HPC WITH RESTORATION OF CEMENT BY GGBS AND FIBER AGGREGATE BY GLASS POWDER

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Abstract
With the world extensive decline in the Availability Of construction Sands at the side of The Environmental Pressures To lessen Extraction Of Sand From Rivers, using synthetic Sand As A alternative Is increasing. With The Ban On Sand Mining carried out by exceptional States, And With The growing demand For River Sand For production Works, Many Civil Engineers Have Expressed The need To promote Use Of synthetic Sand in the production enterprise. As consistent with reports, manufactured Sand Is extensively Used all over the global And Technicians Of major projects round the arena Insist on the compulsory Use Of synthetic Sand because of Its regular Gradation And zero Impurity. Concrete mix layout Of M60 Grade was accomplished in step with Indian wellknown Code Concrete dice; Beam And Cylindrical Specimens had been examined For evaluation Of Compressive, break up Tensile & Flexural electricity Respectively. The Concrete well-knownshows amazing strength With one hundred% alternative of natural Sand, So it is able to Be utilized in Concrete As feasible opportunity To natural Sand. A Concrete upload With diverse probabilities of different Fibers Used. The Compressive electricity Of Concrete obtained at the a long time of 7, 28, 56, Days From The consequences it is Concluded That The M-Sand can be Used As A replacement For first-rate aggregate. it is discovered That one hundred% replacement Of satisfactory aggregate by way of M-Sand provide maximum result in strength aspects Than The traditional Concrete. the proper materials vital For The instruction Of Specimens For Experimentations had been completed. the amount Of Specimens And The checks To Be carried out have been Predetermined. The adding percent of zero.1%, 0.three%, 0.5% In Glass, Polypropylene, Recron 3s Fibers. The maximum power Attains the proportion Of 0.5%. The effects Proved That The replacement of one hundred% Of quality combination via M-Sand & Fibres caused higher Compressive strength And higher split Tensile strength.

General

With the arena extensive decline within the availability of production sands along with the environmental pressures to lessen extraction of sand from rivers, the use of synthetic sand as a replacement is growing. With the ban on sand mining carried out through extraordinary states, and with the growing demand for river sand for construction works, many civil engineers have expressed the need to promote use of manufactured sand inside the construction industry. As in line with reviews, manufactured sand is extensively used all over the world and technicians of predominant tasks around the arena insist at the obligatory use of synthetic sand because of its consistent gradation and zero impurity. Concrete mix design of M60 grade became completed in step with Indian general code Concrete cube; beam and cylindrical specimens had been tested for assessment of compressive, split tensile & Flexural power respectively.

The concrete reveals exquisite energy with a hundred% replacement of natural sand, so it may be used in concrete as viable opportunity to natural sand. A Concrete add with numerous chances of various fibers used. The compressive energy of concrete received at the a long time of 7, 28, fifty six, days.

High Strength Concrete

In recent years, the terminology "high strength Concrete" has been delivered into the construction enterprise. the yank Concrete Institute (ACI) defines high electricity concrete as concrete assembly special combos of performance and uniformity necessities that can't constantly be done automatically when the use of traditional constituents and regular blending, putting and curing practices. A observation to the definition states that a high power concrete is one in which positive characteristics are developed for a particular software and environment.

Examples of traits that may be considered crucial for an application are:

Ease of placement

Compaction without segregation Early age strength

Long-term mechanical properties Permeability

Density

Heat of hydration Toughness

Volume stability

Long life in severe environments

Fibers in Concrete

Fibers may be defined as a small piece of reinforcing cloth owning positive dimensional traits. The maximum important parameter describing a fiber is its thing ratio. "issue ratio" is the duration of fibre divided with the aid of an equal diameter of the fibre. The residences of fibre bolstered concrete are very lots affected by the sort of fibre.

b).High Modulus Fibres

This group consists of fibres, which are capable of generating robust composites; they in the main impart strength and stiffness to the composite to various tiers and Resistance under dynamic loadings. Fibres which might be included in this group are metallic, carbon, asbestos, natural fibres and so forth

Methodology And Experimental Programme

Super plasticizer

as a way to enhance the workability of high-overall performance concrete, awesome plasticizer in the form of Sulphonated Napthalene Polymers complies with IS 9103:1999 and ASTM C 494 type F as a high variety water reducing admixture (CONPLAST SP 430) changed into used. This had 40% energetic solids in answer. The particular gravity is 1.22.it's miles a brown liquid instantly dispensable in water. It changed into gathered from excessive tech- chemical compounds, Salem, India.

Fig-1: *Conplast SP- 430.*

Fibres

Glass Fibres

Glass fibres are made from silicon oxide with addition of small amounts of other oxides. Glass fibres are function for his or her high electricity, exact temperature and corrosion resistance, and coffee fee. Alkali resistant E-glass fibres of 12mm length, 0.014mm nominal diameter, unique gravity of one.nine and density of 2650 kg/m3 have been used.

The glass fibers used in concrete suppressed the localization of micro cracks in to macro cracks for this reason tensile electricity boom. It improves durability of concrete through increasing the electricity of concrete. The component ratio of Glass Fibers is 857.1. The range of fibers in step with 1 kg is 212 million. It turned into accrued from COVAI Seenu & agency, Coimbatore

Binani ***Chopped Strands*** *are chopped from continuous* ***"E" - glass fibres****. The chopped strands are free flowing and are designed to resist the rigors of compounding whilst allowing the finished moulding to develop satisfactory mechanical properties.*

Sl. No.	Property	Value
1	Diameter (μm)	12
2	Specific Gravity	2.60
3	Failure strain	3.0%
4	Elasticity (GPa)	80
5	Tensile strength (GPa)	2.5
6	Elongation	2.5-4.8%

Table 1 *Properties of E-Glass Fibre*

Recron 3s fibres

Recron 3s Fibres are Engineered Micro Fibres with a completely unique "Triangular" pass phase, used as a Secondary Reinforcement Concrete. It arrests shrinkage cracks and increases resistance to water penetration, abrasion and impact. It makes concrete homogenous and additionally improves the compressive energy, ductility and flexural strength together with enhancing the potential to take in extra power. Recron 3s Fibres are synthetic in an ISO 9001:2000 facility to be used in concrete as a "Secondary Reinforcement" at a charge of dosage various from 0.1% to zero.4% with the aid of extent (zero.9kgs/Cu.m – 3.60kgs/Cu.m). Fibres follow ASTMC 1116, kind 111 Fibre strengthened Concrete.

Fig-2: Glass fibres

- *Control cracking*
- *Increase flexibility*
- *Reduction in water permeability*
- *Reduction in rebound loss in concrete*
- *Safe and easy to use*

Mix design & Mix proportions

In this study, manage blend A was designed as in keeping with IS 10262:1986 to acquire a goal compressive electricity of 60 Mpa. River sand changed into used to a hundred% replace M-sand using Portland pozzolana cement (%). The various fibres of zero.1%, zero.three% and 0.five% with the aid of volume fraction of concrete had been used. The casted cubes are check for 7, 28, 56 days Compressive power, split tensile strength & Flexural strength.

Various fibres:

- *Glass fibres*
- *Recron 3s fibres*
  - *Polyester - Type: CT2024.*
  - *Polypropylene - Type: CTP2424.*

Table 2 *Mix design*

Trial number	***Unit***	***Cement***	***Fine aggregate***	***Coarse aggregate (20 & 12.5 mm)***	***Water (lt/m³)***	***W/C***
1	*Kg/m³*	*600*	*375*	*1324*	*190*	*0.3*
	Ratio	*1*	*0.62*	*2.20*		

Mix design

A total no. of 10 mixes was cast using different percentages of various fibres by volume of concrete.

The proportion of Cement, M-sand, Coarse Aggregate, and Fibres & Water was kept same for all mixes.

Various parameters used in the research are given below:

- *Concrete mix ratio: 1:0.62:2.20*
- *Water cement Ratio: 0.30*
- *Fibre percentages by volume of concrete:*
  - *Glass fibres - 0.1%, 0.3% & 0.5%.*
  - *Polyester (Recron 3s) – 0.1%, 0.3% & 0.5%.*
  - *Polypropylene – 0.1%, 0.3% & 0.5%.*
- *Super Plasticizer (CONPLAST SP 430) – 1%*
- *Mix with 0% Fibres content was declared as control mix.*

Table 3 *Concrete Mix proportions*

Mix id	***T***	***T1***	***T2***	***T3***	***T25***	***T26***	***T27***	***T28***	***T29***	***T30***
Cement(kg/m³)	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*	*600*
FA(kg/m³)	*375*	*375*	*375*	*375*	*375*	*375*	*375*	*375*	*375*	*375*
CA(kg/m³)	*1324*	*1324*	*1324*	*1324*	*1324*	*1324*	*1324*	*1324*	*1324*	*1324*
Glass fibres-%	*-*	*0.1*	*0.3*	*0.5*	*-*	*-*	*-*	*-*	*-*	*-*
Polyester-%	*-*	*-*	*-*	*-*	*0.1*	*0.3*	*0.5*	*-*	*-*	*-*
Polypropylene-%	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*0.1*	*0.3*	*0.5*
Conplast sp 430-	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Water (lt/m³)	*190*	*190*	*190*	*190*	*190*	*190*	*190*	*190*	*190*	*190*

T – M sand without fibres

T1, T2 & T3 -M-sand with glass fibres 0.1, 0.3 & 0.5% by vol of concrete

T25,T26 & T27-M-sand with Polypropylene fibres 0.1, 0.3 & 0.5% by vol of concrete T28, T29 & T30 -M-sand with Recron 3s fibres 0.1, 0.3 & 0.5% by vol of concrete.

Specimens Details

Table 4 *Number of Specimens Details*

Sl. No.	Cube id	Cubes			Cylinders			Beams
		7	28	56	7	28	56	28 days
1	River sand	3	3	3	3	3	3	-
2	M-Sand	3	3	3	3	3	3	1
3	Gf-0.1%	3	3	3	3	3	3	-
	Gf-0.3%	3	3	3	3	3	3	-
	Gf-0.5%	3	3	3	3	3	3	1
4	Pp-0.1%	3	3	3	3	3	3	-
	Pp-0.3%	3	3	3	3	3	3	-
	Pp-0.5%	3	3	3	3	3	3	1
	Rc-0.1%	3	3	3	3	3	3	-

The specimen of standard cube of (150mm x 150mm x 150mm), cylinder (100mm dia x 200mm high) & beam (1200mm x 150mm x 100mm) were used to determine the compressive strength, tensile strength and flexural strength of concrete. Three specimens were tested for 7, 28 & 56 days with each proportion of various fibres and M-sand replacement. Totally 99 cubes, 99 cylinders and 4 beams were cast. The constituents were weighed and the materials were mixed by machine mixing. The mixes were compacted using vibrating needle.

The water binder ratio (W/B) adopted was 0.30 and weight of super plasticizer was estimated as 1 % of weight of binder .The specimens were demoulded after 24h, cured in water for 7, 28 & 56 days, and then tested for its compressive and flexural strength as per Indian Standards.

The Cube size	*150mmx150mmx150mm.*
The cylinder size	*100mm diameters x 200mm height.*
The beam size	*1200mmx150mmx100mm.*
The reinforcement details	*1 No's 10mm Dia at bottom of beam* *2 No's 8 mm Dia at top of beam.6mm dia for* *rings c/c 100mm*

Results

Compressive Strength Test

Table 5 Compressive Strength Test Results

Sl. No.	Cube ID	Compressive Strength (N/mm^2)		
		7 days	28 days	56 days
1	River Sand	33.68	53.35	60.24
2	M-Sand	39.88	55.33	61.56
3	Gf-0.1%	36.61	48.66	59.63
	Gf -0.3%	36.89	53.33	62.33

	Gf-0.5%	*43.10*	*61.34*	*64.56*
4	*Pp -0.1%*	*34.52*	*51.55*	*60.78*
	Pp-0.3%	*34.18*	*49.44*	*59.89*
	Pp-0.5%	*42.83*	*59.89*	*62.76*
5	*Rc -0.1%*	*33.89*	*50.77*	*61.67*
	Rc-0.3%	*35.79*	*53.62*	*63.12*
	Rc-0.5%	*44.25*	*61.58*	*65.49*

Split Tensile Strength.

Table *Split Tensile Strength Test Results*

Si.no	***Cube ID***	***Split tensile Strength (N/mm^2)***		
		7 days	***28 days***	***56 days***
1	*River Sand*	*2.82*	*3.96*	*4.70*
2	*M-Sand*	*3.20*	*4.34*	*5.86*
3	*Gf-0.1%*	*3.45*	*4.57*	*6.16*
	Gf -0.3%	*3.81*	*4.76*	*6.72*
	Gf-0.5%	*4.12*	*5.12*	*7.19*
4	*Pp -0.1%*	*3.25*	*4.56*	*6.55*
	Pp-0.3%	*3.64*	*4.95*	*6.89*
	Pp-0.5%	*3.82*	*5.25*	*7.43*
5	*Rc -0.1%*	*3.75*	*4.78*	*6.78*
	Rc-0.3%	*3.83*	*5.31*	*7.56*
	Rc-0.5%	*3.89*	*5.60*	*7.78*

Flexural Strength Test-Behavior of Control Specimen

An experimental investigation on the behavior of conventional reinforced concrete beam was carried out. The parameters like load carrying capacity, ductility and flexural strength were assessed. The Experimental Result for the Control Beam RC is tabulated as in Table 3.3.

Table 6 *Control Specimen of RC beam Test Results*

Sl. NO	***Load In KN***	***Central Deflection in (mm)***
1	*0*	*0*
2	*1.5*	*0.34*
3	*3*	*0.59*
4	*4.5*	*1.24*
5	*6*	*1.93*
6	*7.5*	*2.58*
7	***9***	***3.32***
8	*10.5*	*4.01*
9	*12*	*4.70*
10	*13.5*	*5.45*
11	*15*	*6.23*
12	*16.5*	*7.75*
13	*18*	*9.77*
14	*19.5*	*11.28*

15	*21*	*12.88*
16	*22.5*	*15.42*
17	*24*	*17.92*

Conclusion

A complete take a look at were finished on diverse journals and books associated with the high energy concrete with manufactured sand and various fibres. all of the literatures are studied within the field manufacture sand, one of a kind fibers and chemical admixture. From the results it's far concluded that the M-Sand can be used as a substitute for quality combination. it's miles found that a hundred% replacement of great combination via M-Sand give most result in electricity aspects than the traditional concrete. the best substances important for the guidance of specimens for experimentations were accomplished. the quantity of specimens and the tests to be carried out were predetermined.The adding percent of 0.1%, zero.three%, 0.five% in glass, Polypropylene, Recron 3s fibers. The most energy attains the percentage of 0.five%. The results proved that the alternative of a hundred% of exceptional combination by using M-Sand & fibres brought about better compressive strength and higher cut up tensile electricity.

The workability of concrete turned into boom in addition to lower the slump values because the manufactured sand changed into greater water absorption evaluate to the river sand. The boom the workability in concrete adding some percent of admixture like top notch Plasticizer. these additionally the workability growth minimal values. So change chemical admixture used inside the manufactured sand and increase the stoop values.

The compressive power of the grade M60 concretes made with p.c. The effects display that the 7, 28 and fifty six days compressive strengths ranged from 39.88, 53.33, sixty one.56 MPa, respectively. The a hundred% replaced river sand in to synthetic sand to satisfy the requirement of grade M60 concrete.

The 7, 28, and 56 days splitting tensile strengths of the concretes ranged from 3.20, four.34 and 5.86 MPa, respectively. The corresponding flexural strengths for 28 Days energy is 16 MPa. It appears that the one hundred% replaced river sand in to synthetic sand to fulfill the requirement of grade M60 concrete.

it's far viable to design a concrete incorporating up to 0.five% Recron 3s that meets the strength requirement of grade M60 concrete; such concrete will broaden appropriate early age's strength, higher energy at later ages, and in comparison to different fibres and manage concretes of comparable grade made with p.c only. The both compressive & cut up tensile electricity ranged from 7, 28 and 56 days of (forty four.25,61.58 & sixty five forty nine) MPa and (3.89,5.60 & 7.78) Mpa respectively. The flexural electricity from 28 Days evaluate to all the beams 21 MPa.

The high energy concrete the usage of synthetic sand with Recron 3s fibres . The maximum power attains the dice, cylinder and beam is 0.5% of fibres by volume of concrete. The price additionally minimum for evaluate to other fibres. utilization of Recron 3s fibre will reduce the cost of preservation with the aid of lowering the micro cracks and permeability and subsequently the power & sturdiness will growth. it's miles observed that use of Recron3s fibre reduces the segregation.thus the environmental consequences, unlawful extraction of sand and cost of excellent combination can be considerably decreased.

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