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PARTIAL REPLACEMENT OF RIVER SAND BY WASTE FOUNDRY SAND WITH ADDITION OF FIBERS

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Abstract: Construction industry is one of industry which is growing day by day more. The use of concrete in construction industry is more and prime because of property and durability of concrete it is used in most of regions. Concrete is mainly made of three type of material which are cement, sand and aggregate. In those materials, sand is one of the most important material because of its property and strength parameter. But sand (well graded river sand) is a limited source or it is more difficult to get well graded river sand n now a days. So to overcome or replace this element, most researches are done and lots are in processor under research. So this is also a research to overcome or replace sand with another similar material and also addition of fibers in concrete with mono and hybrid way to recover strength due to addition of waste foundry sand as a partial replacement of river sand. Foundry industry is also a growing industry and because of that waste in foundry is also increased. That foundry waste is nothing but the waste foundry sand. Generally sand which is used in foundry is reused again and again until it will burn up to 70% and after that this waste foundry sand is used for landfill purpose. But there is percentage of waste is more than demand. So it is need also to dispose this waste. So this waste can be useful for partial replacement of river sand. Also fibers are most convenient mode by which strength of concrete can be increase and also reduction of shrinkage and creep in concrete. In this research paper GLASS and POLYPROPELENE fibers are used in concrete. Like a roots of tree adheres soil same the fibers are acting in concrete. Different types of fibers give different types of results in increasing of strength of concrete. In this research paper 1.5% of fibers are added with respect to volume of concrete.

Index Terms **–Fiber Reinforced Concrete, Waste Foundry Sand (WFS).**

1. Introduction –

The foundry waste is generally used for land filling purpose. So this sand having no use in current scenario. That waste foundry sand is used to partial replacement of natural river sand with same percentage in concrete is given in this research. And strength losses due to addition of waste foundry sand will be recovered with addition of fibers with mono and hybrid way in concrete. Fibers used for this research are GLASS and POLYPROPELENE. In this experiment river sand is partially replaced with waste foundry sand with some percentage of river sand and then losses of concrete strength and workability is covered with addition of both fibers with mono and hybrid way. The future scope of this research is very vast and useful because in this research there are two problems are cover, one is disposal management of waste foundry sand and reduction of river sand n preparing concrete by replacing waste foundry sand. And another one is by adding fibers in partial sand mixed concrete, it can reduce shrinkage and creep of concrete.

The main aim of this research is to find optimum percentage of waste foundry sand shall be use in concrete for replacement of sand. And another aim is to recover losses occurred in concrete with addition of waste foundry sand are covered with adding fibers in mixture.

2. Materials -

2.1. Waste Foundry Sand –

Waste foundry sand used for this research is from class III industries in Gokul-Shirgaon MIDC (Maharashtra) area. This foundry sand contains both ferrous and non-ferrous metal castings. As class of Waste Foundry Sand is given below in table-

Table .1 Foundry Sand Industry Classes

No.	Industry Class	Raw Material Used (Input)
01.	Class I	Coal Sand – 96 % potential
02.	Class II	Waste Sand from Class I
03.	Class III	Waste Sand from Cass II
04.	Landfill	Waste Sand From Class III 0% Coal.

As shown in table 1 , Waste Foundry Sand from Class III industries having 0% potential and 0% coal. This Foundry Waste sand is used for land filling. This type of Foundry sand has low particle size as it creates air pollution if it gets spread in air. This sand is dark grey in color. Waste Foundry Sand has Specific Gravity – 2.42.

2.2. Fiber –

For this research two types of fibers are used, one is GLASS Fiber and another is POLYPROPYLENE fiber.

Table 2 Physical Properties of Fibers

No.	Fiber Name	L=Length mm	D=Diameter mm	L/D ratio
01	Glass	6	0.2	30
02	Polypropylene	6	0.2	30

Glass Fibers – Fibers used in this research work is 6mm in length and having aspect ratio is 30 shown in table 2.
Polypropylene Fibers – Fibers used in this research work is also 6mm in length and having aspect ratio is 30 shown in table 2.

2.3. Cement –

In this research work, “Birla Super PPC Cement” is used.

2.4. Course Aggregate –

In this research work, locally available course aggregate is used. (Well graded Course Aggregate. Retained on 4.75 mm sieve)

2.5. Fine Aggregate –

In this research work, locally available fine aggregate is used (Grading Zone – II, specific gravity – 2.42)

2.6. Water –

In this research work, potable water is used for experimentation.

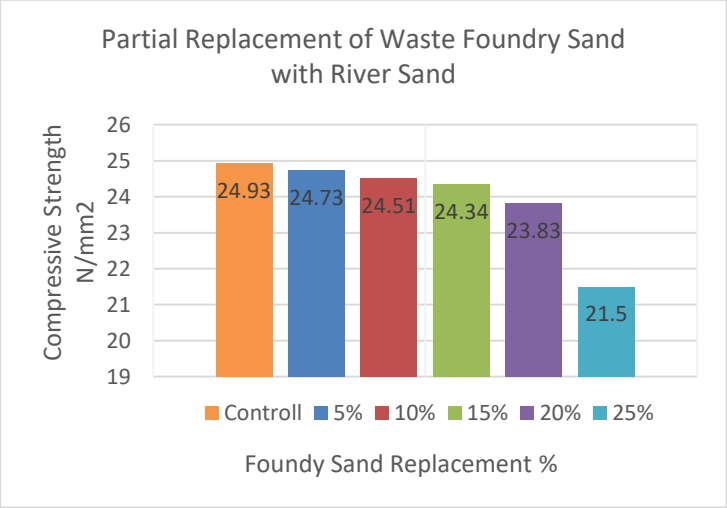
3. Results

3.1. Partially Replacement of Foundry Waste Sand in Concrete with River Sand –

Following table shows result of Waste Foundry Sand partially replaced with River Sand in concrete.

Table-3 Compressive Strengths of Waste Foundry Sand replacement

Sr. no.	% WFS ↓ Specimens →	Compressive Strength N/mm2					
		Control	5 %	10 %	15 %	20 %	25 %
1	C1	24.75	24.20	24.45	24.37	24.60	21.80
2	C2	25.14	24.90	24.27	24.54	22.41	20.60
3	C3	24.90	25.10	24.83	24.12	24.49	22.10
4	Average	24.93	24.73	24.51	24.34	23.83	21.50



For this research work Mix Proportion used is 1:1.53:2.84. Water Cement Ratio used is 0.5 .In this work Waste Foundry Sand percentage replacement are with volume of river sand in concrete. In this study, maximum compressive strength is obtained at 15% replacement of fine aggregate by waste foundry sand. [3] but also workability is decreases with the increase of foundry sand content because of very fine particles. [4]. As the result in table 3, Optimum Percentage replacement of Waste Foundry Sand is 20 % without gaining strength below grade of concrete. (As observed from table strength of 25 % replacement is getting strength 21.50 N/mm^2 which is still greater than M 20 grade – 20 N/mm^2 but considering factor of safety and influence of different materials , different methods of mixing , 20 % replacement is taken as optimum percentageto use in practical situations)

Second stage of this research work is to add fibers in mono and in hybrid way in partially replaced river Waste Foundry Sand in concrete.

3.2. Fiber Reinforced partially replaced river sand with Waste Foundry Sand in Concrete –

Glass Fiber is added in concrete with 1.5 % by volume of concrete. Glass fiber reinforcement gets slow down after addition of 1 % up to 2 % and then after its starts decreasing slowly. Also Polypropylene fiber is added in 1.5 % by volume of concrete in concrete.And also Glass and Polypropylene fibers are added in combined with percentage of 0.75% each by volume of concrete in concrete. The result is as shown in below Table 4. As % of glass fibers increases workability starts to decrease.

Table-4 Compressive Strength of Concrete with addition of Fibers.

Sr. no.	Specimen	Control	Compressive Strength N/mm2		
			Glass (G)-1.5%	Polypropylene (PPF)-1.5%	G+PPF (0.75+0.75)%
1	C1	24.60	24.30	25.50	24.64
2	C2	22.41	24.60	25.61	24.41
3	C3	24.49	23.97	25.29	23.85
4	Average	23.83	24.29	25.47	24.30
5	% Increased	-	+ 1.93 %	+ 6.88 %	+ 1.972

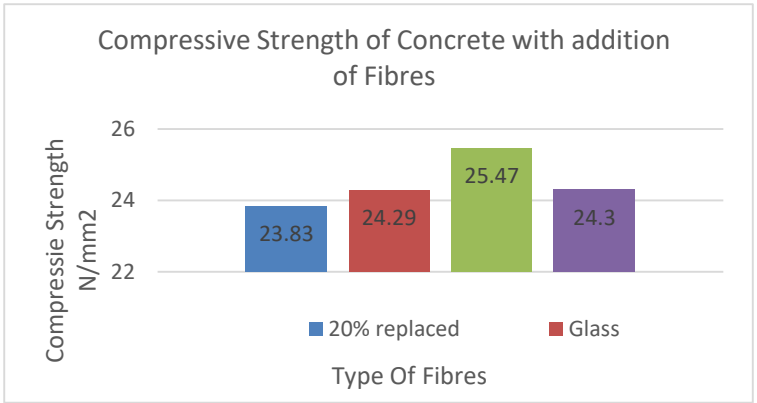


Table 5 Flexural Strength of Concrete with addition of Fibers

Sr. no.	Specimen	Control	Flexural Strength N/mm2		
			Glass (G)-1.5%	Polypropylene (PPF)-1.5%	G+PPF (0.75+0.75)%
1	B1	3.264	3.467	3.616	3.436
2	B2	3.278	3.489	3.656	3.504
3	B3	3.238	3.427	3.687	3.470
4	Average	3.260	3.461	3.619	3.470
5	% Increased	-	+ 6.16 %	+ 11.01 %	+ 6.44 %

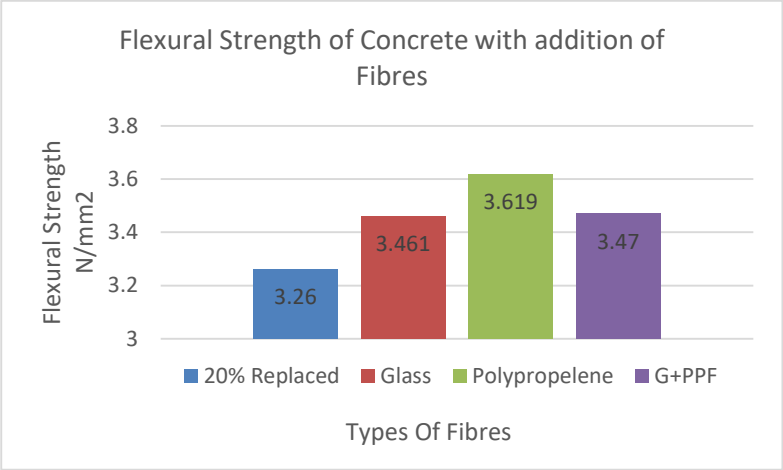
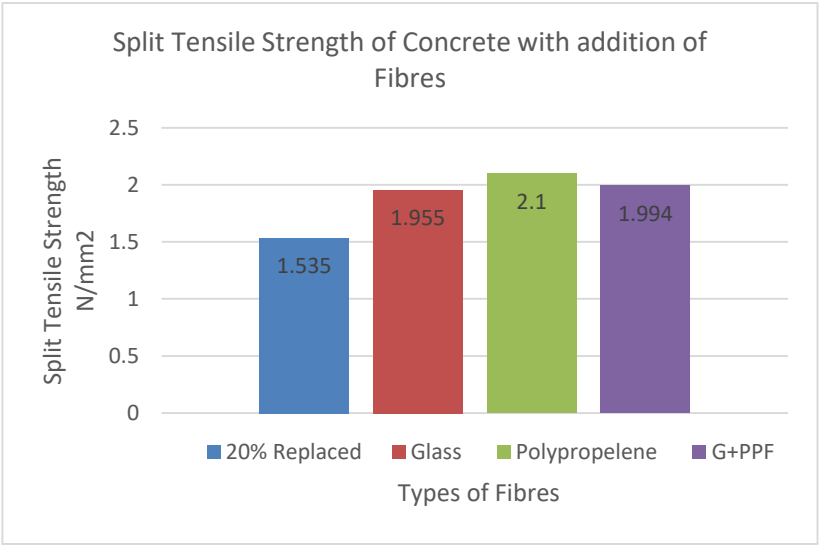


Table 6 Split Tensile Strength of Concrete with addition of Fibers.

Sr. no.	Specimen	Control	Split Tensile Strength N/mm2		
			Glass (G)-1.5%	Polypropylene (PPF)-1.5%	G+PPF (0.75+0.75)%
1	CL1	1.559	2.049	2.033	1.795
2	CL2	1.529	1.889	2.178	2.149
3	CL3	1.519	1.929	2.089	2.039
4	Average	1.535	1.955	2.100	1.994
5	% Increased	-	+ 27.36 %	+ 36.80 %	+ 29.90 %



4. Conclusion –

1. In this research, optimum percentage of waste foundry sand replacement is 20% of volume of fine aggregate in concrete. Although addition of waste foundry sand decreases the compressive strength of concrete but 20 % replacement of foundry sand will get strength of 23.83 KN/mm2 which is greater than M20 Strength. As the percentage of waste foundry sand increases strength decreases.

2. Compressive Strength of Concrete with addition of Glass Fiber (1.5 %) will increases by 1.93 % , with addition of PPF (1.5 %) increased by 6.88 % and by addition of Glass and PPF (0.75 + 0.75 %) in hybrid manner increases by 1.972 %

3. Flexural Strength of Concrete with addition of Glass Fiber (1.5 %) will increases by 6.16 % , with addition of PPF (1.5 %) increased by 11.01 % and by addition of Glass and PPF (0.75 + 0.75 %) in hybrid manner increases by 6.44 %

4. Split Tensile Strength of Concrete with addition of Glass Fiber (1.5 %) will increases by 27.36 % , with addition of PPF (1.5 %) increased by 36.80 % and by addition of Glass and PPF (0.75 + 0.75 %) in hybrid manner increases by 29.90 %

(Note – This values are according to control block's strength. Control Block – Replacement of Waste Foundry sand with river sand with 20 % by volume of river sand.)

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