International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 3, April 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Comparison between Reinforced Cement Concrete and Fibre Reinforced Beam using Finite Element Method

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ABSTRACT

Concrete is one of the most widely recognized development material for the most part delivered by utilizing locally accessible ingredients. This paper investigates the study of workability, mechanical properties and finite element method to investigations of reinforced cement concrete (RCC) with fibre reinforced concrete (FRC) and containing admixture of conplast SP430 was used. Fibre reinforced concrete is gaining attentionto improve the performance of concrete. Experiments were conducted to study the effect of various fibres on the strength parameters of reinforced cement concrete with fibre reinforced concrete. Three types of concrete were prepared, out of which, the first type was prepare by adding polypropylene fibre in concrete proportion of (0.25%, and 0.3%), the second type was prepared by inclusion of nylon fibre in concrete proportion of (0.25%, and 0.3%), the third was carried out by adding Basalt fibre in the ratio of (0.5%) in concrete mix. All the three concrete mixes are prepared with plain M30 grade concrete. The fresh properties like slump cone test are carried out to evaluate the workability of three concrete mixes. The hardened properties like compressive strength, tensile strength and flexural behavior are performed to work out the strength parameter using different proportions of various fibres incorporated in concrete. The experimental results are analyzed by using finite element analysis package ANSYS to predict the mechanical property of composite.

KEYWORDS: *reinforced cement concrete (RCC), fibre reinforced concrete (FRC), Basalt fibre*

How to cite this paper: V. Vishali | A. Baskar "Comparison between Reinforced Cement Concrete and Fibre Reinforced Beam using Finite Element Method" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-3, April 2020, pp.530-531, URL: www.ijtsrd.com/papers/ijtsrd30539.pdf

IJTSRD30539

1. INTRODUCTION

Fiber reinforced concrete (FRC) is a composite material consisting of cement, sand, coarse aggregate, water and fibers. In this composite material, short discrete fibers are randomly distributed throughout the concrete mass. The behavioral efficiency of this composite material is far superior to that of plain concrete and many other construction materials of equal cost. Due to this benefit, the use of FRC has steadily increased during the last two decades and its current field of application includes: airport and highway pavements, earthquake-resistant and explosive-resistant structures, mine and tunnel linings, bridge deck overlays, hydraulic structures, rock-slope stabilization, etc.

A significant reduction in crack width and crack spacing is possible, especially at early ages. They possess a high tensile strength and a high elastic modulus these are available at relatively low costs. The high modulus, which is much higher than the one of concrete or cement paste prevents the Fiber from stretching or cross contraction upon load, which hence leads to a good Fiber–matrix bond and smaller crack widths.

2. MATERIALS USED

- Cement
- Fine aggregates
- Coarse aggregates
- Nylon Fibre
- Polypropylene Fibre
- Basalt fibre
- Water
- Super Plasticizer

3. EXPERIMENTAL WORKS

3.1. PRELIMINARY TEST ON MATERIAL

S. No	Observation	Trail-1
1	Weight of empty bottle (W1)	0.036 g
2	Weight of bottle + cement (W2)	0.08 g
3	Weight of bottle + cement + kerosene (W3)	0.14 g
4	Weight of bottle + kerosene (W4)	0.11 g

Table 3.1 Specific Gravity of Cement

3.2. PERCENTAGE VARIATION OF CONSTITUENTS

MIX	SPECIMEN
CC	M30 concrete
NFRC	0.25% by weight of cement
NFRC	0.3% by weight of cement
PPFRC	0.25% by weight of cement
PPFRC	0.3% by weight of cement
BFRC	0.5% by weight of cement

Table 3.2 percentage variation of constituents

4. RESULT DISCUSSSIONS

4.1. Compression Strength Test

S.No	Grade of Concrete	Mix Proportion	Compressive Strength N/mm² For 7 days test			Average compression strength N/mm²
			1	2	3	
1	M30	CC	23.91	24.62	23.73	24.08
2	M30	NFRC	22.45	22.32	22.62	22.46
3	M30	NFRC	22.48	22.12	22.88	22.49
4	M30	PPFRC	23.95	23.50	24.12	23.86
5	M30	PPFRC	24.62	24.95	25.15	24.90
6	M30	BFRC	25.60	26.41	25.32	25.77

Table 4.1 Compression Strength Test for 7days Variations

Figure 4.1 Compression Strength Test

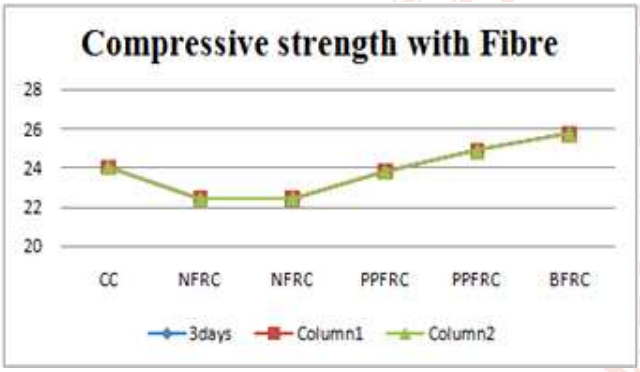

Figure 4.2 Compressive Strength Test Result

4.2. Split Tensile Strength Test

The split tensile strength of cylinder specimen's result. The tested values are taken from average compared values of three specimens. The test setup of split tensile strength test is as shown in Figure 4.3.

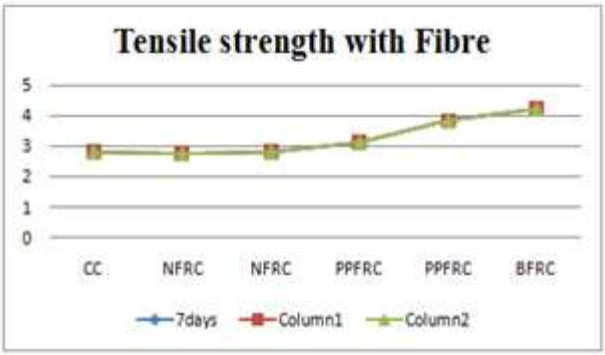

Figure 4.3 Line graph for Split Tensile Strength Test Result

Figure 4.4 Split Tensile Strength Test

5. CONCLUSION

- When comparing the fresh properties of various fibres with conventional concrete BFRC 0.5% gives a better workability.
- The compressive strength of cube reveals that the addition of basalt 0.5% in concrete gives the optimum result at 7 days.
- When comparing the tensile property BFRC 0.5% in concrete at the age of 7 days is increased.

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