# BRITE TESCOP PROJECT

## CONTENTO TRADE SRL

Technological innovation for the environment

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Cleaner solutions in the Life Cycle of Concrete Products

## BRIEF DESCRIPTION:

Partners:

DTI Building Technology, Denmark
Italcementi, Italy
Premix, Greece
Alteren, Greece
Volker Stevin, Netherlands
DCEA, Denmark
Aalborg Portland, UK
Intron, Netherlands
Contento Trade s.r.l., Italy
Conphoebus, Italy

## OBJECTIVES:

The environment protection has became an important issue in the world context. At the United Nations Conference for Environment and Development held in Rio de Janeiro in 1992, this need was reflected in the compilation of the Green Agenda. The construction activities will be planned - as the Agenda requests- to decrease the environmental impact and to achieve a sustainable growth by all the countries.

The main objective of the European Union (EU) in the field of the environmental policy is to protect, preserve and improve the environment quality to assure a prudent and rational use of the natural resources.

The strategies of EU are aimed at the prevention of waste production through the development of anti-pollution processes and at the introduction of cleaner technology.

The concrete is globally one of the most important construction material. The environmental impact caused by the concrete industry isn't considered very bad if it's calculated per functional unity, but even small improvements will have huge effects because of the big quantity of concrete products.

Within this proposal, the concrete industry involves all the partners working in the life cycle of concrete, from extraction and workings of raw materials, to



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production of concrete, from construction and maintenance of building to demolition and dumping of the material.

The economical and environmental objectives for the concrete industry are:

- ✓ reduction in consumption of energy, water and raw materials which reduces the costs of concrete products and ensure a prudent and rational utilization of natural resources by implementation of cleaner technologies;
- ✓ reduction in environmental taxes (where they exist or will be implemented) through the implementation of cleaner technologies;
- ✓ documentation of the environmental impact of concrete products;
- ✓ the development of a LCA software to review where cost-effective cleaner technology solutions are necessary and to assess improvements.

The main industrial objectives of this research program are:

- ✓ to develop cost-effective cleaner technologies to promote the competitively of the concrete industry and reduce the environmental impact of the concrete products.
- ✓ to implement and test the cleaner technologies in practice, including also the technology transfer among European countries

As forming parts to achieve the main objectives, the research program will include:

- ✓ the study of a model for the life cycle evaluation (LCA) to understand the environmental impacts of the life cycle on the concrete products
- ✓ a methodology to collect data on the environmental impact caused by the concrete products
- ✓ the design of a software package with the above mentioned contents usable in the concrete industry
- ✓ the declaration of the environmental impact of concrete products usable by customers and by the ECo label system.
- ✓ A survey of the environmental impact of concrete industry in Europe based on the existing production processes.



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- ✓ An evaluation of political scenarios concerning appropriate steps to ensure full consideration of environment related requirements including both technical requirements and possible environmental taxes. The political scenarios will be used, together with the LCA results, to appoint fields where cleaner technologies must be developed.

The society will benefit of more ecological products with a reduction also in the environmental impact.

The aims of this project are:

- ✓ reducing the power consumption of the 10-20 %. This consist in a power reduction estimated in about 200 millions of MJ per year in the European countries, based on the estimation that the concrete production is 218 millions of m3 per year in the European countries and the average power consumption is 2,6 MJ per kg of produced, maintained and demolished. These estimation are based on the project "Industry Analysis Concrete-Cleaner technology in concrete production" (DTI, 1995)

- ✓ reduce the water consumption of 30 - 40%. This will bring to a water reduction of about 0,5 millions of m3 per year in the EU countries based on a consumption water average of 2,5 liters/ Kg of concrete (except the mixing water ).

Recycle the 60-70 % of the disposed concrete in new products. This will bring to a concrete waste reduction of about 300 millions of m3 per year in the EU countries based on a consumption water average of 0.98 kg per kg of concrete.

## STATE OF THE ART

Over the last years a lot of work has been done in the European Union on environmental topics related to the construction sector.

In Holland some studies have been done to recycle the concrete it in the road construction industry and aggregate in the new concrete (Hendriks, 1994). Furthermore some studies on LCA of window frames have been preformed (Lindeijer, 1992), and on a complete sewer system made in concrete material (INTRON, 1995). The last project was based on a LCA model developed at the Centre for Environmental Science of Leiden University (CML) (Heijungs, 1992).



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In Germany an industry on concrete recycle to be used in the road construction, for the production of new concrete and for its use in the production of aggregates for the concrete was set up (Schultz, 1994). Research has also been carried out on the leaching of heavy metals from concrete and cement (Sprung et al., 1994).

In France, Spain, Belgium, UK and Ireland some works on the recycling of concrete in road construction and as aggregate in cement have been done (Desmyter et al., 1994), (Merlet & Pimienta, 1994), (Morel & Gallias, 1993), (O'Mahony, 1994), (Wainwright & Cabrara, 1994).

Some works on embodied energy have been developed (Miller, 1994): this energy has been calculated for a pre-cast concrete and in situ concrete floors. Is has been defined as the total energy consumption, including all energy consumption from raw materials extraction to concrete manufacture.

In Scandinavia some works on the recycled concrete (Gottfredsen & Thøgersen, 1994), on concrete posts LCA (Erlandsson, 1991), and on cement LCA (VOLD, 1995) have been done as well. The Danish Technological Institute (DTI), in collaboration with the Danish Concrete Industry presented a project called "Industry Analysis Concrete - cleaner technologies in the concrete production, 1995".

The aim of the DTI project was to examine the environmental conditions in the concrete life cycle with a methodology based on the work developed by the Society for Environmental Toxicology and Chemistry (SETAC, 1993). This project examines all kind of concrete. The results of this project are the basis for this new project.

In USA and Japan some studies on the recycle of wastes form concrete industry have been performed. Most of the heavy wastes of which the concrete is composed and the bricks rubbles are used for the road construction/road pavements (Kasai, 1994), (Kibert, 1994) and in limited amounts as aggregate in new concrete (Kikuchi & Yasunaga, 1994), (Yagishita et al., 1994). In USA most of the construction wastes is dumped on sites far from the towns.

One of the main concerns in the use of concrete is the dumping of the demolition wastes. Concrete in fact covers the 67 % in weight and the 53 % in volume of the total demolition wastes in North America (The American Institute of Architects, 1995).



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## MAIN INNOVATIONS

The relationships of the project partners -Greek, Danish and Italian manufacture companies of concrete and cement - to Dutch and Swedish contractors and to European organization and European contractors form a good basis for future implementation of cleaner technologies solutions in the European Concrete Industry.

The innovative aspects of this proposal are:

- ✓ localization of areas in the concrete life cycle, which cause the highest environmental impact;
- ✓ development and implementation of cost effective cleaner technologies in the European Industry o concrete and cement;
- ✓ introduction of the concept of "political scenarios";
- ✓ development and optimization of a software to realize the LCA on concrete products;
- ✓ calculation of the total environmental impact for the life cycle of the concrete products;
- ✓ increased reuse of concrete;
- ✓ upgrading and adaptation of the existing production technology
- ✓ creation of an inventory to perform a future European "eco label" on concrete products.



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