EXPERIMENTAL STUDY ON BLENDED CONCRETE WITH STEEL AND GLASS FIBERS

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ABSTRACT:-Among the Various types of filaments used in the medication of Fiber Reinforced Concrete (FRC), glass filaments come under the order of non metallic and inorganic type. By making use of Alkali Resistant glass filaments, a veritably useful FRC compound can be made. This possesses enhanced parcels like further tensile strength, energy immersion and erosion resistance. Experimenters each over the world are working on GFRC mixes and glass fiber corroborated mortars. Limited quantum of work has been done on structural operations of GFRC.

In the first stage of work, Glass filaments at lower volume probabilities were aimlessly mixed with concrete. Samples were cast, cured and tested for Compressive strength, Tensile strength and Flexural strength. The disquisition showed enhanced strength and superior concrete compound is evolved.

In durability, experimental disquisition was carried out to study the strength parcels of GFRC, with advanced volume probabilities of glass filaments (ranging from0.5 to1.5) aimlessly mixed with concrete. Advanced values of Compressive, Tensile and Flexural strength were achieved and superior concrete compound evolved. Hence it was concluded that structural operations can be tried with Glass Fiber Reinforced Concrete.

The presence of glass fiber in concrete ranging from0.5 –1.5 helps in conducting the parcels like crack resistance, impact resistance, rigidityetc., though its donation towards strength increase is borderline. Still in SFRC, sword filaments contribute further towards increase in strength particularly in pressure and flexure. Hence mixed fiber conception with glass and sword filaments was developed in the coming stage.

I INTRODUCTION

Reinforced concrete can be used to produce frames, columns, foundation, shafts etc. Underpinning material used should have excellent cling characteristic, high tensile strength and good thermal comity. Underpinning requires that there shall be smooth transmission of cargo from the concrete to the interface between concrete and underpinning material and also on to underpinning material. Therefore the concrete and the material corroborated shall have the same strain.

The steel bars are corroborated into the concrete. The bars have a rough, corrugated face therefore allowing better relating with steel rebars the concrete gets redundant tensile strength. The contraction strength, bending also show pronounced enhancement thermal expansion specific of steel rebars and concrete shall match. The rebar shall have cross sectional are equal to 1 for crossbeams and shafts, this can be 6 in case of columns. The concrete has alkaline nature, this forms a passivating film around the bars thereby guarding it from erosion. This passivating film won't form in neutral or acidic condition. Carbonation of concrete takes place along with chloride immersion performing in failure of steel rebar.

Glass Fiber: These show high alkaline resistive and acid resistive property. Polypropylene is a polymer of polyolefin. Polypropylene fiber in the form of fibrillated film filaments show excellent relating with matrix as the matrix can fluently blend into this fibrils therefore giving good impact resistance. The nylon and polypropylene have veritably high tensile strength561.0 –867.0 N/ mm2. They could be used where high energy immersion is needed because their high extension (15-25) absorbs further energy. The low modulus of this fiber reduces the buttressing property. They're considerably used in pile shell,non-load bearing erosion evidence member, sheathing panels floatation unit, guniting crack asset. It's a veritably good steel underpinning cover in the aspect of transportation and handling purpose in case of precast factors because using plastic fiber reduces the size (thinner section are formed) and increases the crack resistance thereby saving material, transportation and construction cost.

OBJECTIVE AND SCOPE OF THE PRESENT RESEARCH WORK:-

The ideal of the present work is to probe experimentally colorful parcels of Mixed Fiber Reinforced Concrete

(MFRC) for structural operations. To develop MFRC that can overcome the draw backs like essential fineness, multiple cracking under crushing loads and not so well defined flexural geste particularly when used with arbitrary exposure. Another debit with SFRC is the agglomerating effect particularly when the fiber chance is further than1.0 with aspect rates of further than 40 that were observed in the literature review, an approach is made by using mixed filaments of steel and glass (MFRC) to colorful proportions are studied in colorful total fiber probabilities along with certain chance of microsilica, an optimum Mixed Fiber Reinforced Concrete is proposed.

In the present exploration study it's planned to make use of glass fiber for structural concrete. The study includes the preface of glass fiber into concrete at colorful probabilities, combining glass fiber with steel fiber to enhance certain parcels like elastic parcels, continuity parcels, flexuralparcelsetc. It's hoped that mixed filaments with steel and glass would be accepted for timber of structural factors.

MATERIALS USED

- **Cement:-**Ordinary Portland cement of 53 Grade from Ultra Tech conforming to I.S: 12269 is used.
- **Fine Aggregate:-**River sand locally available is used as fine aggregate conforming to I.S: 2386 and I.S: 383.
- **Coarse Aggregate:-**Machine crushed well graded angular granite aggregate of nominal size from local source is used.
- **Water**:-Potable water locally available is used for mixing and curing the concrete.
- **Glass Fiber and Steel Fiber** :-Fibers of alkali resistant glass with an aspect ratio of 857:1 and steel fiber with an aspect ratio of 55 conforming to ASTM C 1666M and ASTM A 820M .
- **Microsilica**:-The microsilica used in these experimental examinations is densifiedmicrosilica 920 D supplied by M/ S ElkemIndiaPvt. Ltd. Mumbai. The typical bulk viscosity is ranged between 500 Kg/ m3 – 700 Kg/ m3, conforming to standard ASTM C 1240.
- **Super Plasticizer** :-Conplast SP 430 grounded on SulphonatedNapthalene Polymers fluently dispersible in water from M/ S Fosrock (India)Ltd. is used wherever needed to maintain plasticity.
- **Concrete Mix Details:-**The details of the M25 Concrete mix used are given in table 3.7 is arrived at as per I.S: 10262-2009.

Table 1 Physical Properties of OPC 53 Grade

S.No.	Property	TestResults
1	NormalConsistency	30%
2	SpecificGravity	2.90
3	InitialSettingTime	30min
4	FinalSettingTime	160min
5	FinenessofCement	2800cm^2/gm

Table 2 Properties of Fine Aggregate

S.No.	Property	TestResults
1	SpecificGravity	2.40
2	BulkDensityKgs/m^3	1640

Table 3 Properties of Coarse Aggregate

S.No.	Property	TestResults
1	SpecificGravity	2.60
2	BulkDensityKgs/m^3	1700

Table4MaterialsRequiredfor1CubicMeterofConcrete

Grade	Cement(kg)	Fineaggregate(kg)	Coarseaggregate(kg)	Water cementratio
M25	425	682	1277.76	0.5

Table 5 Properties of Fibers (Glass and Steel)

Fiber	AR-Glass	Steel
Type	Cem-FILARC14 306 HD	Steel wire
Density kg/m3	2600	7850
Elastic modulus GPA	73	210
Tensile strength MPA	1700	250
Dia.	14 micron	1mm
length	12	55
No.of Fiber	212 million /kg	Mono filament

DISCUSSION OF RESULTS

Workability of MFRC :-The workability was affected marginally after the replacement of Glass Fiber with Steel Fiber by 0, 25, 50, 100 percentages from total fiber content for each percentage of 0.5, 0.75 and 1.0 and 1.5 by volume. A compaction factor of nearly 0.9 was achieved by using water cement ratio of 0.5 with all percentages.

Compressive Strength of MFRC:-The Compressive Strength of MFRC specimens with no micro silica is found to be maximum in total fiber percentage of 1.5, when compared to specimens with other total fiber percentages of 0.5, 0.75 and 1.0. It is observed in the MFRC specimens that with increase in glass fiber percentage in a total fiberpercent, the compressive strength is decreasing and it is found to be 59.15 N/mm2 at 1.5 percent total fiber with 100 glass fiber when compared to 66.85 N/mm2 in specimens with 100 percent steel fibers in the same total fiberpercent of 1.5. There is an increase of 29.37 percent compressive strength in specimens at 1.5 total fiberpercent with 100 percent glass fiber over the base reference specimens with no fibers. The same trend is observed in the MFRC specimens with 5 percent and 15 percent micro silica added as partial replacement by weight of cement.

Split Tensile Strength of MFRC:-The split tensile strength of MFRC specimens is found to be maximum in total fiber percentage of 1.5 when compared to specimens with other total fiber percentages of 0.5, 0.75 and 1.0. It is observed in the MFRC specimens that the mixed percentage of fibers of 25 percent glass and 75 percent steel in a total fiberpercent showed higher split tensile strength when compared to various other mixed fiber proportions of glass and steel fiber in a total fiberpercent and the same is true in all the other total fiber percentages. The same trend is observed in the MFRC specimens with 5 percent and 15 percentmicrosilica added as partial replacement by weight of cement.

Flexural Strength of MFRC:-The flexural strength at first crack and ultimate failure of MFRC specimens is found to be maximum in total fiber percentage of 1.5 when compared to specimens with other total fiber percentages of 0.5, 0.75 and 1.0. It is observed in the MFRC specimens that the mixed percentage of fibers of 25 percent glass and 75 percent steel in a total fiberpercent showed higher flexural strength when compared to various other mixed fiber proportions of glassfiber and steel fiber in a total fiberpercent and the same is true in all the other total fiberpercentages. The same trend is observed in the MFRC specimens with 5 percent and 15 percentmicrosilica added as partial replacement by weight of cement.

CONCLUSIONS

- There is a maximum increase of 46.21% in the compressive strength of mixed fiber reinforced concrete at 28 days at 1.5% of total fiber content with 100% steel fiber over reference plain concrete. With 5% microsilica in the same mix, the increase is 46.93% over the reference concrete. With 15% microsilica, there is a further increase to 51.36%.
- The split tensile strength of MFRC with mixed fibers of 25% glass fiber and 75% steel fiber in 1.5% total fiber content is higher and is 55.06% compared to reference plain concrete. With 5% microsilica in the same mix, the increase is 66.29% over the base reference concrete. With 15% microsilica, there is a further increase to 90.73%. Mixed fiber combination results in substantial increase in the split tensile strength. Optimum percentage of microsilica used as replacement to cement contributes to further increase.
- The flexural strength of MFRC standard prisms with mixed fibers of 25% glass fiber and 75% steel fiber in 1.5% total fiber content is higher and is 77.75% compared to reference plain concrete. With 5% microsilica in the same mix, the increase is 117.49% over the base reference concrete. With 15% microsilica, there is a further increase to 133.91%. Mixed fiber combination results in substantial increase in the flexural strength. Optimum percentage of microsilica used as replacement to cement contributes to further increase.

- The ultimate flexural strength at 1.5% total fibers and 15% microsilica in specimens with 100%steel fiber and in specimens with 100% glass fiber is found to have an increase of 47.39% and 28.46% over the first crack strength of base reference specimens.
- By judiciously combining Cem-FIL anticrack HD alkali resistant glass fiber with steel fiber, optimum FRC possessing required strength and other properties can be achieved.

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