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CONCRETE WITH INORGANIC, RESIDUAL PRODUCTS

Mette Glavind
Project Manager, M.Sc., Ph.D.
Danish Technological Institute, Concrete Centre
Gregersensvej, DK-2630 Taastrup, Denmark
Mette.glavind@teknologisk.dk

Dirch H. Bager
Chief Concrete Technologist, Ph.D.
Cement and Concrete Laboratory, Aalborg Portland A/S
P.O. Box 165, DK-9100 Aalborg, Denmark
db@aalborg-portland.dk

Freddie Larsen
Quality and Development Manager, B.Sc.
Unicon Beton A/S
Hjulmagervej 31, DK-9100 Aalborg, Denmark
Flar@unicon-beton.dk

Ronny Boy
Sydsten AB
Stenyxegatan 7, S-200 39 Malmö, Sverige
Ronny.boy@sydsten.se

ABSTRACT

This paper describes a part of the work in the Centre for Resource Saving Concrete Structures focused at developing green concrete with the use of inorganic residual products as a substitute for either the cement or the sand. The products investigated are: Stone dust, concrete slurry, slurry from waste combustion, smoke waste from waste combustion, and flyash from sugar production.

Key words: Green concrete, residual products, stone dust, flyash, slurry, smoke waste.

1. RELATION TO CENTRE FOR RESOURCE SAVING CONCRETE STRUCTURES

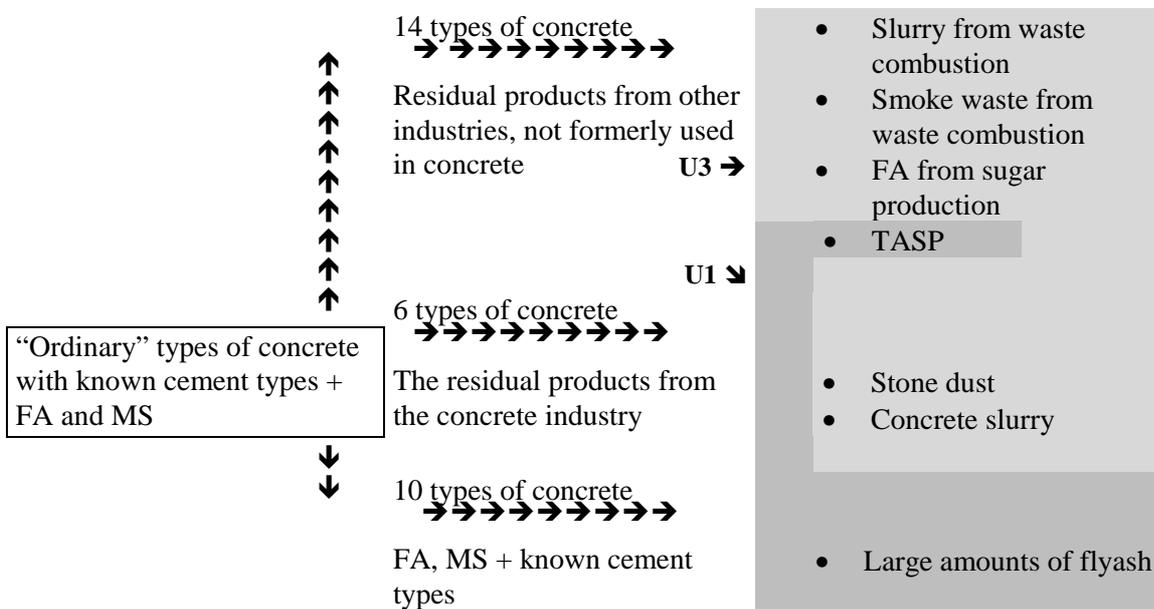
This paper describes a part of the work in the Centre for Resource Saving Concrete Structures also known as “Green Concrete”. The most important goals of this centre is to develop the technology necessary to produce resource saving concrete structures by means of new binder types in new types of concrete combined with a possible reuse of residual materials. The centre is more thoroughly described in (1).

2. DIFFERENT WAYS TO PRODUCE GREEN CONCRETE

In the various development projects in the centre, green concrete is examined in three different ways, (2):

- U1: Concrete with minimal clinker content.
- U2: Concrete with green types of cements and binders.
- U3: Concrete with inorganic, residual products.

This paper focuses mainly on the 3rd option. Nevertheless, the following Figure 1 is included to give an overview of the total concrete developments in the centre.



FA: flyash, MS: microsilica, TASP: dry desulphurization product.

Figure 1 Overview – Concrete developments in the centre for resource saving concrete structures.

New types of cement and binders (U2) can be utilised in U1 as well as in U3.

3. EVALUATION OF INORGANIC, RESIDUAL PRODUCTS

Information about numerous inorganic, residual products regarding suppliers, amounts, particle size distribution, chemical composition etc. have been collected (3).

The materials, which have been judged as useable for concrete production and selected for further development, are shown in Figure 1. The judgement has been based on an evaluation concerning both concrete technology and environmentally aspects.

Inorganic, residual products from the concrete industry (i.e. stone dust, concrete slurry) and products which make up a huge waste problem to society and which are in political focus (i.e. slurry from waste combustion, smoke waste from waste combustion and FA from sugar production) have been given highest priority.

Stone dust is a residual product from the crushing of the aggregate. It is an inert material with a particle size between the size of cement and sand. Stone dust is expected to substitute part of the sand.

Concrete slurry is a residual product from concrete production i.e. washing mixers and other equipment. The concrete slurry is either a dry- or a wet substance, and can be recycled either as a dry powder or with water. In the case of recycling of the dry material, it is necessary to process it to powder. The concrete slurry can have some pozzolanic effect and might therefore be used as a substitute for part of the cement or for other types of pozzolanic materials as flyash.

Slurry from waste combustion is a residual product from water purifying plants. It has the same particle size and shape as flyash. The content of heavy metals in the slurry is expected to be approx. at the level as for flyash. The slurry can have some pozzolanic effect and might therefore be used a substitute for part of the cement or for other types of pozzolanic materials as flyash.

Smoke waste from waste combustion can have some pozzolanic effect. The content of heavy metals is significantly higher than for ordinary flyash. Furthermore, the content of chlorides, fluorides and sulphate can result in negative effects in connection with reinforcement corrosion, retardation, and possible thaumasite reactions. Further processing will be necessary before use in concrete.

The flyash from sugar production is not expected be very different from ordinary flyash.

4. DEVELOPMENT PLANS

Currently, the last information about the described materials is being gathered. Possibly, chemical analyses, leaching tests or laboratory investigations will be performed, and finally, the materials will be tested in concrete at Unicon Beton A/S's and AB Sydsten's ready mix concrete plants.

Initially trials will be performed on 15 concrete types with the 5 inorganic, residual products. These trials include measurement of workability, air content, compressive strength development, E-modules, heat development, homogeneity, water separation, setting time, density and pumpability. Some of the concrete types in the aggressive exposure class will further be tested for chloride penetration and freeze/thaw durability.

The most promising types of green concrete will be chosen for further testing such as shrinkage, creep, fire resistance and out door exposure in different environments.

5. REFERENCES

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