Experimental Study on Slurry Infiltrated Fibrous Concrete With Sand Replaced By Msand

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Abstract **- Slurry-infiltrated fibrous concrete (SIFCON) can be considered as a special type of fibre concrete with high fibre content. It is different from normal fibre reinforced concrete (FRC) in two aspects, viz., the fibre content and method of production. The matrix usually consists of cement slurry or flowing mortar. This slurry-based matrix must consist of fine particles to infiltrate the fibre network. SIFCON has excellent potential for application in areas where high ductility and resistance to impact are needed. - The natural river sand was the cheapest resource of sand. However the increasing demand for sand in construction industry has led to an ecological imbalance. Moreover the sand available in river bed is very coarse and contains very high percentage of silt and clay. One of the best replacements for this is the manufactured sand or Msand. Therefore replacing the natural sand with Msand in Slurry infiltrated fibrous concrete which is a new addition to the high performance concrete will help in maintaining the ecological balance. The main objective of this project is to determine the effect of Msand on compressive strength, split tensile strength behaviour on slurry infiltrated fibrous concrete. Experiments were conducted on the replaced SIFCON with various fibre contents (4%, 6%, 8%, 9%). The test result reveals that the replacement of natural sand improves the strength as well as the durability nature of SIFCON. This study recommends the replacement of natural sand with Msand in the production of high strength slurry infiltrated fibrous concrete.**

Key words: SIFCON, Msand, and Strength.

1. INTRODUCTION

Slurry-infiltrated fibrous concrete (SIFCON) is a high-strength material first invented by Lankard. It has excellent mechanical properties with greater energy-absorption characteristics. SIFCON is considered as a special fibre-reinforced concrete. Generally, fibre-reinforced concrete contains 1–3% of fibres by volume, but SIFCON contains 6–20% of fibres. And the other major difference is that the composition of the matrix. In SIFCON, the matrix is made-up of flowing mortar slurry as compared to aggregate concrete in normal fibre-reinforced concrete. The casting is also different. In many cases, SIFCON is fabricated using a bed of pre-placed fibres with mortar slurry. Though SIFCON is a new material, it has found applications in areas of pavements repairs, safe vaults, repair of bridge structures, and defence structures because of its excellent energy-absorption capacity. It is already founded by the authors that SIFCON slab exhibits excellent behaviour in flexure when compared to Fibre reinforced concrete (FRC), reinforced cement concrete (RCC) and plain cement concrete (PCC) slabs.. The four main design factors that should be noted in a SIFCON product are slurry strength, fiber volume, fiber alignment, and type. The fiber volume depends on fibre type and vibration effort needed for proper compaction of cubes. Sudarsana Rao and Ramana tested the SIFCON slab under flexure and compared the results with FRC and PCC slabs then concluded that SIFCON slabs exhibit higher performance in flexure when compared against FRC and PCC slabs. Sudarsana Rao et al. investigated the SIFCON two way slabs under impact loading and concluded that SIFCON slabs with 12% fibre volume exhibits excellent performance in energy-absorption characteristics.
The natural river sand is the cheapest source of sand. But the excessive mining of the river bed has led to ecological imbalance in the society. Hence the best replacement for this in the industry is the Msand or Manufactured sand. It is also cost efficient as it contains nil impurities and waste materials.

This paper presents the experimental results that show the strength behaviour of SIFCON produced with sand replaced by Msand.

2. EXPERIMENTAL INVESTIGATIONS

An experiment was conducted to produce a high strength concrete with nil natural sand content by replacing it with Msand. It comprises of casting of cubes of size 100 X 100 X 100 mm for compressive strength and casting of cylinder of size 100mm diameter and 200mm height for split tensile strength. The materials used, mix proportions are described in the following sections.

2.1 Materials used

Cement

Ordinary Portland cement of 53 grades conforming to IS: 12269 was used. The specific gravity of cement was found to be 3.15 by proper experimentation.

Msand

Manufactured sand passing through 4.75 mm sieve was used. The specific gravity was found as 2.79.

Fibre

Hooked end steel fibres having a diameter of 1.00 mm and length of 30 mm with aspect ratio of 30 was used. Random orientation of fibres was carried out.

Water

Fresh water available in the local sources was used for the mixing and curing of SIFCON.

Super plasticizer

To accelerate the workability of SIFCON, CONPLAST- 250, a high range water reducing super plasticizer has been used.

2.2 Mix proportions

A fibre content of 4% was adopted initially and a Water cement ratio of 0.5 was used. Slurry consisted of cement and Msand mixed in the proportion of 1:1 by weight is prepared. Compaction is done by table vibrator to ensure complete penetration of slurry into the fibre pack. 24 hours after casting, the cubes were taken out from the mould and cured in water for 28 days. The fibre content was changed as 6%, 8%, and 9% respectively. A super plasticizer of 6ml was added to improve the flowability of the slurry.

2.3 Test program

2.3.1 Compressive strength test

The compressive strength of concrete is the most common measure of strength in designing buildings and other structures. The 100mm cubes were tested for compressive strength on a computerised compressive testing machine with capacity 3000KN.

2.3.2 Split tensile strength

The split tensile strength test was conducted on a computerised compressive testing machine of capacity 3000KN, the test specimens were cylinders, placed between two platens.

3. RESULTS AND DISCUSSION

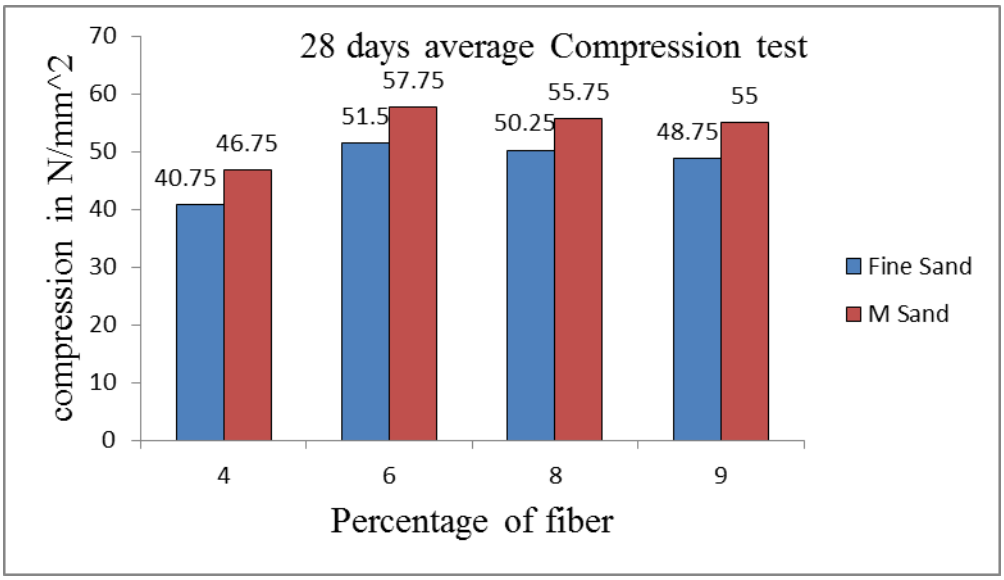
3.1 Compressive strength

The compressive strength results are presented in table 1. It can be clearly seen from the table, the strength is increased from the 4% to 8% replacement of fibres and there is a very small decrease for 9%. And Figure 1, clearly shows that the compressive strength shows a proper improvement when the natural sand gets replaced by Msand in SIFCON.

Table 1 Compressive strength of Msand replacement in SIFCON

S No	% OF FIBRE	FINE SAND		M SAND	
		LOAD (kn)	f_{ck} (N/NM^2)	LOAD (kn)	f_{ck} (N/NM^2)
1	4	407.5	40.75	467.5	46.75
2	6	515	51.5	577.5	57.75
3	8	502.5	50.25	557.5	55.75
4	9	487.5	48.75	550	55

Figure 1 Graph showing the compressive strength comparison



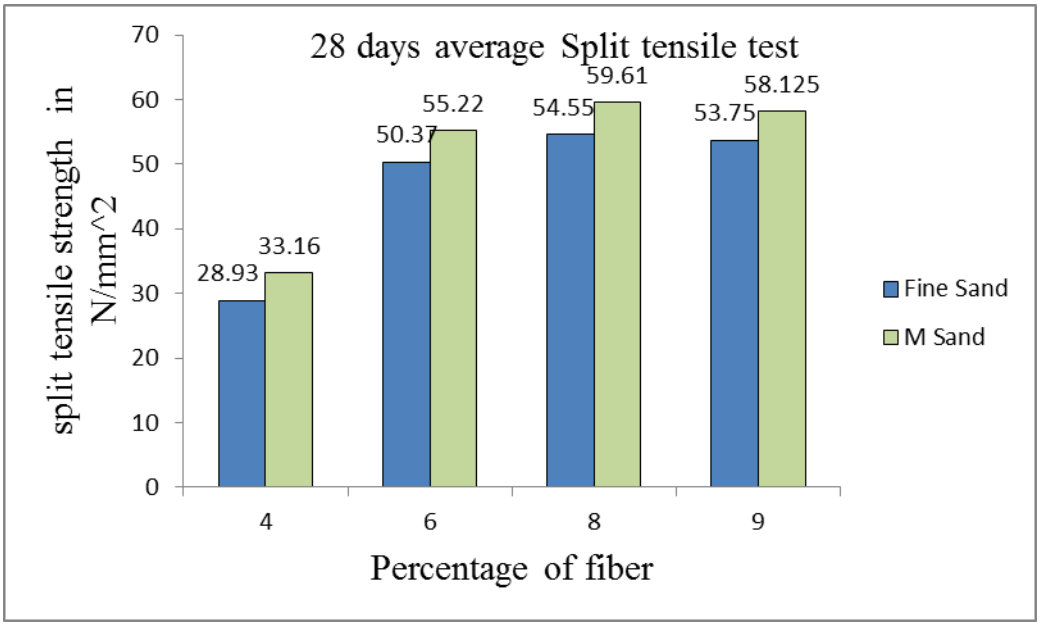
3.2 Tensile strength

Table 2 portrays the variations of split tensile strength. The strength gain is almost similar when compared to that in the compressive strength. It can be seen from the table that the strength increased gradually when the sand gets replaced for all percentages of fibre.

Table 2 Split tensile strength of Msand replacement in SIFCON

S No	% OF FIBRE	FINE SAND		M SAND	
		LOAD (kn)	f_{cp} (N/NM^2)	LOAD (kn)	f_{cp} (N/NM^2)
1	4	289.3	9.21	331.6	10.56
2	6	503.7	16.04	552.2	17.58
3	8	545.5	17.36	596.1	18.98
4	9	537.5	17.11	581.25	18.51

Figure 2 Graph showing the tensile strength comparision



From the figure 2 it is clearly shown that there is a constant increase in the tensile strength of the Msand cylinders when compared to the normal ones.

4. CONCLUSION

Based on the results of this study, the following conclusions are drawn:

1. It is observed that utilisation of Msand in SIFCON is well accepted because of its strength properties.
2. There is a steady increase in the strength of the cubes and cylinders when river sand gets replaced by Msand.
3. Thus Msand can be a better replacement to river sand in Slurry infiltrated fibrous concrete.

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