STABILITY OF MANUFACTURE SAND AS FINE AGGREGATE WITH FIBRE REINFORCED CONCRETE

MOHAMMED JAMEEL KHAN
Student, Dept of Civil (Structural) Engineering, Shri Shirdi Sai Institute of Science and Engineering, India
mjrk7860@gmail.com

P. NAVEEN KUMAR
Assistant professor Dept of Civil (Structural) Engineering, Shri Shirdi Sai Institute of Science and Engineering, India

ABSTRACT

The experimental study of fibre reinforced concrete with manufacturing sand (M-Sand) in addition of crimped steel fibres. Normally a huge quantity of concrete is required for the construction but we know that concrete is weak in tension and strong in compression and the fine aggregate that normally used for concrete is natural river sand but our aim is to replace the natural sand by artificial sand (manufactured sand) and to increase the compressive and tensile strength of the concrete by addition of steel fibre .To over-come the difficulties due to excessive sand mining, M-Sand is used as fine aggregate. M-Sand is uniformly in size, produced from gravel crushers. The main objective of this research is to investigate the effect of steel fibres on concrete manufactured by M-sand as fine aggregate and develop a high-performance concrete. It is proposed to determine and compare compressive strength, split tensile strength of the concrete and flexural strength of concrete grade M30 having different percentage of steel fibre (0%, 1%, 1.5% & 2%). And different percentage of manufacture Sand (0%, 20%, 40%, 60%,80%,100%) The chemical admixtures is used to increase the workability of concrete. The investigation is carried out by conducting compressive strength test, split tensile test and flexural strength of concrete

Keywords: *Steel fibre, M-sand, compression test, split tensile test and flexural strength*

1.0 INTRODUCTION

Concrete typically uses natural sand as an aggregate and more sand in rivers is used for construction, contributing to the loss of natural resources, to resolve such a condition we intended to use fine m sand to make the stone cursed at the appropriate level to attain its uniformity, due to the uniformity, to hit the highest level. The creation of the micro cracks is prevented by applying steel fibre tensile strength due to the distribution of these micro cracks that ultimately lead to a broken concrete fracture. It was accepted that adding thin, tightly divided and evenly spaced fibres to cement would serve as a cracking agent and greatly increase its strength in compression and tensile properties. Fiber reinforced concrete (FRC) is a fibrous material concrete which improves structural integrity. Thus, fibre reinforced concrete may be described as a composite cement concrete or mortar and discreet and uniformly distributed fibre.

Steel fiber

Steel fibres are usually added in low dose concrete (less than 1% on a regular basis) and are apparently decreasing plastic shrinkage successfully. Steel fibre doesn't generally change cement free shrinkage entirely, but does improve protection against dividing and reducing break width in relatively high measurements the steel fibre is commonly used in the most part of the building site and various types of steel fibres vary on the market. The steel fibres straight were used in this paper. It strengthens certain qualities and properties of the concrete.

Manufacturing Sand (M-Sand)

A very significant part of concrete is the thin aggregate. Generated fluvial sand is the most widely used fine aggregate. Owing to the comprehensive use of horn in numerous building systems, global use of natural sand is high. The demand for natural sand in developing countries is particularly strong due to the rapid development of infrastructure. In the word 'real sand' the substance historically obtained from geologically recent sand deposits is defined. The sand processed is a substitute of 50% for natural sand and was extracted from the basaltic block. The laboratory work carried out on the M-sand limits it to the centre of Zone II.

Objectives of the Research

- To investigate the properties of M-sand
- To study the effect of manufactured sand on concrete properties.
- To provide background information on manufactured sand, cements, aggregates and mix design processes.
- To assess existing concrete produced using manufactured sand.
- To draw conclusions and give recommendations based on the research findings and indicate areas for further study.

2.0 LITERATURE REVIEW

GOKULNATH.et al .(2018). In this paper we research the power obtained by adding fluvial sand and replacing the fluvial sand with M sand in self-compact concrete with steel fibres. The following inference is taken from the inquiry. By applying stainless steel fibres to the crushing power of fresh concrete, cracks are resistant and robust. Substitution of river sand and sand by m gives a good strength and can be used for river sand as an alternative source.

M.Adams joe et al.(2013) It is assumed in this article that M-Sand is an alternative to fine aggregates. Five percent substitution of fine aggregate by M-Sand has been found to provide the best toughness and strength as well. The findings reveal that the substitution of 50% of the fine aggregation with M-Sand contributed to higher density, higher break power, higher bending power. This will greatly decrease environmental risks, unlawful sand removal and fine marginal costs.

Shafeeq Ahmad .et al (2017). The contrast of standard and FRC-MS fibres (with 1% steel fibres and 50% natural sand replacement) was made and the test results showed that the incorporation of fibres of crimped steel or natural sand substituted by natural sand has a higher value on all aspect of the sample in contrast to the usual mix of concrete of M30 grade material.

Dinesh barad.et al. (2017). The following are discussed in this article. The M-sand is the perfect alternative to fine sand, compliant with all basic specifications of IS CODES and even M-sand, which has no impurities

3.0 METHODS AND MATERIALS

The technical structures compose primarily of materials known as building materials or constructions. Prior to the final material selection for specific application, the working conditions of structures which are subject to a variety of materials and the different properties of materials such as solidity, shape, permeability, water pressure, temperature tolerance, physical and chemical properties must be carefully researched. A specific and appropriate material should be selected according to the necessary properties to increase the consistency and the quantity of a building structure. The lightweight, reinforced concrete is primarily made up of cement mixtures, light-weight aggregates, natural aggregates, air conditioning agents and admixtures. For the project implementation, the following content is selected:

- Cement
- Cinder Aggregates
- Silica fume
- Fly ash

Properties of Material

The durability of the sand forming aggregate of fibre reinforced cement used for the project requires a blend of cement, fine aggregates and the processing of sands (M-SAND).

Cement

For the current exploratory test, ordinary Portland cement of 53 grades was used. The application of high-fire cements is critical for manufacturing high-level concrete. Name and cement grade are the most important for making a strong concrete product. The cement form has affected the moisture content. In order to complete the study, process the current draught still needs to ensure the similarity of the chemical and mineral mixtures with cement that reported IS 12269-1987.

Fine aggregates:

The natural sand was extracted from the local source. The sand washed in by the river was clean of all the silt, mud and other waste. The inventory of natural fine total (sands) complied with zone II IS: 383(1970), according to the seven analyses performed. In the course of the decades the sand extract from the Rocks is visible on banks of the river under varying environmental conditions.

Manufacturing sand (M-Sand)

Rapid building and declining natural sand supplies appeal to the replacement commodity known as sand manufacturing (M-sand). The accessibility and transport of M-sand is produced from the hard granite rocks. Only in M Sand washed water is Moisture available. Higher strength of concrete compares with the fluvial sand used for concreting and the atmosphere is healthy. The sand processed is a substitute of 50% for natural sand and was extracted from the basaltic block. The laboratory work carried out on the M-sand limits it to the centre of Zone II.

Figure: Manufacturing sand (M-SAND)

STEEL FIBRES

In the current plant, steel fibres (cramped) 50 mm in length and 1 mm in width at an aspect ratio of 50. A constant fibre rate i.e. 1 percent is added to the experimental study. They are fairly distributed by mixing and shaping in the mortar. The characteristics of steel fibres have been verified with development and satisfy all characteristics such as bending capacity, strength and the minimum tensile force with regard to ASTM-A820:90. Increased ductility properties of concrete are supported with steel fibres. Strong 40 aspect fibres are used. Aspect is the L / D ratio.

MIX DESIGN OF CONCRETE

The concrete mix design is called the method for choosing appropriate concrete materials and deciding their relative quantities in order to manufacture the required concrete, strength, toughness and working ability as cheaply as possible. In two states, namely plastic, and hardening, the proportioning of the component in cement is controlled by the required output of concrete. It cannot properly place and compact if plastic concrete is not workable. Therefore, the property of workability becomes essential.

Mix Proportion Designations

In terms of parts or percentages of asphalt, fine and coarse aggregates, the typical method is for expressing component proportions in a concrete mix. The For example, a concrete proportion mix 1:2:4 is a mixture of cement, fine and ground aggregates 1:2:4, where one segment of cement, two sections of the fine aggregate, and four pieces of the rough aggregate is used in the blend. Whether by volume or weight, the proportions. The water-cement ratio is characteristic of mass

4.0 RESULTS AND DISCUSSION

The Investigation programme involves casting, curing and testing of a total 84 specimen, it includes casting and testing of 48 nos cubes, 18 nos cylinders, 18 no sprisms . All the test were carried for 7, 28 and 90 days of curing except the cube specimen subjected to higher temperatures. Among the 48 cubes casted, 18 cubes were subjected for carrying the compressive test for 7,28 and 90 days after curing, 9 cubes for normal M30 grade concrete and 9 cubes for the Steel fiber reinforced concrete (FRC-MS*). Cubes were of the dimension 150mm x 150 mm x 150 mm casted in the steel cubical moulds. Testing being carried out in the compression testing machine. *Steel (crimped ,1% constant) fiber reinforced concrete with 50% natural sand replaced with M-sand.

The nominal mixtures of defined cement (by volume) ratios differ greatly in strength and can lead to under- or over-rich mixtures. Therefore, several parameters included the limited compressive power. These blends are considered regular blends. The mixes in a variety of stages, M10, M15, M20, M25, M30, M35 and M40, have been allocated for IS 457-2000. The letter M corresponds in this classification to the mixture and the number to the stated intensity in N / mm 2 of the 28-day cube. The M10, M15, M20 and M25 classification combination refers to the mixed ratios (1:3:7, 1:2:4, 1:1.5:3) and 1:1:1:2, respectively. respectively.

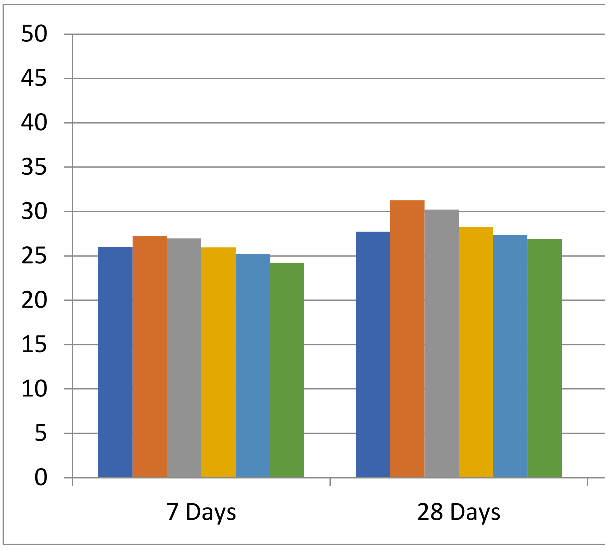
COMPRESSIVE STRENGTH TEST

It is one of the most significant characteristics of concrete and impacts many other descriptive aspects of the harded concrete. At a given period, normally 28 days, the mean compression force required specifies the water-célement ratio of the mix. The compactness is the other element that influences the strength of concrete in a given period and is cured at a specified temperature. The intensity of totally compressed concrete is, according to Abraham 's theorem, inversely proportional to the proportion of water.

Table 4.1: Compressive Strength Test Results

S NO	MIX DESIGNATION	COMPRESSIVE STRENGTH IN N/mm2		
		7 Days	28 Days	90 Days
1	M- SAND 0%+ FRC 1%	25.98	27.71	42.07
2	M- SAND 10%+FRC 1%	27.26	31.25	46.28
3	M- SAND 25%+FRC 1%	26.98	30.22	45.26
4	M –SAND 50%+FRC 1%	25.96	28.26	43.40

5	M- SAND 75%+ FRC 1%	25.23	27.32	41.32
6	M- SAND 100%+FRC1%	24.23	26.89	40.80



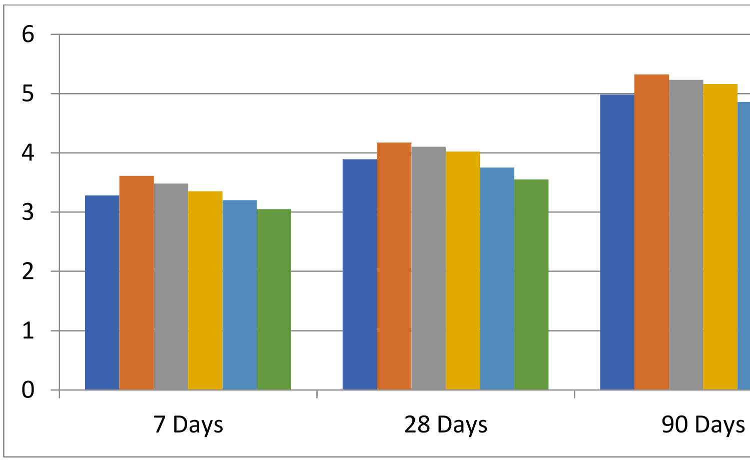
Graph: 4.1 Difference in the Compressive Strength of Normal Concrete Vs FRC-MS

SPLIT TENSILE STRENGTH TEST

Because of its low tense intensity and fragmentary nature, concrete is typically not anticipated to withstand immediate stress. However, tensile strength determination is needed to assess the load the concrete pieces will break. The fracture is a tensile defect.

Table 4.2: Split Tensile Strength Test Results

S NO	MIX DESIGNATION	SPLIT TENSILE STRENGTH IN N/mm2		
		7 Days	28 Days	90 Days
1	M- SAND 0%+ FRC 1%	3.28	3.89	4.98
2	M- SAND 10%+FRC 1%	3.61	4.17	5.32
3	M- SAND 25%+FRC 1%	3.48	4.10	5.23
4	M –SAND 50%+FRC 1%	3.35	4.02	5.16
5	M- SAND 75%+ FRC 1%	3.20	3.75	4.86
6	M- SAND 100%+FRC1%	3.05	3.55	4.66



Graph: 4.2 Difference in the Split Tensile Strength of Normal Concrete Vs FRC-MS

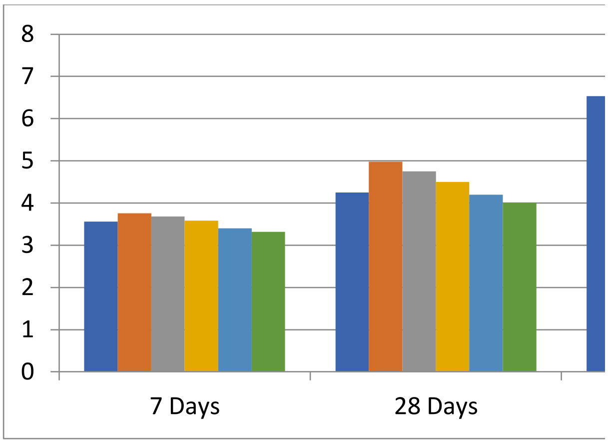
FLEXURAL STRENGTH TEST

Prepare and fill the concrete in the correct mould form with proper compaction in the appropriate proportions by filling the specimen in 10x10x50 cm prism after 24 hours in the correct mould After defined time of preparation, remove the excess sample from the water and clean off top. Leave the sample in the atmosphere 24 hours prior to the test.

Table: 4.3 Flexural Strength Test Results

S NO	MIX DESIGNATION	FLEXURAL STRENGTH IN N/mm2		
		7 Days	28 Days	90 Days
1	M- SAND 0%+	3.56	4.25	6.53

	FRC 1%			
2	M- SAND 10%+FRC 1%	3.76	4.98	6.95
3	M- SAND 25%+FRC 1%	3.68	4.75	6.73
4	M –SAND 50%+FRC 1%	3.58	4.50	6.62
5	M- SAND 75%+ FRC 1%	3.40	4.20	5.96
6	M- SAND 100%+FRC1%	3.32	4.01	5.78



Graph: 4.3 Difference in the Flexure Strength of Normal Concrete Vs FRC-MS

CONCLUSION:

The comparison was between normal and FRC-MS (with 1% steel fibers and 50% replacement of natural sand to that of Manufacturing sand) and the test results proved that the inducing of the fibers of crimped steel and natural sand replaced by M-Sand has a greater value on all the aspect of the study made compared to the normal M30 grade design mix concrete. The compressive test results show a 14.2% increase in strength for 28 days curing by the FRC-MS concrete compared to the normal concrete. The split tensile test conducted has a 23.7 % increment of strength for 28 days curing by the FRC-MS. This increment specifies due to SF addition, helps the concrete to resist tensile load since the concrete is weak in tension. Same case in the flexural part of the concrete that the involvement of Steel Fibre has an impact of gaining additional strength of about 18 % after 28 days of curing.

The flexural test conducted on the prism specimen also shows good resistance to load carrying capacity and there is an increment in shear of FRC-MS with that of normal concrete. Due to the presence of the fibers in the specimen the breaking pattern is of wedge shape in the cantilever portion of FRC-MS, whereas the specimen breaks exactly at the cantilever portion with less resistance to load shown by the normal concrete.

The Test conducted on higher temperature for both the concrete specimens shows that there is marginal effect of higher temperature on the FRC-MS concrete compared with that of the normal concrete which has rapid reduction the strength due to varying temperature. Thus, the overall results implicate that the usage of FRC-MS with replacement of natural sand by M-sand (50%) have a significant growth in strength and durability compared to that of the normal concrete.

REFERENCES

1. *Mr. V. GOKULNATH, DR.B. RAMESH, V.RAJESH (2018), Influence Of M-Sand &Addition Of Steel Fibers In Self Compacting Concrete, International Journal of Pure and Applied Mathematics, Volume 119, No. 17, ISSN: 1314-3395.*
2. *M.Adams Joe, A.Maria Rajesh, P.Brightson, M.Prem Anand (2013), American Journal of Engineering*

Research (AJER) e-ISSN : 2320-0847 p-ISSN : 2320-0936 Volume-02, Issue-12

3. *SHAFEEQ AHAMED, BRIJBHUSHAN S, MANEETH P.D (2017), International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 07 , July -2017,p-ISSN: 2395-0072*
4. *Dinesh Barad, Maneeth P D, Brijbhushan S, Dr.Shreenivasreddy Shahapur (2017), Effect of Steel Fiber on M30 Grade Concrete with Varying Percentage of GGBS to the Cement and Replacement of Fine Aggregate by 60% M Sand , International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321 9653; IC Value: 45.98; SJ Impact Factor:6.887 ,Volume 5 Issue VIII, August 2017.*
5. *Vishal Gadgihalli , MeenaY.R , Sindu , Raghavendra Prasad Havanje Dinakar (2017),analysis of properties of concrete using steel fibers as fiber reinforcement admixture, International journal of research-Granthaalayah, Gadgihalli et. al., Vol.5 (Iss.4: RASM), April, 2017, ISSN- 2350-0530(O), ISSN- 2394-3629(P)*
6. *Saravanya.R, Vinitha.M (2018), experimental studyon mechanical properties of steel fiber reinforced concrete using m-sand and metakaolin, issn (print): 2393-8374, (ONLINE): 2394-0697, VOLUME-5, ISSUE-5, 2018*