

Regular digest of news from the members of the European Network of Building Research Institutes (ENBRI)

## Characterizing the environmental quality of building products



CSTB's researchers have established a method for analyzing the life cycle of simple products. The method is appropriate for the specific characteristics of the building field as well as for the users' needs.

Unlike consumer products, building products go through particular phases all along their life cycle: assembly, incorporation on the worksite, life in the structure (servicing, renovation), demolition or dismantling at the end of service life.

Building, renovating, servicing, while preserving the environment, building products are obliged more and more to provide proof of their environmental quality. This is because we now know that all along their service life they may have non negligible impacts not only on the environment but also on the health and comfort of the inhabitants.

Until now the building sector lacked the

tools needed to assess the environmental quality of its products. Today this has been achieved with the method developed by CSTB based on analyses of the life cycle. These analyses totalled the consumptions of resources and the discharges into the environment at each step in the life of a product, "from the cradle to the grave". Their impacts were then converted into environmental indicators such as toxicity for man, greenhouse effect, exhausting of natural resources.

This approach to the analysis of the life cycle has, until now, been used mainly in other industrial sectors. CSTB's researchers wanted to make it more flexible in order to be able to respond to the needs, to the constraints and to the vision of the environment of various users: manufacturers naturally, but also contracting authorities, architects, contractors or even demolition firms. This also meant taking the definite peculiarities of building products into account. (See panel on page 2)

The analysis method developed by CSTB is the fruit of three years of research conducted jointly with the Environment and Energy Agency (Ademe, in French). Today it has resulted in an operational software package.

### Characteristics specific to building products

Building products behave differently from consumer products. They pass through particular phases during their service life : incorporation on worksite, life within the structure, demolition at the end of service life.<sup>2</sup>

The time parameter plays a major role. The life of the structure is very long, lasting longer than technological evolutions, than changes in the regulations, but also longer than the life of certain technical performances of the product..

A clear definition and a management of

the borders around the system being analysed is necessary. Special care has been given to the interface between what directly concerns the product and what concerns the whole building. The "recycling" processes, as long as they are outside the more specific scope of the product being analysed have been treated in a special way.

The particular characteristic (variability, dispersion) of the data must be taken into account. The transparency of the choices made and of the origin of the figures is indispensable to guarantee correct application and use.

### Life cycle analysis: some examples of use

- ◆ For a manufacturer : choose, within a production process of a "multi-material" product, the integrated manufacture or outside purchase of one of its components.
- ◆ For a dealer : convert the information contained in the technical documentation of certain products into effects on the close environment.
- ◆ For a main contractor : specify the appropriate floor covering for the renovation of the allergy department of a hospital.
- ◆ For a building manager : compare several methods of servicing wood elements exposed outside.
- ◆ For a demolition firm : choose between various solutions of elimination or salvage of wastes on the worksite.

Furthermore, the goal of CSTB's work has been to contribute to improving the environmental quality of all existing products and to aid in the design of new products. However, environmental quality is only one element in product quality. All this requires meeting the demands for performance, suitability for use, durability.

The method proposed by CSTB aims to avoid succumbing to the temptation to prepare a catalogue of good or bad products and to avoid triggering a war between materials. The method fits within a dynamic of progress and innovation.

When the time comes, this methodology will serve as the basis for introducing environmental criteria in the Technical Approval procedure.

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# in brief

## EC's Targeted Research Action - Environmentally Friendly Construction Technologies

The ENBRI European Economic Interest Group, ENBRI Development, has submitted, on behalf of the European Council for Construction Research and Innovation (ECCREDI), a proposal to the European Commission for ECCREDI to manage the above Action. The primary objective of the action is to boost transfer and dissemination of technology and expertise between the projects covered by the Action. These projects are construction-related ones within the Brite-Euram, SMT, CRAFT, and Steel research programmes. There are currently 80 projects within the scope of the Action, grouped into nine focused clusters.

The activities covered by the proposal include the preparation of annual action plans, press releases, quarterly newsletters, internet homepage, multimedia CD-ROM, market reviews, strategic notes on future research needs, annual reports on network activities.

### ECCREDI Responses to Commission on Future Innovation Proposals

ECCREDI has been busy responding on behalf of its members to a number of papers distributed by the Commission for comment. In particular, responses outlining members' views have been sent to the Commission in relation to the "Green Paper on Innovation" and "Construction - Review of European RTD and Related Activity". It is anticipated that these papers and their responses will go some way to formulating the approach and research topics within the Commission's Fifth Framework programme.

A paper is in preparation, outlining members' views of major research challenges, as a response to the Commission's paper "Preliminary Guidelines for the Fifth Framework Programme of RTD Activities".

It is anticipated that these activities will help the European construction industry secure a reasonable proportion of innovation funding in future European research programmes.

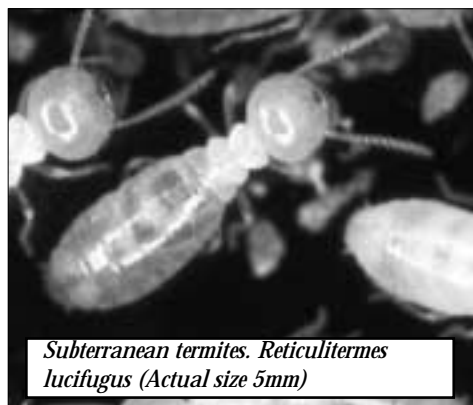
## Boron-based wood preservatives for



Wood is a highly complex composite of cellulose, lignin and hemicelluloses, thus subject to the activity of decomposer organisms. From

the several types of organisms involved in this process, termites represent, whenever present, the highest risk for timber applied in construction usually involving high economic losses and/or destruction of historical timber structures and this happens almost independently of the hazard class of application.

Termites are social insects found in a wide range of terrestrial environments and are widely distributed throughout the tropics. Nevertheless a number of species is now perfectly adapted to less warm and humid conditions, like those of southern Europe where termites are a major source of destruction of timber in service.



Subterranean termites. *Reticulitermes lucifugus* (Actual size 5mm)

Usually in termite control three main strategies can be considered: (1) installation of chemical and/or physical barriers to prevent termites from entering a building or attacking timbers in contact with the ground; (2) use of naturally durable timbers or impregnation of

susceptible ones with a wood preservative; (3) destruction of the termite nest using chemicals applied directly to the nest or indirectly via bait toxicants that are eaten and distributed through the colony.

A research programme, developed mainly during 1991-95, in collaboration with the Imperial College of Science, Technology and Medicine (University of London), aimed to extend the knowledge of the relation between a wood preservative and subterranean termites, having in mind the development of effective though environmental-friendly wood preservatives. Boron compounds were chosen for this purpose.

The first objective of the study was to provide evidence that boron compounds could be effective wood preservatives against *Reticulitermes* sp., when applied by suitable methods and for adequate exposure conditions of the

timber. Basic toxicity testing was conducted on boron treated paper and maritime pine wood and the lowest effectiveness/dose relation was established. Parallel studies were conducted on wood and wood-products treated by a novel process (vapour boron treatment) and the efficacy against termites verified using standard and adapted methodology.

## Using the past to show the way to the



BRE is leading the way in encouraging greater use of construction and demolition waste as an alternative to natural aggregates in the construction of the Energy Efficient Office of the future at BRE.

The demolition of the old building on the site and the construction of the new one has been used as an opportunity to study the use of recycled building materials. The project is a practical demonstration of work carried out by Dr Rod Collins of BRE's Inorganic Materials Division into the use of recycled aggregates.

In the first demonstration of its kind in the UK, recycled concrete from a 12-storey building being demolished in central

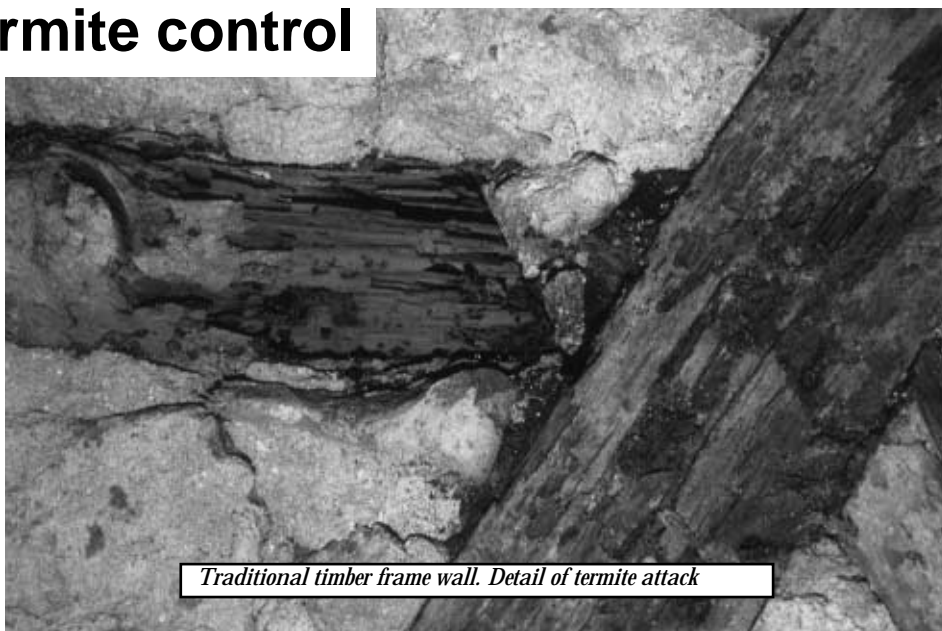
London was used as aggregate for new concrete in the new building both in the foundations and higher up in the structure.

This will show that crushed concrete can be put to high grade use as well as being used as site fill or for landfill engineering. Concrete and masonry from the demolished BRE building has been crushed on site for use as hardcore in the foundations of the new building. In addition more than 70,000 reclaimed bricks has been used in the construction.

The project shows that reuse and recycling of construction and demolition waste should be planned from the very start of any construction programme.

The Energy Efficient Office of the future is an EEO club project aiming to define the performance requirements and

# termite control



*Traditional timber frame wall. Detail of termite attack*

Meanwhile, a program of work was developed to investigate possible influences of the boron treatments in several physiological parameters of the termites, mainly connected with the digestion process of cellulose and also on the effect of boric acid in the gut protozoa. More data was needed on the particular action of boron compounds on termites, to evaluate whether they are killed by indirect action, that is, boron is in fact killing the protist and bacterial populations and then the termites are starving to death or by direct action on the insect.

Boric acid clearly interferes with all the parameters tested and both disodium octaborate tetrahydrate and trimethyl borate (applied by vapour boron treatment) were able to prevent the attack by termites. Nevertheless, because of the

possibly of leaching, the use of boron compounds should be considered mainly for non-wetted applications.

Though an overall explanation of the mode of action of the active ingredient could not yet be proposed, the results obtained point to a direct action of boric acid on the termites as a general metabolic poison. The knowledge of this mode of action may help to formulate new products specially taking into account the idea that future control of termites will probably favour the use of a combined strategy involving physical barriers and bait toxicants.

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# e future



individual components of future low energy buildings. The design brief called for energy performance targets 30% better than current best practice whilst providing a comfortable and healthy working environment. The new building has been

designed with the intention of scoring an Excellent BREEAM rating - the highest possible.

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# Improved Quality Assurance and Methods of Grouting Post-Tensioned Tendons

## Brite/Euram project BRPR-CT95-0099



IN the field of civil engineering the development of prestressed concrete is undoubtedly one of the most important achievements of this century. Nowadays post-tensioned cast in-situ and segmental constructed bridges and flyovers constitute in a lot of cases the vital links in many rail- and motorways.

Even more than in the case of reinforced concrete the protection of the steel is an essential element for the durability of prestressed structures.

As the high strength prestressed steel is particularly sensitive to corrosion, due care has to be taken to protect the steel from external aggressive factors such as, especially in the case of bridges, the infiltration of de-icing salts. Therefore post tensioned cables, whether they are externally fixed or placed in internal ducts, have to be grouted after stressing.

In the case of bonded tendons these grouts have next to their protective role also a structural role to fulfil. Indeed in these cases an adequate stress transfer from the cables to the concrete is to be assured as well.

The grouting of the prestressing cables is thus of prime importance for construction where post-tensioned bonded cables are used.

This grouting however constitutes one of the major difficulties in the construction process. Indeed grouts, which have the capacity of hardening, are infiltrated uniformly in small channels over long distance which is not at all a simple task.

No wonder that corrosion problems due to badly grouted cables have been experienced with a lot of prestressed structures. Accidental collapses, premature demolitions and required extensive maintenance works created great concern.

At present the Structures Division of the BBRI is involved together with British, Danish and other Belgian partners in a BRITE-EURAM project which aims at the following objectives:

- ◆ the development of very fluid grouts which will allow to improve the quality of the grouting operations for post tensioned structures
- ◆ the development of adapted and improved high pressure grouting techniques

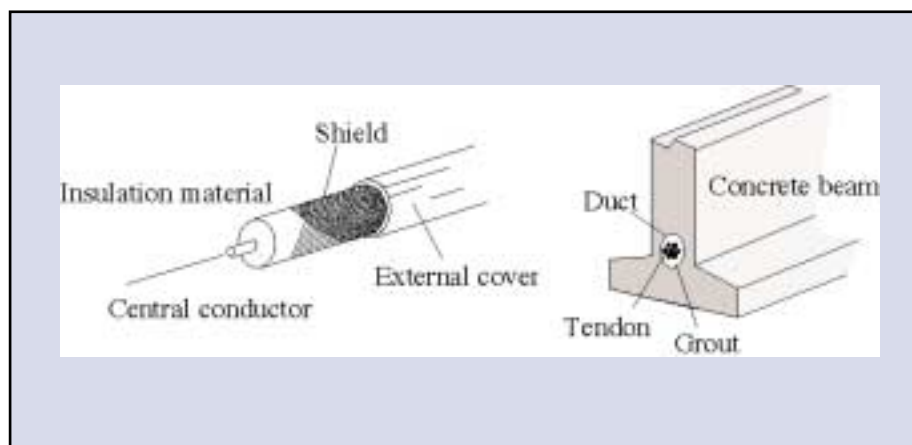
- ◆ the development of suitable QA/QC systems which could be applied during and immediately after grouting.

With respect to the QA task it is in this research amongst others the aim to develop as a spin-off of the available reflectometry technology used for the inspection of transmission lines a reliable technique for the on-line quality assurance of the grouting process of prestressing ducts.

The starting point for the work on reflectometry is the observation that a prestressing cable can be compared with a transmission line (e.g. a coaxial cable).

The grout is to be considered as the insulating dielectricum which separates the outer and inner leads of the line.

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