MANUFACTURED SAND WITH FIBER REINFORCED CONCRETE

M. Devi Pravallika[1], B. Fayaz[2]
[1]M.Tech Student, PVKK Institute of Technology
[2]Assistant Professor, Department of Civil Engineering, PVKKIT

ABSTRACT
This experimental work aims to determine the mechanical strength properties of basalt fiber-reinforced concrete when natural river sand is replaced partially with manufactured sand. In this experiment natural river sand is replaced with manufactured sand by 0%, 25%, 50%, 75%, and 100%. A total of 30 cubes of size 0.15 x 0.15 x 0.15 meters and 30 cylinders of size 0.15 x 0.15 x 0.3 meters were casted respectively to check the compressive strength and tensile strength of the basalt fiber reinforced concrete when they age 7 days and 28 days. Also slump tests were conducted on each mix to determine the workability of the basalt fiber reinforced concrete. For ages, fiber-reinforcement has known to lead to improved tensile strength. In this research, basalt fibers of length 12mm, diameter 0.2mm and an aspect ratio of 60 are used by 0.25% of the total volume of concrete.

1. INTRODUCTION

1.1 GENERAL:

Concrete is the most prominent part in the structural construction, it is the most widely used construction material throughout the globe. Concrete is placed at very next position after water. Construction consisting of cement, fine aggregate, coarse aggregate, water and some admixtures in required proportion for a quick and better results in different conditions.

The construction industries consumed the large quantity of concrete worldwide.Using natural sand conventional concrete is produced from river beds that as fine aggregate in India.The environmental problem is decreasing natural sources so that there is a restriction on sand quarrying resulted in scarcity and so that its cost is high. There are no normally particles are present in river sand indesired quantity. It is danger to the environment to dig excess amount of sand from river bed. It affects the water level in ground. So alternative material must be found. The easy and cheap way of getting substitute for natural sand is obtained from granite stone quarries, lime stone and crushing stone quarries. This is known the manufactured sand.

By the replacement of natural sand in concrete may attain more or less compressive strength,tensile strength, permeability, modulus of rupture and lower degree of shrinkage as the control concrete. Concrete using various methods of obtaining sand as fully replacement for conventional natural sand. Then result are found better workability and high compressive strength and split tensile strength.

In the present years, the expansion within the structural construction and therefore the sequence increase in consumption have result in fast decline of accessible natural resources on the opposite hand, a high volume of production has generated a substantial quantity in fact material that have adverse impact on the atmosphere. The developing industries are to be one in all foremost potential customers of mineral resources, so generating an excellent quantity of manufactured sand by crushing hard granite stone, lime stone, natural stone. It is very excellent sand which have been unique properties required for normal sand.

In this study, the scope of research will be contemplated on the use of m-sand as a

normal sand with and without steel fibres in concrete.

Before going to the discussion, we need to something about rocks. Mainly we have three different types of natural rocks like Igneous rocks, Sedimentary rocks, and Metamorphic rocks.

1.2 SIGNIFICANCE:

In structural construction, the usage of natural sand is most prominent material of concrete. Resources having natural sand have no problem in construction industry, but places with the other type of sand is also available as equal to then natural sand. We need to preserve the natural sand material for upcoming generations, it is very important to use other available resources as construction material up to some percent. Because of this reason this study should be carried out to overcome the problem as well as to the benefits of coming generations.

The consumption of concrete in worldwide is estimated at 3 billion tons or half ton for every living human beings. In many places the ratio of concrete consumption to steel consumption exceeds 10 to 1.Why it is the most widely used engineering or structural materials? Cheapest and most readily available material on the job. Cement and aggregates are relatively inexpensive and are more commonly available in most area of the world. About 10000yen/1m3, it is less than 5yen/kg. Cement concrete is much more durable and it can be formed into a variety of forms and sizes.

1.3OBJECTIVES:

1. To provide some details about the use of manufactured sand and galvanized iron fibres.
2. To find the suitability of locally manufactured sand as a natural sand.
3. To be examine the workability, compressive and split tensile strength of concrete with replaced m-sand.
4. To be examine the shear resistance by G.I. fibres.
5. Beneficial and economic value to the local people.

To make explore the usage of locally available materials in structural constructions.

2. LITERATURE REVIEW

2.1 INTRODUCTION:

2.1.1 Previous Study:

The research person Ilangovanaet.al in 2008 studied the feasibility of usage of manufactured sand as hundred percent substitutes for natural sand in concrete. Using design approach of IS, ACI, USBR, RN.No.4 and BRITISH codes for both conventional concrete and M – Sand concrete Mix design has been developed for three grades. Tests were conducted for cubes and cylinders to study the strength of concrete made of manufactured sand and compared with the natural sand concrete. An attempt has also been made to durability studies on manufactured sand when compared with the natural sand concrete. And it is found that the compressive strength, split tensile strength and durability studies of concrete made of manufactured sand are nearly 10% more than the conventional concrete.

2.1.2 Present study:

In the present investigation we design mix for M25 has been calculated using I.S code 10262-2009 for the conventional concrete and quarry dust concrete. Tests were conducted for cubes and cylinders to study the strength of concrete by using manufactured sand and the results compared with the natural sand concrete. During the present study, 0%, 25%, 50%, 75% and 100% of traditional fine aggregate with replaced with the robo sand. Compressive strength, split tensile strengths and workability were found after 7 and 28 days curing.

Since granite stone is using as coarse aggregate in structural construction, even the

other materials available in huge quantity. The common people are not ready to use the other quality materials like lime stone, marble stone, hard granite stone etc in the construction industry as concrete material. We should need to improve some awareness about this type of materials by performing some research on this type of materials. Due to this connection a small research work has been performed on the cube moulds and cylindrical moulds to the compressive strength, split tensile strength and of concrete and workability is carried out on fresh concrete respectively.

2.2 THEORY OF SAND:

Sand is wide range needful material for the construction but this important material must be purchased with all care and vigilance. Any sand which is used in the construction purpose must be clean, free from stones and impurities. It is so important to know what type of sand is beneficial for construction purpose and as sand is also classified into three different forms that make it suitable for specific type of construction.
Sand is classified as: Fine Sand (0.075 to 0.425 mm), Medium Sand (0.425 to 2 mm) and Coarse Sand (2.0 to4.75 mm). Any how the classification of sand further has types of sand in particular and on that basis only they are being incorporated in the construction.

Fig 2.1: Sample of Natural River Sand

2.3 TYPES OF SAND:

2.3.1 Pit Sand (Coarse sand) :

Pit sand is classified under coarse sand which is also called badarpurin common language. The coarse sand procures from deep pits of abundant supply and generally in orange and red colour. The coarse grain is angular, sharp and certainly free from salts which mostly employed in concreting.

2.3.2 River Sand :

River sand is procured from river streams and banks and is fine in quality unlike pit sand. This sand has rounded grains generally and in white-grey colour. River sand has used in the construction purpose such as plastering.

2.3.3 Sea Sand :

As the name suggest, sea sand is taken from seas shores and it is generally in distinct brown colour with fine circular grains. For the purpose construction of concrete structure sea sand is avoided, and in engineering techniques because it contains salt which tries to absorb moisture from atmosphere and brings dampness. Eventually cement loses its action when mixed with sea sand that is why it is only used for the local purpose instead of structural construction.

There are different standards for the construction purpose which must be checked and considered for the better construction. The requirement is taken according to which sand is chosen should be like:

- For plastering purpose, the overall fine sand used must not be less than 1.5 while silt is preferred to not less than 4 percent.
- For brick work fine sand used must not be less than 1.2 to 1.5 and silt is preferred is 4 percent generally.
- The concreting work requires coarse sand in modulus of 2.5 to 3.5 and with not less than 4 percent silt content.

3. EXPERIMENTAL INVESTIGATION AND TEST RESULTS

3.1MATERIALS USED:

Few experimental works have been done on following materials to achieve the specified objectives, which were said in the previous chapters.

3.1.1 Cement:

A.C.C. Ordinary Portland cement of 53 GRADE was used. The physical and chemical properties ofcement is presented in following tables 4.1 & 4.2.

Table 3.1 physical properties of cement

S.NO	PARTICULARS	RESULTS	BIS SPECIFICATIONS (IS 12269-2013)
1.	Specific Gravity	3.1	-
2.	Normal Consistency	33%	-
3.	Fineness of Cement (m^2/kg)	289	225 min
4.	Setting Time(minutes): a. Initial setting b. Final setting	 125 185	 30 min 600 max0
5.	Sound Ness: Le-chatleir expansion (mm)	 1.0	 10 max

Table 3.2 chemical properties of cement

S.NO	PARTICULARS	RESULTS	BIS SPECIFICATIONS (IS 12269-2013)
1.	Soluble Silica (%)	19.96	-
2.	Alumina (%)	5.20	-
3.	Iron Oxide (%)	5.65	-
4.	Lime (%)	60.79	-
5.	Magnesia (%)	1.72	Not more than 6.0 %
6.	Insoluble Residue	0.96	Not more than 4.0 %
7.	Sulphur Calculated as SO_3 (%)	2.61	Not more than 3.5 %
8.	Loss On Ignition (%)	1.47	Not more than 4.0 %
9.	Lime Saturation Factor	0.92	In between 0.80 & 1.02
10.	Proportion Of Alumina To Iron Oxide	0.92	Not less than 0.66
11.	Chloride (%)	0.006	Not more than 0.1 %

Fig 3.1: Sample of A.C.C. cement

3.1.2 FINE AGGREGATE:

a. Natural River Sand:

Generally, Natural river sand available near pit sand, which is passing through 4.75 mm I.S sieve was used. The physical properties and sieve analysis results are listed in the following tables 3.3 and 3.4.

Table 3.3 Sieve Analysis of Fine Aggregate

S.NO	IS Sieve	Weight Retained	% Weight Retained	Cumulative % Weight Retained	% Of Passing	Standard Zone - Ⅱ
1.	4.75 mm	26	2.6	2.6	97.4	90 – 100
2.	2.36 mm	70	7.0	9.6	90.4	75 – 100
3.	1.18 mm	194	19.4	29	71	55 – 90
4.	600 µ	210	21.0	50	50	35 – 59
5.	300 µ	390	39.0	89	11	8 .0 – 30
6.	150 µ	94	9.4	98.4	1.6	0 – 10
7.	75 µ	12	1.2	99.6	0.4	-
8.	Pan	04	0.4	100	Zero	-

Figure 3.2: sample of fine aggregate

Table 3.4 Physical Properties of Fine Aggregate

S.NO	PARTICULARS	RESULTS
1.	Specific gravity	2.78
2.	Fineness Modulus	4.7852
3.	Bulk density	16.70 kn/m^3
4.	Bulking of Sand	4% @11cm
5.	Grading of Sand	Zone –2

b. Manufactured Sand (M-Sand):

The size of manufactured sand (M-Sand) is less than 4.75mm.Manufactured sand is the sand manufactured in the stone quarries. It is a substitute for the river sand used in the construction. Manufactured sand or crusher dust obtained from local granite crushers was used as partial replacement of fine aggregate in the present investigation to cast the concrete cubes. The fineness modulus of Manufactured sand is 3.02. The specific gravity of Manufactured sand is 2.62 respectively.

Fig 3.3: Sample of M-Sand

Table 3.5 sieve analysis of manufactured sand

S.NO	IS Sieve	Weight Retained	% Weight Retained	Cumulative % Weight Retained	% cumulative weight	% of finer
1.	4.75 mm	6.0	1.2	6.0	1.2	98.8
2.	2.36 mm	93	18.6	99	19.8	80.2
3.	1.18 mm	124	24.8	223	44.6	55.4
4.	600 µ	44	8.8	267	53.4	46.6
5.	425 µ	61	12.2	328	65.6	34.4
5.	300 µ	108.5	21.7	436.5	87.3	12.7
6.yu	150 µ	44.5	8.9	481	96.2	3.8
7.	75 µ	16	3.2	497	99.4	0.6

3.1.3 Coarse aggregate:

Natural granite aggregate which is available in the local sources has been used. In this study all-in-all size coarse aggregate which passing through the 20 mm IS sieve and retained in the 10 mm IS sieve has been used for the effective utilization and good placing of coarse aggregate. The following tables 4.5 and 4.6 shows the different properties granite aggregate.

Table 3.6 sieve analysis of Coarse aggregate

S.NO	IS Sieve	Weight Retained	% Weight Retained	Cumulative % Weight Retained	% Of Passing
1.	63	-	-	-	100

2.	63 – 50	-	-	-	100
3.	50 – 40	-	-	-	100
4.	40 – 31.5	-	-	-	100
5.	31.5 – 25	-	-	-	100
6.	25 – 20	304	6.08	6.08	93.92
7.	20 – 16	3020	60.4	66.48	33.52
8.	16 – 12.5	1476	29.52	96	4
9.	12.5 – 10	180	3.6	99.6	0.4
10.	≤ 10	20	0.4	100	Zero
Fineness modules = 3.7					

Table 3.7 properties of Coarse aggregate

S.NO	PARTICULARS	RESULTS
1.	Specific Gravity	2.59
2.	Fineness Modules	3.70

3.	Flakiness Index	18.50 %
4.	Elongation Index	23.7 0%
5.	Crushing Value	15.82%
6.	Impact Value	6.9%
7.	Water Absorption	0.4 %

Figure 3.4: sample of coarse aggregate

3.1.5 Water:

The water used in this experimental investigation is locally available potable water.

CONCLUSION

The effect of percentage of replacement of river sand by manufactured sand on strength and workability were evaluated and compared with the reference mix of 0% replacement of river sand by manufactured sand.

1.Thecompressive strength of concrete mix increased when the replacement of natural sand with manufacturing sand increases gradually up to 100% by 40.25% and the addition of galvanized fibres increases the compressive strength by 48.78%.

2.The split tensile strength value ofconcrete mix increased when the replacement of natural sand with manufacturing sand increases gradually up to 100% by 47.71% and by the addition of galvanized fibres that increases the split tensile strength by 62.43%.

3. Workability of concrete mix decreased with replacement of natural sand with manufacturing sand. But up to some extent even replaced concrete mix batches got optimum results. At the same time after 75% replacement of natural sand the workability of concrete mix decreases gradually.

4. By considering all the above parameters like slump cone value, compaction factor value, compressive strength value & split tensile strength value it is recommended that is better to limit the replacement of natural sand with manufacturing sand up to 75% only for better fresh and hardened concrete.

5. Failure pattern of cube moulds and cylindrical moulds is almost similar for both natural sand and manufacturing sand.

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