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Experimental Study on Young's Modulus of F.R.C. with Bottom Ash

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Abstract: The experiment investigation has been conducted on hybrid fibre reinforced concrete (combine of hooked end polyolefin & steel fiber) get the volume of aggregate fibre 0.6%, 1.1% and 1.3% were readied Workability conditions like blending, compaction & curing conditions. To adding of uniformly dispersed fibre to concrete will give fitness to the structure and improve its dynamic, static properties. The cylinder dimensions are 150mmX300mm.The experiment result shows that the concrete strength of steel fibre with the addition of decrease to PCC. The Young's Modulus of samples increases with the amounts of steel fibers in the concrete mix. The form of concrete in which fibres are added is called as FRC. The addition extra than one or two fibres in the concrete is Called as HFRC. Fibres can be used in tension members in the structures because the structure will be strongest in compression and weakest in tension members. Here Steel fibre & polyolefin fibre are used as Hybrid fibres in HFRC. A trial was directed out to ponder the impacts of steel fiber and polyolefin fibre in various extents in concrete. Compressive strength tests were conducted to know the properties of hardened concrete. The experiment also aimed to study the capacity of BA as a fine aggregate in concreting mix. Bottom ash is a scrap material available in industries like thermal power plants. Fiber expansion supposedly enhanced an expansion in compressive quality and ductility respectively. The fine aggregate is replaced by 15% of bottom ash. The Final Results of this experiment showing the percentage of hybrid fibres it the maximum performance of the concrete. Adding of HF generally energy absorbing an increases value of strength. The Young's modulus of concrete is a very critical factor in the concrete to elastically deform. The whole laboratory experiments were conducted in Malla Reddy Institute of Technology at CT&HM laboratory, Maisammaguda, Hyderabad.

Keywords: Young's Modulus, Fiber Reinforced Concrete, Steel & Polyolefin Fibres, Bottom Ash, Compressive Strength Test etc.

1. INTRODUCTION

Before, endeavors had made to give enhanced in improved property of solid individuals by a method for utilizing traditional fortified steel bars and further more by applying controlling procedures.
Fiber is a little bit of strengthening material having clear definite properties. They can be spherical or level. The fiber is as often as possible depicted by a reasonable parameter called "aspect proportion". The perspective proportion of the fiber is the extent of its length to its width. Delegate aspect proportion extends from 30 to 150.The tensile strength of steel fibre is 275-2758, for polyofin fibre is 551-758.

Naaman et al (1991) This study tests the pullout steel fibres with cement mortar. By 3 different fibre shape (straight, deformed and end hooked), and the addition of additives such as latex, flyash and microsilica. Examined that polyolefin with enhanced mechanical properties permits the creation of superior cement with great pliability and flexural durability. Polyolefin filaments are light and demonstrate a huge distortion limit. Low sum expansion empowers steady and solid post splitting conduct and keeps up new properties of cement with the low weight of fibre.

Sidney Diomond et. Al (1995) In this paper studied that the tests did on the compressive property of different fiber-fortified types of cement at low volume parts of strands up to 0.5%. Contrasted with reference concrete without filaments, fiber expansion supposedly enhanced the pre-peak and addition post-top locale of the heap diversion bend fundamentally. The best flexural execution was acquired at the most elevated volume division of 0.50%. At this volume portion, flexural strength and flexibility of half-breed fiber cement (joining a mix of steel and non-metallic filaments) were tantamount to steel fiber cement. Enhanced fiber accessibility in the HFS (because of the lesser densities of non-metallic fiber), notwithstanding that the limit of non-metallic strands of crossing over littlest smaller scale splits are prescribed as the purposes behind the change in flexural properties.

M.R Nokken, RO Hooton (1998) Hybrid fiber can give support at all the scope of strains. A blend of less and high modulus filaments can capture breaks at minimised scale level & additionally complete scale level. To overcome downside of minor workability caused because of consumption of just most noteworthy level of steel strands. Conceivable favourable position in enhancing solid properties and also diminishing the entire cost of solid creation for the economic need.

2. MATERIALS USED

In this trial study cement, FA, CA, both end steel fiber, polyolefin fiber& super plasticizer bottom ash were used.

2.1 Cement: OPC (Bharathi Cement OPC 53 grade) Test results are shown in Table 1

2.2 Fine Aggregate

Clean & River sand locally available was used. Sand passes through IS 4.75mm sieve [IS: 383:1970]

The reason for utilizing the fine aggregate in the solid blend is to fill voids in the coarse total and to go about as a workability operator in the entire basic solid blend. Totals are the significant elements of cement, as they include 70-75% of the aggregate volume, FA is presented in Table 2

2.3Coarse Aggregate

Coarse total comprises of waterway rock, smashed stone or made total with a specific size equivalent to or more prominent than 4.75mm. It should consent to the prerequisites of IS 383-1970. In this exploration coarse total of greatest size, 12.5mm was utilized. Test results on coarse aggregate are given in Table 3

2.4 Polyolefin Fiber

Good quality of materials supplied from Ranigunj, Hyderabad. The various properties of Polypropylene fiber are given in Table 4

2.5 Both end bend Steel Fiber

Properties of steel fiber are presents in Table 5

2.6 Bottom Ash

Thermal industrial Scrap or waste material bottom ash was collected from Singareni Thermal Power Plant. Properties of bottom ash are shown in Table 6

2.7 Water

Portable drinking water for mixing & curing, having pH 6.6-8 for this experiment tap water is used for both mixing and curing.

2.8 Super Plasticizer

Super plasticiser conplast SP430 is utilized where a most outstanding level of workability and its maintenance are required contrasted with other superplasticizers, where delays in transport or setting are likely or when high encompassing warmth cause brisk droop sticking.

3. MIX DESIGN

A design mix has been adopted as per IS10262:2009 for M25 grade concrete. Mix proportion & material consumption is in Table-

4. Experimental Methodology

For the compressive strength cube having 150mm*150mm*150mm was cast and for modulus of elasticity cylinder having 150mm*300mm were cast. After that hardened concrete was allowed for submersed curing in a water tank in room temperature.

4.1 Compressive Strength Test

It is determined by using the compressive testing machine as specified IS 516-1959. Cubes of 150 mm size were subjected to a uniformly rated compressive load of 140 Kg/cm^2 per minute until failure at age 28 days. Average of three is taken. The compressive strength of concrete is 57Mpa.

STRESS AND STRAIN BEHAVIOUR

For making the total stress-strain curve experimentally for High Strength Fiber Reinforced Concrete of grade M25 using steel and polyolefin fibers and bottom ash compressive strength

RESULTS & DISCUSSION

This section examines the exploratory outcomes which are introduced. Each of the compressive quality test information plotted in tables and bar graphs relates to the Young's modulus view of the compressive quality of concrete cylinders in an arrangement. The anxiety of stress and strain practices of high-quality mixture fiber strengthened cement with and without Bottom ash.

The test results were averaged over all the types of fibers to derive the compressive stress-strain relationship; the evaluation and definition of the stress-strain relationship of concrete are required for this test. In this experiment compression tests was carried out on FRC using steel and polyolefin fibers with the replacement of 15% with bottom ash and the stress-strain relationship is studied

CONCLUSION

From the compression tests carried out it shows that optimum15%of bottom ash, though the strength does not give enough strength compare with Hybrid fibers but it possess acceptable strength. Because of the hybrid fibers added the compressive strength varies with different combinations of fibers, the modulus of steel fiber reinforced concrete is observed to increase the strength of concrete, this is showing that good bonding on steel and polyolefin fiber.

Table- 1 Properties of Cement

Properties	Value
Sp Gravity	3.72
FM	3.45
Zone	III
Moisture Content	5%
Bulk Density	1.62

Table- 2 Properties of FA

Properties	Value
Length (mm)	25
Diameter (mm)	03
Density g/cm^3	0.87 - 0.97
Water absorption	Nil
Tensile strength	KN/sq mm

Table- 3 Properties of CA

Properties	Value
Length (mm)	55
Diameter (mm)	2
Tensile strength MPa	1000 -1050
Water absorption	Nil

Table- 4 Properties of Polyolefin Fiber

Properties	Value
Sp Gravity	2.42
FM	3.35
Moisture Content	10%
Bulk Density (Kg/m^3)	850

Table- 5 Properties of Steel Fiber

Particulars	Value
Cement (Kg) per Cum	280
FA (Kg) per Cum	255
CA (Kg) per Cum	560
Water (Lit) per Cum	155
w/c	0.45%

Table-6 Properties of Bottom Ash

Properties	Value
Sp Gravity	2.69
FM	7.13
Bulk Density($grm/_{cm^3}$)	1.69
Impact Strength (%)	27.33

Table- 7 Mix Proportion

Properties	Value
Fineness (%)	3.19
Sp. Gravity	3.1
Soundness (mm)	3
Consistency (%)	33
Initial setting Time (Minute)	25
Final setting Time(minute)	300

TABLE8: Specimen Detail PCC without bottom ash without bottom ash

Sl no	Name of Specimen	Volume Fraction	Steel Fabre (vf)	Polyolefin Fibre (vf)
1	PC1	0	0	0
2	SC1	0.6	0.6	0
3	SPC1	0.6	0.4	0.2
4	SPC2	0.6	0.3	0.3
5	SC2	1.1	1.1	0
6	SPC3	1.1	0.8	0.3
7	SPC4	1.1	0.7	0.4
8	SC3	1.2	1.2	0
9	SPC5	1.2	1	0.2
10	SPC6	1.2	0.7	0.5

TABLE9: Specimen Detail with bottom ash

Sl no	Name of specimen	Volume Fraction	Steel fibre(vf)	Polyolefin Fibre(vf)
1	PC2	0	0	0
2	BSC1	0.6	0.6	0
3	BSPC1	0.6	0.5	0.1
4	BSPC2	0.6	0.3	0.3
5	BSB2	1.1	1.1	0
6	BSPC3	1.1	0.8	0.3
7	BSPC4	1.1	0.6	0.5
8	BSC3	1.2	1.2	0
9	BSPC5	1.2	1	0.2
10	BSPC6	1.2	0.7	0.5

Fig1: Specimen Placed in CTM

Fig2: Cylinder Specimen Placed in CTM Strain dial gauge

Table- 10 CALCULATING YOUNGSMODULUS

Specimen Name	Stress N/mm^2	Strain	Youngs modulusN/mm^2
PC1	8.45	0.00021	40238
38409	8.45	0.00022	
SPC1	8.45	0.00025	33800
SPC2	9.93	0.00027	36777
SC2	8.49	0.00023	36913
SPC3	8.49	0.00025	33960
SPC4	8.49	0.00026	32653
SC3	8.49	0.00018	47166
SPC5	8.49	0.00021	40428
SPC6	9.93	0.00024	41375
AC2	9.92	0.00025	39680
BSPC1	9.98	0.00027	36962
BSPC2	11.28	0.00028	40285
BSB2	11.31	0.00028	40392
BSPC3	9.92	0.00025	39680
BSPC4	11.32	0.00028	40428
BS3	8.45	0.00022	38409
BSPC5	8.42	0.00021	40095
BSPC6	8.41	0.00022	38227

Stress-Strain Graphs

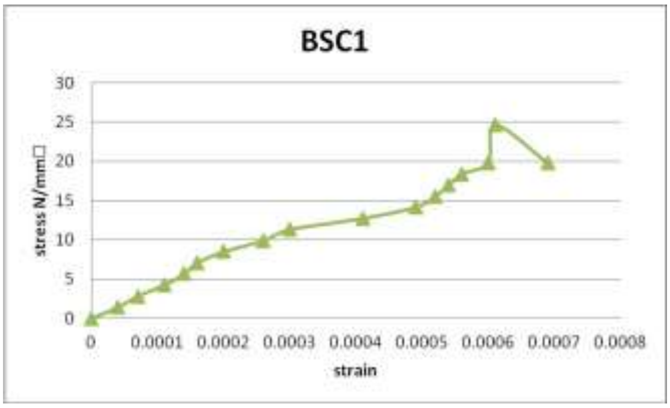

Fig4: 0.6steel, 0%polyplefin

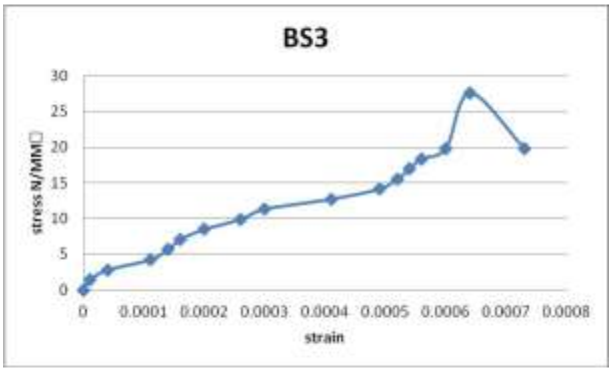

Fig5: 0.8steel, 0.3%polyplefin

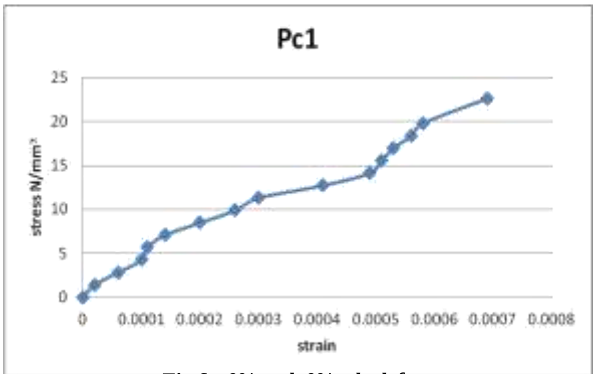

Fig 6: ***0%steel, 0%polyolefn***

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