Experimental Study of Behaviours of Structural Elements in Concrete

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Abstract- *high strength concrete is a safe material that maximizes the advantages of concrete when used as a compressive member.. Therefore, the research is not done for innovation but to get the first gain of experience on the structural behaviour of UHPC.A singly under reinforced section of beam with a concrete of strength 40Mpa, 60Mpa, 80Mpa and 130Mpa with steel grade of Fe-415Mpa is considered. In the past 10 years, important experimental research has been done mostly on the material. However, few experimental test results are available on the flexural capacity and deflection of UHPC beams at the structural level.*

I. INTRODUCTION

it provides significant improvements in strength and workability when compared to reinforced concrete or conventional high- performance concrete. demands to use 100Mpa or Ultra-high concrete. Ultra –high strength concrete is a safe material that maximizes the advantages of concrete when used as a compressive member. UHPC exhibits a tensile strength unheard of in conventional concrete, allowing for the possibility of elimination steel reinforcement in some applications. This program included casting and testing of RC beams of constant steel ratio which were designed to fail in flexure and shear with UHPC and HPC beam with silica fume, steel fibre and without steel fibres, with silica fume respectively. This program included casting and testing of RC beams of constant steel ratio which were designed to fail in flexure and shear with UHPC and HPC beam with silica fume, steel fiber and without steel fibers, with silica fume respectively.

II. LITERATURE REVIEW

Tensile Strength/Flexural strength: The significant improvements in compressive strength are complimented by the fact that UHPC also exhibits tensile strength that has not been demonstrated in conventional concretes. The tensile strength allows the material to support both pre-cracking and post-cracking loads without experiencing the brittle failure that would be common in a conventional concrete. UHPC has demonstrated tensile strengths ranging from 6mpa-50mpa with various curing regimes and standard ASTM testing methods (Graybeal and Hartmann 2003). These tensile strengths were achieved as a result of the interaction of the steel fibres on the microscopic level and their ability to sustain load after the onset of cracking. It is governed by fibres orientation, scatter, and non brittleness. In addition to the improvements in tensile strength, UHPC can also achieve flexural strengths ranging from 35mpa-50mpa (Perry and Zakariasen 2003). This combination of the tensile and flexural strength makes UHPC an extremely ductile material, capable of supporting significant loads beyond cracking and allows designers to create thinner sections, longer spans, and taller structures (Perry and Zakariasen 2003).

III. COMPOSITION OF UHPC

The cement used in the manufacturing of M-40, M-60, M-80 and M-100 is ordinary Portland cement, OPC. The used aggregate for mix was a 10mm; 20mm. For UHPC the aggregate was not used.

Table 2.1 UHPC MIXER

Material	Amount (kg/m3)	% by wt.
Portland Cement	712 (1,200)	28.5
Fine Sand	1020(1,720)	40.8
Silica Fume	231(390)	9.3
Ground Quartz	211(355)	8.4
Super plasticizer	30.7(50.5)	1.2
Accelerator	30(50.5)	1.2
Steel Fibres	156(263)	6.2
Water	109(184)	4.4

IV. RESULTS

Beam H-RCB-1 was without shear reinforcement. It failed at a load of 241Kn. Results showed an increase of 137.7 % in shear capacity over beam CCB-1. The failure was first initiated at 90Kn it showed an increase of 125% over CCB1.The load propagation and crack pattern is shown. The Load-deflection curve is shown in fig.3.1

Test Results and discussion

The propagation of cracks was marked at different loading step. Crack was not observed when the load was increased linearly at the beginning of the test.

Fig.3.1 *Load Propagtion and Crack Pattern of H-RCB1*

Beam HRCB-1 was designed for shear and the first crack occurred at 70Kn. It showed an increase of 57.14% and failed at a load of 240Kn it showed an increment of 137.6% in shear capacity over beam CCB-1. It was failed in shear It shows the beam loaded till complete failure.

Fig.3.2 *Load-Deflection of M-100MPa UHRC1 (shear)*

These results indicate the ability of UHPC to redistribute stresses and undergo multiple cracking before fibre pullout.

Typical Load-Strain Curves of M-100

The load-strain relationship was evaluated based on the strains measured by the strain gauges on the concrete and rebar surfaces. Fig.3.3 to Fig.3.4 shows the load-strain curves of beam. Negative strains represent compressive strains while positive strains represent compressive strains while positive strains represent tensile strains at positions C-1 and C-2.

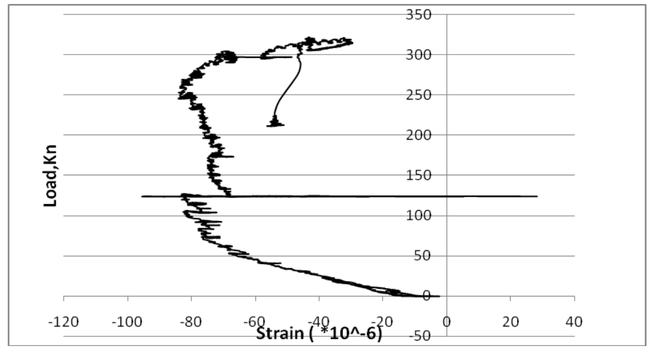

Fig. 3.3*Load-Strain on the top of the concrete Section M-100 at C-1*

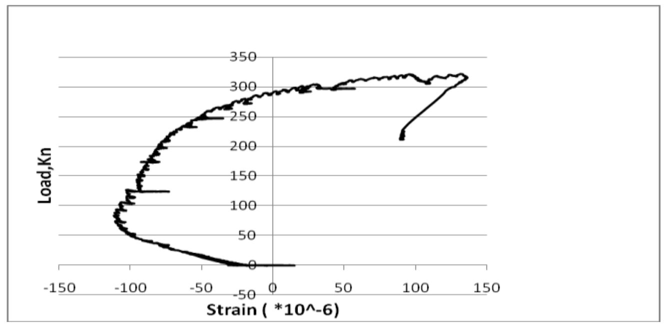

Fig3.4 *Load-Strain on the top of the concrete Section M-100 at C-2*

V. CONCLUSION

Moment-Curvature analysis is an analytical modelling method which is carried out in order to predict the load-deformation characteristics of the reinforced concrete sections. The beam's deflection until the initiation of cracks increased linearly and was proportional to load. After the initial cracking, deflection increased nonlinearly until the maximum load was reached. The initial cracking load for each beam ranges between 40 KN to 150KN. Beam-CRCB-1 had smaller cracking load 40KN. While beam had the largest cracking load 150KN. The percent difference between these two extreme values is 73.33%. Eventually, the fibres bridging the highly stressed crack began to pull out. Thereafter, the failure of the beam was precipitated by the local bound failure between fibres and the UHPC matrix as well as rebar yielding. These test results indicate that fibre pullout resulted in member failure and that failure occurred via failure for all of the members.

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