Experimental Study on Polymer Modified Concrete Beams

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ABSTRACT

In this experiment the study of influence of polymer in reinforced High Performance Concrete (HPC) beams was done. The polymer being used was Styrene Butadiene Rubber (SBR) Latex The specimen being used here is a rectangular beam section of 2100mm span with 200mm wide and 300mm deep. The beam was tested after 28 days of curing and was subjected to a two-point loading under the loading frame. The parameters studied were load deflection curve, post cracking strength, ductility factor and strength gain factor. The Post Cracking Strength for HPC was 0.0958 kN/mm^2 and for MHPC was 0.1063 kN/mm^2.The relative ductility factor 1.38. The strength gain factor was 14.715.

Keyword: *High Performance Concrete (HPC), SBR Latex, Flexural strength, Load deflection.*

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1. INTRODUCTION

Concrete is the most broadly utilized development material in world. It is outstanding that customary cement outlined based on compressive quality does not meet numerous practical necessities, for example, impermeability, protection from ice, warm breaking sufficiently. There are a few demerits of concrete such as the tensile strength of concrete is relatively low when compared to other binding material, the ductility of concrete is less, is contains some soluble salts leads to efflorescence.

The flexural strength can be defined as the stress in a material just before it yields in a flexure test. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three-point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of yield.

The application of these can be widely used in the repair and the rehabilitation of old damaged concrete, for the preparation of steel bridge and ship decks surfaces, for the concrete structure that is more subjected to large doses of de-icing salts, for the cementing ceramic tiles to concrete.

2. LITRETURE REVIEW

[1] conducted experimental study on concrete mix design by packing density method, results obtained by packing density method are compared with IS code method. The co-relation curves were plotted for packing density results alone and also combining the results of packing density and ARE code methods. These curves can be used to decide the water cement ratio and paste content for the specified grade of concrete in case of packing density method thus reducing the material and time involved in trial testing.

[2]Formulated a simplified mix design procedure for HPC by combining BIS and ACI code methods of mix design and available literature on HPC. The performances of the design mixes obtained were very good and the results were reported.

[4]Conducted an experimental study on beams using steel fiber and latex. The latex did improve the cracks widening, crack propagation and made the concrete more tough and ductile.

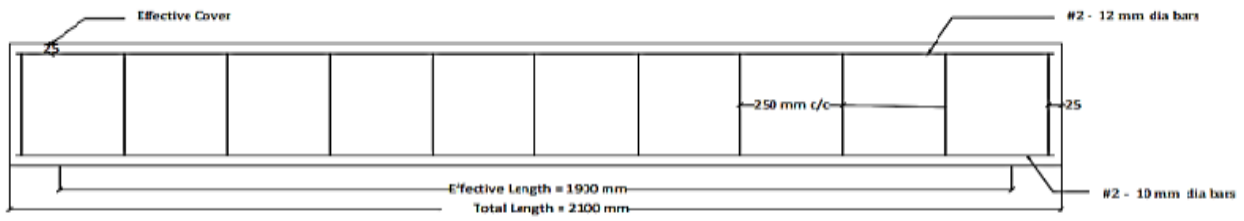
[5]Did the study on behaviour of high performance reinforced concrete modified with carbon nanotubes tubes and SBR latex under flexure. By the addition of polymer there was increase of ductility by 57%. The cracking moment was reduced by 6.5%

3. TEST PROGRAMME

Beam specification: The rectangular beam was casted of size 200X300X2100mm and the reinforcement was provided with 2no's. 16mm diameter tension bars, 2no's. 10mm diameter compression bars and 2-legged stirrups of 8mm diameter with 250mm c-c spacing.

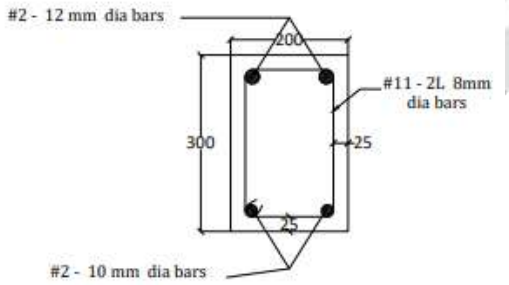
The beam was cured with gunny cloths for 28days

The beam casted was being tested under the loading frame for testing of flexure.



LONGITUDINAL SECTION

Fig No: 1

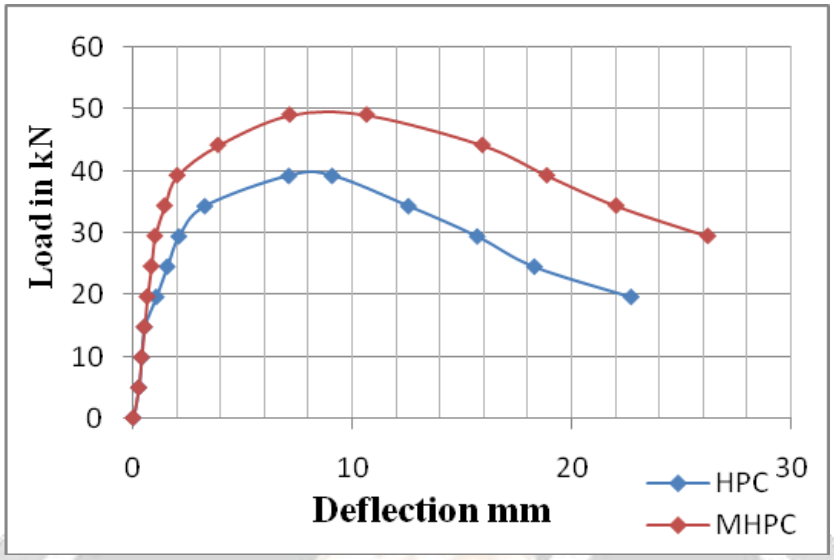


CROSS -SECTIONAL

Fig No: 2

4. TEST RESULTS

4.1 Load deflection curve



Plot: 1

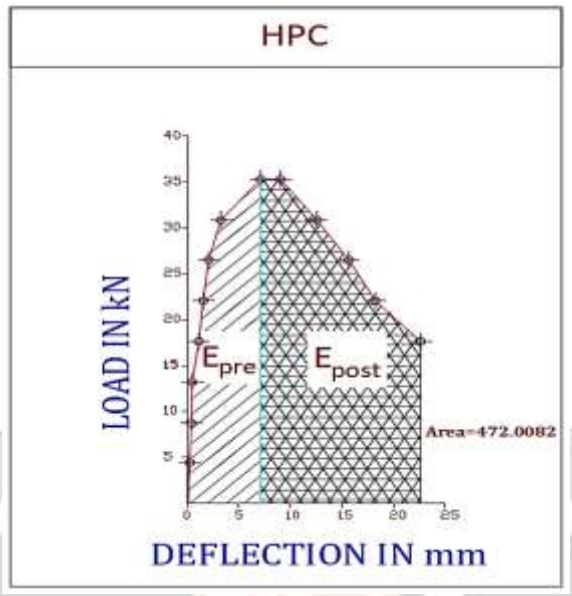
HPC

LOAD (kN)	DEFLECTION (mm)
0	0
4.905	0.25
9.81	0.38
14.715	0.51
19.62	1.05
24.525	1.55
29.43	2.08
34.335	3.26
39.24	7.08
39.24	9.05
34.335	12.52
29.43	15.65
24.525	18.25
19.62	22.65

MHPC

LOAD (kN)	DEFLECTION
0	0
4.905	0.25
9.81	0.38
14.715	0.51
19.62	0.64
24.525	0.83
29.43	0.99
34.335	1.43
39.24	2.01
44.145	3.87
49.05	7.14
49.05	10.65
44.145	15.93
39.24	18.87
34.335	22.03
29.43	26.21

4.2 Post Crack Strength



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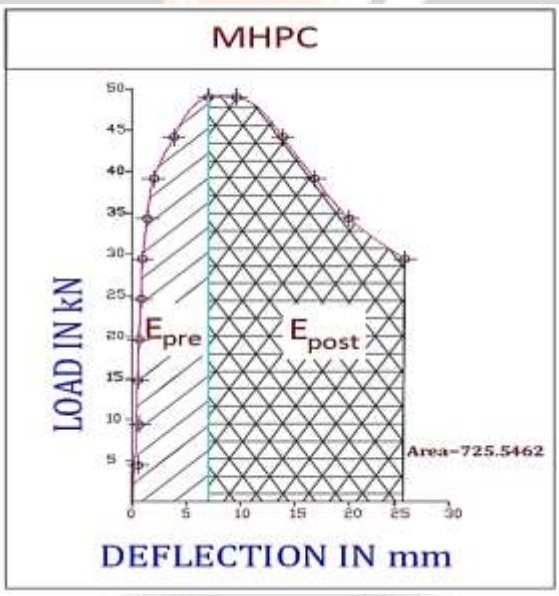


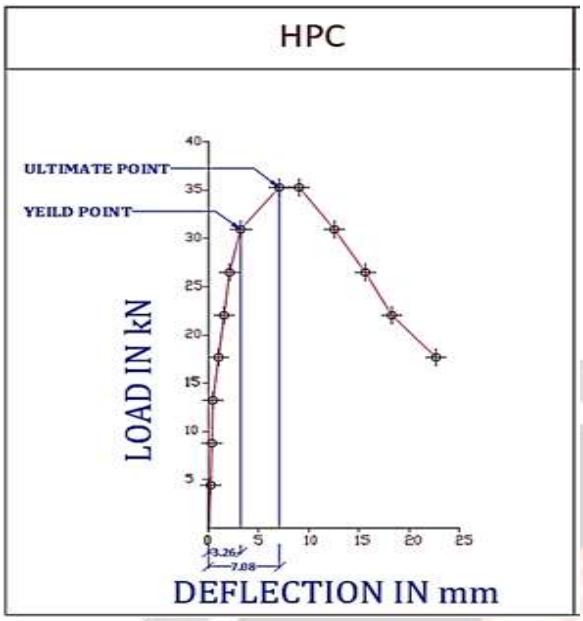
Plot: 3

The post cracking strength was calculated by the following formula:

$$PCS = \frac{E_{post}\ X\ L}{\left(\frac{L}{250} - \delta_{peak}\right) X\ b\ X\ h^2}$$

The Post cracking strength for HPC was about 0.09581 kN/mm^2 and that for MHPC was about 0.10637kN/mm^2. The post cracking strength was increased in case of polymer modified concrete when compared to the conventional concrete. The bonding was increased by the polymer SBR latex in the concrete.

4.3 Ductility factor



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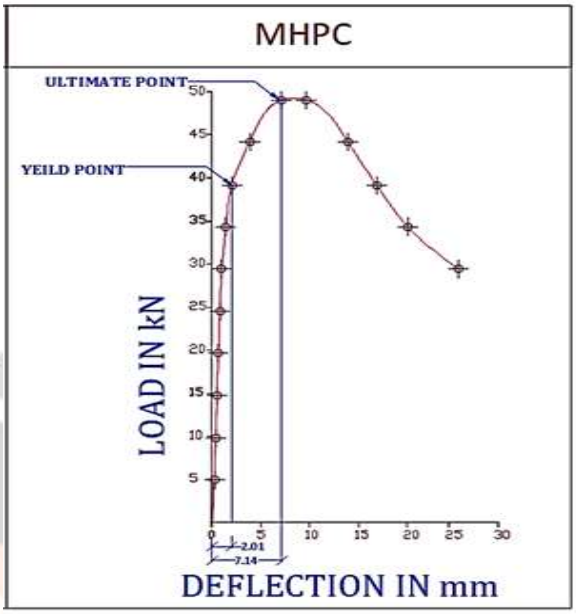


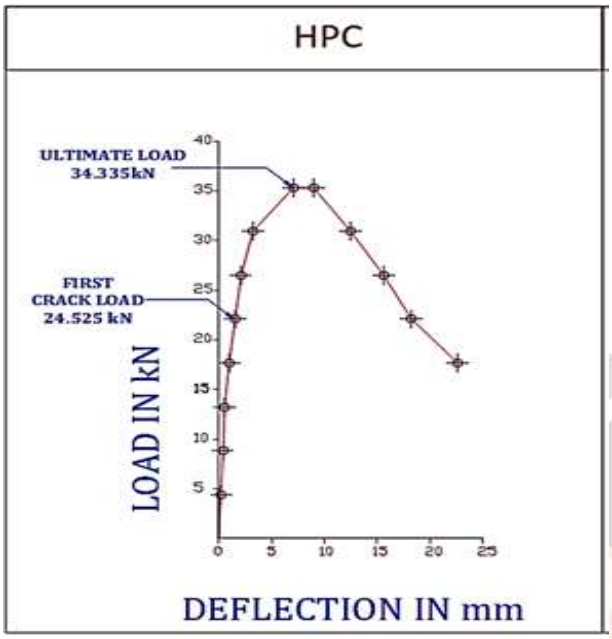
Plot: 5

Table-1

BEAMS ID	DEFLECTION AT ULTIMATE LOAD (δu)IN mm	DEFLECTION AT YIELD LOAD (δy)IN mm	DUCTILITY FACTOR (δu/δy)	
			ABSOLUTE	RELATIVE
HPC	7.08	3.26	2.17	1
MHPC	7.14	2.01	3.55	1.38

The ductility factor is defined as the ratio of ultimate deflection (δ_u) to the deflection at yield (δ_y). The absolute ductility factor for HPC and MHPC was 2.17 and 3.55 respectively. The relative ductility factor was 1.38. This shows that the ductility of the MHPC was increased when compared to HPC.

4.3 Strength gain factor



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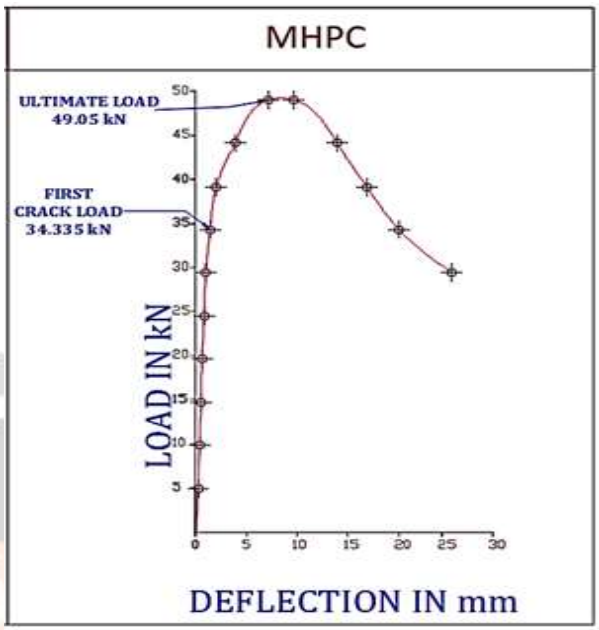

Plot: 3

Table-2

BEAMS ID	FIRST LOAD IN kN	ULTIMATE LOAD IN kN	STRENGTH GAIN FACTOR
HPC	24.525	34.335	1
MHPC	39.24	49.05	14.715

The strength gain is defined as the ratio of ultimate deflection (δ_u) to the deflection at yield (δ_y). The strength for HPC was 34.335kN and for MHPC was 49.05kN. Therefore, the strength gain factor by the addition of polymer was 14.715.

5. CONCLUSION

Based on the experimental results following conclusions are drawn

a) Comparative bending behavior of High Performance Concrete and Polymer modified Concrete indicated the influence of SBR latex polymer in the enhancement of flexural strength.
b) The load taking capacity for MHPC increased at the peak deflection compared to HPC. This is due to energy absorption by polymer matrix.
c) Post crack strength is enhanced to0.10637kN/mm^2 form 0.09581 kN/mm^2.
d) The relative ductility factor for HPC is 1 and MHPC is 1.38.
e) The strength gain factor for MHPC is 14.715.

6. PHOTOS

Fig No: 3

Fig No: 4

Fig No: 5

Fig No: 6

Fig No: 7

Fig No: 8

Fig No: 9

Fig No: 10

7. ACKNOWLEDGEMENT

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