

REPORT 5

**SUSTAINABLE CONSTRUCTION
IN IRELAND : 2010**

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NATIONAL REPORT (ABRIDGED)

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1. INTRODUCTION

1.1 Preamble

It was towards the middle of 1997 that Ireland became involved in this very valuable Study Project, initiated by CIB Working Commission 82 : Futures Studies in Construction , on the subject of developing a response, in built form, to « **sustainable development** » - a concept first given expression at the beginning of the 1970's, but elaborated in a readily understandable form only at the end of the 1980's (Bruntland Report, 1987).

We are grateful for the opportunity of this involvement, and warmly appreciate the guidance, documentation and encouragement offered by the members of W 82.

Joining the Project at such a late stage presented us with challenges, but also with the advantage of being able to learn from earlier contributions of the Project's many international participants.

Our considered view is that Sustainable Construction represents a quantum leap in the evolution of design philosophy, and that its relentless progress forward is inevitable.

We wish the Project every success.

1.2 National Policy in Ireland

Official national policy in Ireland with regard to « **sustainable development** » is set out in the following document :

Sustainable Development - A Strategy for Ireland
Government Publications. Dublin. 1997.

Also in 1997, a review of the construction industry was published :

Building Our Future Together - A Strategic Review of the Construction Industry in Ireland
Government Publications. Dublin. 1997.

Of interest in this document is the section on Environmental Sustainability.

Both publications, however, are long on general statements - but very short on matters of substantive and immediate implementation. Attached in Appendix 1 is a recently printed magazine article which shows Ireland's actual performance, in relation to housing, compared with other countries in Europe.

It is a continuing concern for the practical implementation of Sustainable Construction which first informed our approach to the Questionnaire Survey in 1997 (Section 2), and which now also directs our search for meaningful understanding (Section 3).

1.3 What is Sustainable Development ?

We have carried out sufficient investigations and research to be able to state, with certainty, that we do not yet know what « **sustainable development** » means.

More and more, however, we are beginning to see the wide scope of this concept, and the complex inter-relationships between different components:

- (a) Environmental Protection
 - ◊ land / marine use, and transport ;
 - ◊ energy ;
 - ◊ waste and emissions ;
 - ◊ healing, preservation and enhancement of natural ecosystems ;
 - ◊ awareness raising and education ;
 - ◊ dissemination ;
 - ◊ urban and rural land management, marine management ;
 - ◊ etc.

- (b) Human / Social Development
 - ◊ justice and empowerment ;
 - ◊ equality of opportunity ;
 - ◊ inclusion ;
 - ◊ « person-centred » environments and services provision ;
 - ◊ health, welfare and quality of life ;
 - ◊ etc.

- (c) Cultural Development
 - ◊ human identity ;
 - ◊ local distinctiveness and civic pride ;
 - ◊ social cohesion ;
 - ◊ inter-cultural and inter-generational understanding ;
 - ◊ skills enhancement ;
 - ◊ urban and rural regeneration ;
 - ◊ etc.

- (d) Economic Development
 - ◊ financial mechanisms and incentives ;
 - ◊ employment generation ;
 - ◊ socially responsible business ;
 - ◊ the Information Society ;
 - ◊ etc.

1.4 Implementation of Sustainable Construction

The strategy we would propose for consideration at international level, therefore, is three-fold :

- I Raise awareness and irreversibly influence the mainstream international construction industry, related educational establishments and professional bodies by the year 2010.
- II Use the time between now and 2010 to fully understand the concept of « **sustainable development** », and to assemble a coherent and comprehensive statement of the problem. Develop the framework for an effective and practical response.
- III Target the remainder of the next century to implement this response, monitor and control implementation, and to continuously adjust and improve performance indicators. Refine and complete the response.

The present condition of our planet indicates very clearly that a voluntary, « laissez-faire » approach to implementation will not work. A firm, caring and sensitive interventionist policy is strongly advocated.

It is of absolute importance that a legal base evolves which will validate such a policy. This process has already commenced in the European Union (E.U.), and by implication, the remainder of Europe. See Appendix 3 of this Report.

We would not propose, however, that the response which will eventually be found to be suitable and appropriate for conditions in Europe, will be either suitable or appropriate for any other region of the world.

1.5 Ireland's Contribution

At a meeting of CIB Task Group 16 : Best Practice for Sustainable Construction in Paris, on 11th. June 1997, we drew attention to the need for international agreement on:

- (i) the language and terminology of Sustainable Construction ;
- (ii) the protection of indigenous architecture and methods of building.

We are progressing work in both of these areas.

2. QUESTIONNAIRE SURVEY - 1997

2.1 Methodology

As previously explained in the Introduction, a concern for the practical implementation of Sustainable Construction informed, to a great extent, the approach taken to this questionnaire survey last year:

- (i) contacts were made only with front line participants, either individuals or organizations, in the mainstream Irish construction industry ;
- (ii) those contacted were requested not to engage in attempting to foretell the future, but to express written views, opinions and observations within their own experience.

In order to encourage maximum participation in the survey, an undertaking was given that contributions would not be attributed to named individuals.

The following individuals / organizations were circulated with the questionnaire on Monday and Tuesday, 1st.- 2nd. September, 1997 :

- ◊ Head, Construction and Engineering Technologies, Forbairt ;
- ◊ Architect, Historical Buildings Section, Office of Public Works ;
- ◊ Building Contractor (SME) , Munster Region ;
- ◊ Multi-Disciplinary Environmental Consultancy, Dublin ;
- ◊ Lecturer, Faculty of the Built Environment, Dublin Institute of Technology (Bolton Street College) ;
- ◊ Manager, Irish Agreement Board.

Survey Response :

One questionnaire was never completed ; the last was returned on 7th. October, 1997.

After much discussion, one set of questionnaires was withheld. Genuine disagreement was expressed with the survey, the reasoning behind it, and what it was meant to achieve. The preferred course of action, in their view, was that a 'bottom-up', individual approach to sustainable development should be allowed to take place naturally in each society, at its own rate.

The response was sufficient to discern current thinking, and the general level of awareness about the subject in the mainstream construction industry.

2.2 Answers to Main Question & Six Subsidiary Questions

It was felt necessary to add a preliminary two-part question relating to the term, Sustainable Construction, and its meaning.

Have you ever heard of the term ' Sustainable Construction ' before ?

Three individuals/organizations answered "yes".

One answered "no".

If " yes " , what do you understand to be the meaning of this term ?

- (a) Full lifetime, real production cost and reusability audit of materials and construction.
- (b) Sustainable construction should mean that the construction of buildings becomes a cyclic process rather than a linear process as it is at present.
- (c) Construction that can continue indefinitely.

2.2.1 Main Question:

What will be the consequences of sustainable development for the construction industry in Ireland by the year 2010 ?

- (a) Without cost penalties, none. With penalties, concentration on renewable materials - careful evaluation before redundancy of buildings and elements.
- (b) A radical change in outlook is required by the construction industry in Ireland to achieve sustainable development.
- (c) Major changes in construction practices are required because of existing minimum attention to this issue.

2.2.2 Subsidiary Question No. 1:

What does this entail for town planners and the 'built environment' (urban and rural) by the year 2010 ?

- (a) Audits of building stock relating more to elements rather than services/standards as presently. Development based equally on life cycle and immediate usability.
- (b) Town planners seem to think that sustainable development can be achieved by simply having a higher density of people alongside modern public transport systems. This approach will not provide what is required and a more enlightened strategy is required.
- (c) Retraining of planners/local authorities professional and technical staff is required.
A proactive stance in selling the concept and demanding a 'higher standard' of building from developers.

2.2.3 Subsidiary Question No. 2:

What does this entail for initiating, designing, constructing, maintaining, operating, and demolishing buildings by the year 2010 ?

- (a) Demolishing of buildings should require audit/recycling of elements/materials. Operating will include maintenance costs.
- (b) Buildings need to be designed, constructed and maintained so that they have a continuous life cycle.
- (c) A total new approach is required - next to no attention is being paid at the moment by the sector.

2.2.4 Subsidiary Question No. 3:

What does this entail for construction related materials, components, component assembly, and building servicing by the year 2010 ?

- (a) High energy elements, such as PVC doors and windows, will be more keenly evaluated against natural renewable elements, such as timber windows and doors.
- (b) Construction materials and their assembly must be such that their production and use does not harm the environment and that they can be reused.
- (c) Less use of virgin material, more reuse of demolition waste. Components should be designed for reuse. More attention paid to making better use of 'building' salvage.

2.2.5 Subsidiary Question No. 4:

What does this entail for human resources and skills needed in the construction industry by the year 2010 ?

- (a) Quantities will include energy rather than solely cost. Skills in adaptability/reuse will be needed.
- (b) A considerable amount of education will be required at all levels in the construction to ensure that everyone involved has the same common goal of sustainable development and retraining will be required for the new construction skills needed to build sustainable buildings.
- (c) Rethinking and training for designers. Concept should be 'thought in', and then 'built in' to developments.

2.2.6 Subsidiary Question No. 5:

What does this entail for construction related R & D up until the year 2010 ?

- (a) R & D in Ireland is limited and cost driven. Materials are generally imported so effects generally minimal.
- (b) A significant amount of R & D will be required to provide the information and materials necessary for sustainable construction.
- (c) Increased emphasis on R & D in the environmental end of construction with respect to reuse of materials.

2.2.7 Subsidiary Question No. 6:

Is it possible to formulate strategic recommendations for the management of construction companies based on the answers to the questions in this box ?

- (a) Strategic recommendations for construction companies relate solely to requirements both legislative and economic (e.g. client requirements of Green Insurance Companies, etc.) .
- (b) Strategic recommendations can be formulated and a group should be set up to achieve this.
- (c) Yes ! in a general sense
 - ◊ Investment in R & D
 - ◊ Increase training and
 - ◊ Develop standards
 - ◊ Promote 'Sustainability' at design
 - ◊ Design for reuse

2.3 Some Immediate Consequences for the Construction Industry in Ireland

In Ireland, there is no pressure (legislative, economic or financial) , there are no signals from the marketplace, and but sparse and isolated calls from individual clients for a move in the direction of Sustainable Construction.

At international level, even the language of sustainability causes strong disagreement, as witnessed at a conference held in Paris during June, 1997 - 'Batiment et Environnement', organized by CSTB / CIB.

There is no agreed terminology.

The Principles of Agenda 21 do not appear to be well known, or understood.

Reference to the existing body of relevant International (ISO's) and European (EN's) Standards is less than adequate.

It is early to talk in terms of good practice in Sustainable Construction, and entirely premature to think of best practice.

There is a profound need, worldwide, for radically innovative thinking in the construction industry.

Four matters, however, require immediate attention in the Irish construction industry :

- the craft base in the industry must be saved, significantly deepened and extended ;
- the use of materials, products or processes which have an ' **environmental impact** ' must be properly re-examined ;

- existing EU health and safety, and environmental legislation must be properly complied with, monitored and controlled ;
- the awareness of senior personnel, in all sectors of the industry, must be raised.

2.4 Recommendations for Action

Short to medium term actions in Ireland should take the following courses :

A high-level national research group should be established to examine the concept of « sustainable development » , and its practical implementation in this country.

A national forum on Sustainable Construction should be established to develop a suitable response, in built form, to that concept - and to act as a focus for construction related activities at national level.

(Human/social development is a particularly important component of 'sustainable development', and requires special attention in both of the above areas.)

An initial set of Sustainable Construction « **performance indicators** », suitable for application in Ireland (but within an EU context), should be compiled to cover :

- ◊ the process of construction ;
- ◊ newly completed buildings and civil engineering projects ;
- ◊ the operation, servicing, maintenance, adaptation, modification, alteration or extension of existing construction works ;
- ◊ de-construction, and disposal (incl. re-use) .

The political systems in Ireland, and at EU levels, should be lobbied :

- ◊ to make firm commitments with regard to the real implementation of Sustainable Construction ;
- ◊ to put in place suitable economic / financial mechanisms and incentives to foster and encourage a conversion towards Sustainable Construction ;
- ◊ to re-assure those individuals / organizations within the construction industry, e.g. manufacturers of plastic windows, who may feel threatened by this conversion to new practices.

The opinion of the public, politicians, government administrators, and all of the actors in the construction industry should be carefully nurtured by means of a concerted programme of awareness raising and education.

2.5 Case Study - Short Description of a Recently Completed Building

« Internet Office and Ecohouse Pavilion » , Lough Derg, River Shannon. Designed by Paul Leech, **Gaia Associates** , Dublin 2. Completed in November, 1995. (See Appendix 2).

3. TOWARDS AN UNDERSTANDING OF SUSTAINABLE DESIGN, CONSTRUCTION / DE-CONSTRUCTION AND MAINTENANCE

3.1 Introduction

The big picture on this planet, the long-term goal over the next century, is a fully sustainable natural and built environment, each co-existing with the other in balance and harmony, and each, in their own way, capable of providing for responsible human, social, cultural and economic development. Previous injury to the natural environment must be healed in order to arrive at this outcome ; initial damage repair by human intervention, sufficient only to promote a process of natural self-healing, is suggested.

This level of sustainability is a very complex phenomenon. Nobody yet fully understands what is happening and further experimentation on the natural environment should, to a certain extent, be out of the question because of its current state of fragility.

Sustainability of the 'built environment' (see definition below) can only be understood in relation to that of the natural environment ; it involves, with precision and reliability,

- (i) establishing limits on the capacity of the natural environment to sustain itself ;
- (ii) stopping short of those limits, by a controlled factor of safety, in any further future modification or extension to the built environment ;
- (iii) altering the nature and course of human development, i.e. sustainable development.

The International Council for Building Research, Studies and Documentation (**CIB**) has determined to formulate a response to (ii) above on behalf of the construction industry worldwide, i.e. **Sustainable Design, Construction / De-Construction and Maintenance**.

An evolution in design philosophy, such as this, is also complex. We are only beginning to understand what is happening. In order to properly co-ordinate a response, however, and to provide an objective and quantitative basis for decision making, we must first of all define the problem and analyse the operation of its resolution. The system is dynamic. The method of work must be widely multi-disciplinary - a working dialogue between practitioners, researchers and end-users must be actively encouraged.

3.2 The Problem & Course of Its Resolution

See Figure 1 - Model of a Complex, Dynamic System

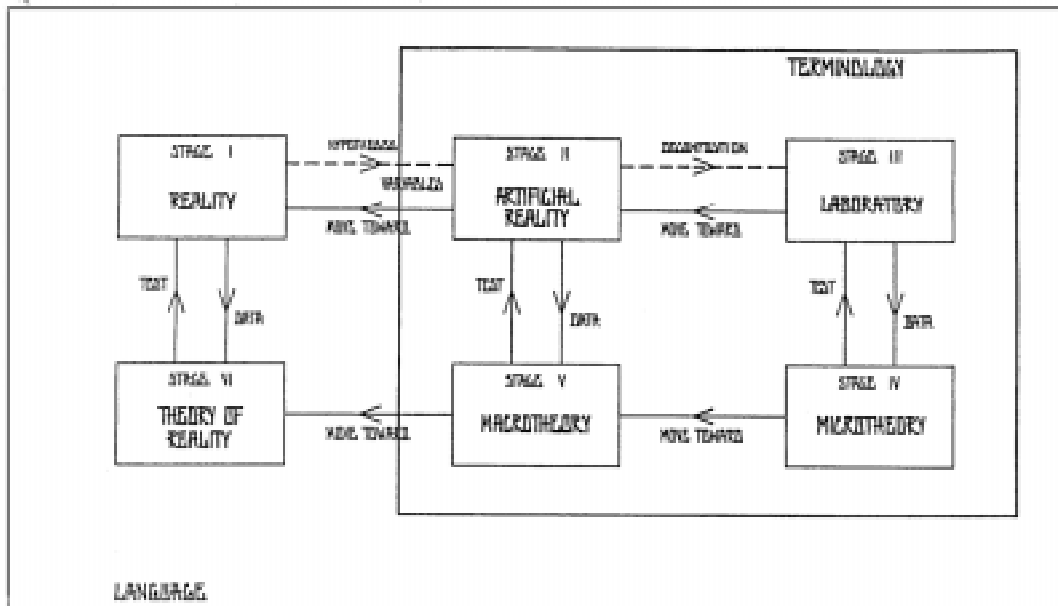


Figure 1 : Sustainable Design, Construction / De-Construction & Maintenance Co-Ordination and Experimentation

Stage I

The realistic end condition, or 'reality', is the design, construction / de-construction, and maintenance of sustainability in the built environment.

Literature dealing with 'reality' is reviewed. Relevant hypotheses are extracted, and as many variables as possible are identified.

Reference to statistics must be limited to those which can be shown to be impartial, reliable, objective, scientifically independent, cost-effective and statistically confidential.

Stage II

An 'artificial reality' is designed which is complex enough to permit testing of the hypotheses formulated in **Stage I**. Observations must be capable of description in quantitative terms.

Questionnaire surveys are carried out with real users of buildings, civil engineering works and infrastructural networks, e.g. transport. To be effective, it is essential that each survey is carried out, on a person-to-person basis, by an independent, competent, non-threatening individual, and using both open and closed format questions. These surveys are not only very valuable sources of information, but they formalize the process of consultation between practitioners and end users. See definition of 'person-centred design' in 3.3 below.

Stage III

'Artificial reality' is broken down into simple experimental situations at small and medium scale, e.g. advanced energy surveying of buildings or groups of buildings using infra-red thermography, detailed analysis of air quality in buildings and at external locations, real time monitoring of thermal comfort (EN ISO 7730) conditions in buildings, etc., which generate test results under controlled conditions, i.e. a laboratory in the real environment.

Special attention must be paid to measurement uncertainty, and test method precision.

Stage IV

A simple theory, or microtheory, is developed to explain the test results. When this microtheory is tested and found valid, it is expanded to contain test results in more complex situations, e.g. satellite and/or aerial based infra-red surveys of geographic regions. This process is repeated until a macrotheory is formulated which explains the 'artificial reality' .

Special attention must be paid to calculation uncertainty. Computer modelling packages must also be transparent to practitioners, and validated by an independent, competent individual and/or organization.

Stage V

'Artificial reality' is modified in the direction of 'reality' and **Stage IV** is repeated yielding a fresh macrotheory. The process is repeated again and again.

Stage VI

When a macrotheory is sufficiently developed, it can be used to extrapolate an explanation of 'reality' .

It is essential that such a 'theory of reality' is accessible to all concerned with the implementation of sustainable design, construction / de-construction and maintenance in the built environment and, therefore, a boundary to the use of terminology is delineated.

Terminology must focus on, and be always directly related to, the realistic end condition.

Without **research and development**, this system remains static and the problem cannot be fully resolved.

3.3 Interpretation

Adaptability :	The extent to which a building, or a building component, is designed when new, or capable of being easily modified at any later stage, to meet the changing living or working needs of the broad average of potential occupants, who may be disabled or able-bodied.
Buildability : (CIRIA-GB)	The extent to which the design of a building facilitates ease of construction, subject to the overall requirements for the completed building.
Built Environment :	Anywhere there is, or has been, an intervention by a human being in the natural environment.
Construction Works : (EU Directive 89/106/EEC)	Any building or civil engineering works.
Cost Effectiveness : (IEC Treaty, 1994*)	To achieve a defined objective at the lowest cost, or to achieve the greatest benefit at a given cost.
Dimensional Co-Ordination : (ISO 1791)	A convention on related sizes for the co-ordinating dimensions of building components and the buildings incorporating them, for their design, manufacture, assembly and/or installation.
Disabled :	<p>Those people, of all ages, who are unable to perform, independently and without aid, basic human tasks or functions because of physical, mental or psychological impairment, whether of a permanent or temporary nature.</p> <p>This definition is derived from / based on the World Health Organization's definitions (1980) of 'impairment' and 'disability' only.</p> <p>The term disabled includes</p> <ul style="list-style-type: none">• wheelchair users ;• people who experience difficulty in walking, with or without aid, e.g. stick, crutch, calliper or walking frame ;• the elderly (people over the age of 60 years) ;• the very young (people under the age of 5 years) ;

- pregnant women ;
- people who suffer from arthritis ;
- the visually impaired ;
- the hearing impaired ; and
- people who panic in a fire situation or other emergency ;
- people who suffer incapacitation as a result of exposure, during a fire, to poisonous or toxic substances, and/or elevated temperatures.

Economically Reasonable Working Life :
(EU Directive 89/106/EEC)

(i) The working life is the period of time during which the performance of the works will be maintained at a level compatible with the fulfilment of the Essential Requirements.

- (ii) An economically reasonable working life presumes that all relevant aspects are taken into account, such as
- costs of design, construction and use ;
 - costs arising from hindrance of use ; risks and consequences of failure of the works during its working life and costs of insurance covering these risks ;
 - planned partial renewal ;
 - costs of inspections, maintenance, care and repair ;
 - costs of operation and administration ;
 - disposal ;
 - environmental aspects.

Energy Cycle :
(IEC Treaty, 1994)

The entire energy chain, including activities related to prospecting for, exploration, production, conversion, storage, transport, distribution and consumption of the various forms of energy, and the treatment and disposal of wastes, as well as the decommissioning, cessation or closure of these activities, minimizing harmful environmental impacts.

Environmental Impact :
(IEC Treaty, 1994)

Any effect caused by a given activity on the environment, including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interactions among these factors ; it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors.

Human Health :

A state of physical, mental, psychological, social,

cultural and economic wellbeing.

Improving Energy Efficiency : (IEC Treaty, 1994)	Acting to maintain the same unit of output (of a good or service) without reducing the quality or performance of the output, while reducing the amount of energy required to produce that output.
Life Cycle : (EN ISO 14040)	Consecutive and interlinked stages of a product (and/or service) system, from raw material acquisition or generation of natural resources to the final disposal.
Life Cycle Assessment : (EN ISO 14040)	Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product (and/or service) system throughout its life cycle.
Life Cycle Impact Assessment : (EN ISO 14040)	Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts of a product (and/or service) system.
Life Cycle Interpretation : (EN ISO 14040)	Phase of life cycle assessment in which the findings of either the inventory analysis or the impact assessment, or both, are combined consistent with a defined goal and scope in order to reach conclusions and recommendations.
Life Cycle Inventory Analysis : (EN ISO 14040)	Phase of life cycle assessment involving the compilation and quantification of inputs and outputs, for a given product (and/or service) system throughout its life cycle.
Performance : (EU Directive 89/106/EEC)	Performance is a quantitative expression (value, grade, class or level) of the behaviour of a works, part of the works or product, for an action to which it is subject or which it generates under the intended service conditions (for the works or part of the works) or intended use conditions (for products) .
Safety : (ISO/IEC Guides 2 & 51)	Freedom from unacceptable risk of harm
SEED :	<u>S</u> ustainable , <u>E</u> nergy-efficient , <u>E</u> nvironment-friendly <u>D</u> evelopment.
Sustainable Development : (Bruntland Report, 1987)	Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

An improved definition of 'sustainable development' must also embody the following concepts

- the place of human beings in the environment, and the relationship between both ;
- the nature of human, social, cultural and economic development, their current imbalances and inequities, and their future course ;
- the healing of existing injury to the natural environment.

Sustainable Construction :
(CIB/W82 & TG16)

The creation and responsible maintenance of a healthy built environment based on resource efficient and ecological principles

Sustainable Design :

The art and science of the design, supervision of related construction / de-construction, and maintenance of sustainability in the built environment.

The definition of 'sustainable design' embodies the following concept

- 'person-centred' design , i.e. that design process which places real people at the centre of creative concern and gives due consideration to their safety, health and welfare in the built environment - it includes such specific performance criteria as a sensory rich and accessible (mobility, usability, communications and information) environment, fire safety, thermal comfort (EN ISO 7730) , air, light and visual quality, unwanted or nuisance noise abatement, etc.
- an important 'person-centred' design **aid** is the questionnaire survey, carried out by an independent, competent, non- threatening individual, and which comprises both open and closed format questions.

Sustainable Engineering :

The application of scientific principles to relevant aspects of sustainable design.

Welfare :

A general feeling of health and happiness.

3.4 Reference Documentation

ISO 6241 : 1984

' Performance standards in buildings - Principles for their preparation and factors to be considered '

ISO 6707-1 : 1989

' Building and civil engineering - Vocabulary. Part 1 : General terms '

ISO 6707-2 : 1993

' Building and civil engineering - Vocabulary. Part 2 : Contract terms '

EN ISO 14040 : 1997

' Environmental management - Life cycle assessment - Principles and framework '

ISO / TR 14177 : 1994

' Classification of information in the construction industry '

International Charter for the Conservation and Restoration of Monuments and Sites

International Council of Monuments and Sites (**ICOMOS**) . Venice, Italy. May, 1964.

Rio Declaration on Environment and Development - Agenda 21

Adopted on 14th. June 1992, at the 19th. plenary meeting of the United Nations Conference on Environment and Development. Rio de Janeiro, Brazil. 3rd.- 14th. June, 1992.

E.U. Council Regulation (EEC) No. 1836/93 , of 29th. June 1993, allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme.

Helsinki Declaration on Action for Environment and Health in Europe

World Health Organization, Regional Office for Europe. 2nd. European Conference on Environment and Health. Helsinki, Finland. 20th.- 22nd. June, 1994.

International Charter for the Protection of Indigenous Architecture and Methods of Building

Conscious of the meaning of 'environmental impact' , it was agreed at a meeting of **CIB/TG16** in Paris, on 11th. June 1997, that work should commence on this Charter. Possible sponsorship of the document by the United Nations should also be explored. See Principle 22 of **Agenda 21** .

* **International Energy Charter Treaty**

Lisbon, Portugal ; December, 1994. Official Journal of the European Communities. **OJ L 380** . Office for Official Publications of the European Communities. Luxembourg. 1994.

4. APPENDIX 1 : SURVEY « SUSTAINABLE HOUSING IN EUROPE »

5. APPENDIX 2 : CASE STUDY « INTERNET OFFICE AND ECOHOUSE PAVILION »

**6. APPENDIX 3: INSTITUTE OF EUROPEAN AFFAIRS,
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7. APPENDIX 4 : HUMAN / SOCIAL DEVELOPMENT WITHIN THE EUROPEAN UNION

'Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.'

Principle 1

1992 Rio Declaration on Environment and Development (Agenda 21)