شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومـــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

Structural Department
Faculty of Engineering
El-Mansoura university
EGYPT

HIGH STRENGTH CONCRETE MANUFACTURED FROM SPECIAL AGGREGATES FOR PARTICULAR USES IN CONSTRUCTION

BY

Mohamed G. Ibrahim Mahdy
B.Sc. (Civil Eng.) – M.Sc. (Struct. Eng.)

A THESIS

Submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy

In

Structural Engineering

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Supervision Committee

No.	Name	Position	Signature
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2	Prof. Dr. P. R. S. Speare	Deputy Head of Civil Eng., School of Eng., City University., London (UK).	Curspeare

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Abstract of Research Presented to the Faculty of Engineering, Mansoura University, EGYPT, Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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Special high strength concrete can be used when particular properties are required. Two types of concretes will be considered. First, heavyweight concrete (using magnetite as a coarse and fine aggregate) with density (3.2 – 4 t/m^3) significantly higher than the density of concretes made with normal aggregate. The second type of concrete to be considered is lightweight concrete (using leca as a coarse aggregate), that is concrete with a density (1.9–1.7t/m^3) significantly lower than the density of concretes made with normal aggregates. Comprehensive literature surveys relating to heavyweight concrete, lightweight concrete, high strength concrete and properties of this concrete were carried out. In order to obtain high strength concrete, 77 trial mixes were produced for both heavy and light weight concrete. For heavy weight concrete, 12 mixes were selected to achieve a

slump above 100mm and strength up to 140 MPa at 180 days with W/C 0.24 and 3.5% superplastizer (SP6). For lightweight concrete, 14 mixes were selected to achieve the slump over 100mm and strength up to 71 MPa at 180 days and at W/C 0.34, 0.3, 0.28 for cement content 400, 500, 600 kg/m^3 with 2% superplastizer (SP6). The present program deals with the use silicafume and superplasticier to produce special high strength concrete. To investigate the properties of magnetite high strength concrete, three levels of silicafume (0, 10%, 20%) by weight of cement, two ratios of coarse aggregate content (0.48, 0.65) by volume and two type of fine aggregate (magnetite, sand) were used. On the other hand, three cement content (400, 500, 600) kg/m^3, two levels of silicafume (10, 20%) and two ratios of coarse aggregate content (0.48, 0.65) by volume were used to investigate lightweight high strength concrete. For both type of concretes, information on mechanical properties, stress-strain under static and cyclic load, creep, shrinkage, permeability, surface absorption, sulphate resistance and exposure to high temperature was provided. In addition shielding properties for heavyweight high strength concrete were also provided. All experimental work was conducted with the full co-operation of the technical staff and facilities in City university, London, UK

A statistical method of analysis of experimental results was used to arrive at an optimal solution. Analysis of variance (ANOVA) was used to analyse the results, particularly for mechanical properties.
The results indicated that :-

Heavyweight high strength concrete (HWHSC)

- Silicafume is to be a good mineral admixture, improving all mechanical properties, fatigue life, creep , shrinkage and durability. Silicafume is effective in enhancing concrete residual compressive strength after exposure to high temperature. Silicafume has a significant effect on reduction the thickness required to shielding.
- There is a significant effect of coarse aggregate content on the all mechanical properties, fatigue life, water absorption, oxygen permeability. There is no effect of coarse aggregate content on creep and shrinkage, residual compressive strength after exposure to high temperature.
- Magnetite as a fine aggregate gave a higher compressive strength than sand as fine aggregate. For silicafume concrete, sand as a fine aggregate gave a higher fatigue life than using magnetite as a fine aggregate.

Magnetite as a fine aggregate has a significant effect on residual compressive strength after exposure to high temperature.

- Relationship between compressive strength and splitting tensile strength or flexural strength for HWHSC is not the same as for NWHSC.
- There is no relationship between compressive strength and fatigue life.
- Specimen shape has an effect on the values of modulus of elasticity.
- The mode of failure of specimens tested under static and cyclic loading is the same.
- There is not a clear relationship between the compressive strength and water absorption or oxygen permeability coefficient.
- Compared with normal strength concrete, the water absorption and permeability coefficient of HWHSC are found to be extremely low.
- There is insignificant effect due to sulphate attack on compressive strength at age 180 days.

Lightweight high strength concrete (LWHSC)

- Cement content has a significant effect on all mechanical properties of LWHSC, fatigue life, creep and shrinkage.
- Increasing cement content gave a significant effect on permeability and water absorption
- The loss of compressive strength due to exposure to high temperature is decrease when increase cement content.
- Silicafume content seems to attain high early age strength in 7 days with relatively less increase in strength at 28 day. The economic silicafume content for LWHSC is 10%
- Increasing silicafume content has a significant effect on improving the fatigue life and does not lead to an increase shrinkage and specific creep.
- Increasing silicafume content from 10% to 20% leads to significant decrease in both water absorption and oxygen permeability.
- There is no significant effect of silicafume content on residual compressive strength after exposure to high temperature.
- At 0.48 coarse aggregate ratio, compressive strength, flexural strength and modulus of elasticity were higher than for 0.65 coarse aggregate ratio.
- The most effective coarse aggregate content under cyclic loading is 0.65
- Increasing coarse aggregate content improved values of both shrinkage and specific creep.
- There is no significant effect of coarse aggregate content on water absorption and oxygen permeability.

- The coarse aggregate content has a significant effect on residual compressive strength after exposure to high temperature.
- Steel fibres have a significant effect and lead to an increase in values of all mechanical properties, particularly, splitting tensile strength and flexural strength.
- Steel fibres lead to an increase in shrinkage , specific creep, water absorption and oxygen permeability. There is no effect of steel fibre content or residual compressive strength after exposure to high temperature.
- The equation for the prediction of splitting tensile strength and flexural strength from the compressive strength of LWHSC is closer to the relationship recommended other references. There is no relationship between compressive strength and fatigue life.
- There is insignificant effect due to sulphate attack on compressive strength at age 180 days.

Contents