the knowledge of a select panel of experts in the areas of post-construction liability and insurance will be one of the highlights of the first part of Symposium C: Legal and Procurement Practices - Right for the Environment.

The first part which is scheduled to take up all day on Tuesday 9th June 1998 will be under the direction of Professor Anthony Lavers, Oxford Brookes University in the United Kingdom who is Coordinator of Working Commission W87 - Post-Construction Liability and Insurance.

Established in 1985 this Commission has rapidly evolved into what is widely held to be the premier international forum in the world when it comes to construction law and insurance.

A specialist in construction law, a scientific director of a major European Building Research Organisation and two international insurance brokers who are global players in the field will be on hand

throughout the day to follow up their presentations by leading discussions on how the Congress Theme impacts on liability for the performance of construction products.

In fact what will come under the microscope, possibly for the first time at any international gathering, will be the Insurance Industry's response to developing pollution issues and its implications for post-construction liability.

How does an insurer go about approaching damage to the indoor environment?

Then there is the topical legal question: Is blame a necessary component in deciding on liability for environmental harm arising from defective construction?

It is aspects of procurement which will take over on the second day which is under the auspices of W92 - Procurement Systems led by Professor David Jaggard of John Moores University, Liverpool, United Kingdom; Dr. Steve Rowlinson, University of Hong Kong; and Professor Colin Davidson, University of Montréal, Canada.

Two internationally recognised experts from the USA and UK, one of whom incidentally has done fundamental work on the Oresund Bridge, will keynote Part 2 where contributors from places as far afield as Hong Kong, China and Korea, plus of course Europe will describe case studies of procurement systems that illustrate the essential links between procurement and environmental degradation.

- Who actually foots the bill for construction waste?
- What role do procurement practices play in occupational health and safety and the environment?
- What is collaborative performance-based purchasing and does it really promise sustainable innovation?

These are some of the questions that will be answered.

- Put off by the often exorbitant cost of litigation in construction matters?
- Apprehensive of the negative effect on business as a result of protracted legal proceedings?

A cost-saving, viable and durable alternative course of action has evolved in Conflict Management and Dispute Resolution.

This is the sphere of Task Group TG15 and forms the subject matter of Part 3 of the Symposium. Coordinator Peter Fenn from the University of Manchester, Institute of Science and Technology will be launching a publication with some 20 national monographs on the topic and this gives an accurate indication of the geographical spread of those engaged in TG15. It will be amply reflected in the background of papers presented in Part 3.

One of these asks:  
New dawn or false hope?

Participants in Part 3 will be guaranteed enough material to decide for themselves.



## **SYMPOSIUM D**



### **MANAGING FOR SUSTAINABILITY - ENDURANCE THROUGH CHANGE**

**by Peter Brandon,  
Research and Graduate College,**

## **University of Salford**

The management of sustainability within the Built Environment has been a developing issue in recent years. How do we create an environment which endures through all the external changes which are being forced upon it? Human beings have set up systems which in many cases have resulted in decisions which have created many of the environmental problems we see around today, and which contribute to the problem of sustainability. If this position is to change, then those responsible for decision making, i.e. the managers, have to engage in the process of understanding what sustainability entails and how it can be managed.

The problem 'management' face in addressing this problem is that the right criteria are not available. There is an absence of knowledge concerning the manner in which man-made products and human settlements interact with the environment, and economic performance often runs contrary to the long term requirements of sustainability. There is a well trodden debate between those who wish to create wealth and those who wish to conserve the earth's natural resources. There are many who believe that a technological fix can be developed, which will ensure that as the renewable resources of the world are depleted, a new solution will be found.

We therefore have a spectrum of views, which ranges from 'conservation at all costs', to a strong belief that science and engineering will resolve the problem. Within these polarised stances is a whole spectrum of views which attempts to find the middle path responding to any new crises that arise and new knowledge that is developed but in an ad-hoc manner. The advocates of this more pragmatic approach attempt to feel their way through this uncertain and opaque world, by dealing with the issues as they arise. Nevertheless the shortcomings of such an approach are evident as the response to one problem may often exacerbate another.

For this reason there has been a call which has grown in momentum over the past decade, for a more holistic approach, engaging all aspects of the various systems which impact on the environment and which endeavours to assess the interaction between them. Out of this view has grown the concept of sustainability. This concept is still poorly defined, but it seems to contain certain features which make it distinct. It is about endurance rather than conservation, although conservation, particularly of non renewable resources, plays a large part. It is holistic and attempts to avoid the trap of reductionist approaches, but is yet to establish a framework within which there is a shared vision to which all can contribute. It implies both self control and discipline within society which may well require sacrifice now in order to allow future generations not to be disadvantaged. It also recognises change as an essential ingredient of universal systems, including evolution within the bio-sphere and the impact of knowledge in human development, but suggests that a measure of intervention can be beneficial. This is where management and organisation have an important part to play.

These features will be seen to be embracing some of the most complex issues known to man. At this stage of the development of management for sustainability, it would be unwise to move down the path of setting specific goals with high expectations. It is likely to be an exploration, a journey, a revealing, rather than a conclusion which we can expect as we progress. This symposium as part of the CIB World Congress, attempts to start that journey and to define eventually a framework within which there is consensus and we can all contribute.

### **The Built Environment needs Research**

Within the overview of sustainability as a concept, the built environment represents a sub-set. It is, however, a significant player in its own right and also has a significant impact on the world in general. Looking in, it engages the most basic needs of man in terms of accommodation, comfort, and social organisation. Looking out, it impacts on the quality of the natural environment, the quantity of non-renewable resources and the services needed to support human gatherings in any form. At its most prevalent, within the urban context, it permeates the whole fabric of human existence and extends into

the eco-systems upon which all living species depend. No consideration of sustainability can avoid consideration of the structures human beings have developed to accommodate themselves. Within the context of this symposium "management and organisation" applied to sustainability has a major, difficult and maybe impossible task. If the aim of management is to bring 'about' or 'contrive' or 'to direct or conduct the affairs', of something as suggested by Websters Comprehensive Dictionary, then the discipline has a problem. At this moment it is not clear exactly 'what it is to bring about' and in most cases it does not have the authority to direct or conduct the affairs of all the facets which would lead to a sustainable built environment. It is therefore truly a research topic, for all these matters need addressing. It is a complicated problem, because, for obvious reasons, the complexity of the built environment means that the management task is divided.

## Fourfold Classification

The papers in the symposium try and deal with this matter at many different levels. We have tried to classify the papers into four main categories, i.e., Management and Organisation, Methodologies and Regulation, Feedback and Evaluation, Design and Productivity. It is recognised that the subject is still in its embryonic phase and that the tools required to address the problem are not yet fully developed. Nevertheless the sharing of this good practice will be of benefit to all those concerned with managing sustainability in the built environment. Underpinning the papers are a number of aspects which need further addressing and provide a research agenda. These can be summarised as follows:

1. A clear definition and understanding of what we mean by sustainability. Without this we cannot progress very far.
2. A philosophy which leads to an understanding of the relationships between the different complex factors contributing to sustainability must be shared in a public consensus. How do we establish this consensus and appropriate structure?
3. A robust classification system must develop which structures the problem in such a way that the complex interrelationships can be modelled, in order to aid communication, understanding and the growth of knowledge.
4. A set of measures which allows progress to be calibrated must be developed - otherwise how are we to know what progress has been achieved?
5. A management framework must be developed which allows for planning, design, construction, monitoring and feedback on sustainability, as an integral part of the development and occupation cycle. Without this framework the sustainability agenda is sterile and inoperable.
6. A protocol for decision making must be established within the above framework which challenges those involved in the decision process to respond to sustainability in a positive way. It must engage where appropriate the regulatory bodies and the judiciary to enforce the public consensus.

There has been an attempt to develop the tools and the methods required for sustainability in buildings and these are still developing. The issue becomes much more complex as we begin to look at the urban level and higher. The complexity of factors and systems means that it is often difficult to establish the effect of decision making on the sustainability of, say, a local environment. The papers in the symposium provide a way forward for decision making, largely at the sub problem level. It is recognised by many of the authors that a holistic approach is required and the symposium will explore how we take these matters forward. The subject is still in its embryonic stage and it will be interesting to see how it will emerge and evolve over the years ahead. It is most unlikely that it will disappear, but the degree of commitment with which it is addressed will reveal much about the seriousness with which we address it and the maturity of the research community to derive suitable models for the aid of all of us engaged in the development process.

