

## GREEN CONCRETE



Marianne Tange Jepsen

M.Sc.

Concrete Centre, Danish Technological Institute

Gregersensvej, P.O. Box 141, DK-2630 Taastrup, Denmark

E-mail: marianne.t.jepsen@teknologisk.dk

### ABSTRACT

A workshop about green concrete was held in Reykjavik on August 5, 1999. The article concerns the two introductory presentations about the Danish *Centre for Ressource Saving Concrete Structures* and the discussion afterwards: What is "sustainability", what should be the ambitions for further research and development, and how can we promote the use of green concrete in the Nordic countries?

Key words: Green concrete.

### 1. INTRODUCTION

On August 5, 1999, a workshop about green concrete was held in Reykjavik. The workshop was arranged as a part of the *XVII Symposium on Nordic Concrete Research* in Reykjavik, August 4-6, 1999. The workshop was chaired by Christian Munch-Petersen, Danish Technological Institute.

The workshop began with two introductory presentations by Jesper Sand Damtoft, Aalborg Portland, and Mette Glavind, Danish Technological Institute, who are both involved in the Danish project *Centre for Resource Saving Concrete Structures* (in short: Centre for Green Concrete). This article contains a brief summary of the two presentations (a comprehensive summary is given in /1/ and /2/) and a report of the subsequent discussion.

### 2. DANISH CENTRE FOR GREEN CONCRETE/ Jesper S. Damtoft

In comparison to most other building materials, concrete is an environment-friendly material. However, since concrete is produced in such large amounts, the production still causes a heavy environmental impact. The Brite Euram project TESCOP regarding cleaner technology for concrete products has revealed that the most important targets are CO<sub>2</sub> reduction and reduced consumption of scarce resources (like fossile fuel) and harmful substances, e.g. those in water reducing agents.

In Denmark, partners from all sectors related to concrete production, among these aggregate, cement and concrete producers, a contractor, a consulting engineering company, Danish Technological Institute, the technical universities and the Danish Road Directorate have formed the Centre for Green Concrete. The aim of the centre is to develop new green types of concrete

and green structural solutions. The centre works on five development projects to achieve the target:

- Concrete with minimal clinker content
- Concrete with green types of cement and binders
- Concrete with inorganic residual products
- Performance and maintenance of green concrete structures
- Green construction technical solutions and construction technical solutions for green types of concrete.

### **3. CONCRETE WITH INORGANIC, RESIDUAL PRODUCTS/ Mette Glavind**

While the first presentation could have had the headline “Green concrete - why?”, the second presentation answered the question “Green concrete – how?” by outlining the specific work in one of the above mentioned development projects. Here the aim of the project work is to develop green types of concrete with inorganic residual products as substitutes for either cement or sand.

The participants in this working group have gathered information about numerous inorganic, residual products from the concrete industry and from other industries, from which the waste products have not previously been used in concrete. Each product has been evaluated from a concrete technological and an environmental point of view and five different products have been chosen for an experimental investigation. A test programme is planned in order to test these concrete types as well as concrete types with high contents of fly ash. The initial testing includes workability, air content, compressive strength, heat development, homogeneity, water separation, setting time, density and pumpability. Some of the concrete types intended for aggressive exposure will also undergo different durability tests. From the initial mix testing, the most promising types of green concrete will be selected for more advanced testing.

### **4. DISCUSSION**

After the presentations, there was time for questions and discussion. Most of the questions directed to the speakers concerned practical details (e.g. if water/binder ratio should be preferred instead of water/cement ratio). Below, the focus is on the principle questions, which were posed during the discussion. The comments have been grouped according to subject and not necessarily in the order, they were expressed.

#### **4.1 What is “sustainability”?**

- Relying on an industrial by-product or waste material such as fly ash is not the same as sustainability.
- The definition of sustainability is a very philosophic discussion. Even though it might not be sustainable to use fly ash in concrete, on the short term there will be plenty of fly ash, and it is better to use it than to store it.
- The definition of sustainability is very dependent on how local your environmental calculations are.

## 4.2 Ambitions for further research and development

- It is important to put one's sight high and be ambitious. Much of the work done in the field of green concrete is more or less optimisation of well known technologies instead of new solutions, and this will never result in a break-through.
- The research and development work should not solely be based on environmental goals. Some consideration about the market to serve is also needed. If there are no limits of costs, there will be no technical limits either.
- The focus needs to be widened. Often focus is on CO<sub>2</sub> reduction, but the whole environmental impact should be covered. Accordingly, the investigations of the material should include not only the binder but all parts of the concrete and the structure it is build into.
- When choosing materials, we are focusing on a lot of technical parameters such as strength, but sometimes low strength is adequate. There might be a market for a green concrete even though it does not have exactly the same properties as conventional concrete, so we ought also think in terms of new ways to use the material.

## 4.3 How can we promote the use of green concrete?

- Green concrete does not fulfil the requirements of the existing standards so new standards are needed.
- The building owners should try to influence standards in a green direction.
- Removal of technical barriers is not enough to make green concrete a success. There has to be a demand for the product. In Norway, a project on recycled aggregates has started recently, and in this project focus is also on how to minimise the scepticism of the consumer against a new product.

## 5. CONCLUSION

We need high tech to lower the environmental impact of concrete production. Additionally we need to combine the efforts in international projects to benefit the most from the work performed in the field of green concrete. Different countries have different traditions (e.g., in Denmark the ready mix plant adds the inorganic additives whereas in the Netherlands it is the cement producer) and therefore different aspects can be presented.

After the workshop a Nordic network in the field of green concrete has been initiated. Everybody interested is very welcome to contact Mette Glavind, Danish Technological Institute.

## REFERENCES

- /1/ Mette Glavind, Jesper S. Damtoft, and Anette Berrig, *Danish Centre for Green Concrete*, Proceedings, Nordic Concrete Research Meeting, Iceland (1999).
- /2/ Mette Glavind, Dirch Bager, Freddie Larsen, and Ronny Boy, *Concrete with inorganic, residual Products*, Proceedings, Nordic Concrete Research Meeting, Iceland (1999).

