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Experimental Studies On The Properties Of Concrete Made By Fine Aggregate By Mineral (Quartz) Sand

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Abstract
For combination produces concrete combination are give up products even as for concrete manufacturers, aggregates are uncooked materials for use for concrete production. The quality of aggregates can be motivated while raw substances, gravel or rock might also have characteristics that can't be changed via the production manner. One extraordinarily important issue is regular deliver of coarse, pleasant combination. In this regard a rough aggregate produced through crushing basaltic stone and river sand is the principal herbal supply of first-class combination. However the extreme construction pastime is ensuing in growing scarcity and rate increase of the herbal sand in the united states further the combination and concrete industry are currently facing a growing public focus associated with environmental threats. Therefore, seeking out a possible alternative for natural sand is a ought to. One opportunity used as alternative is the use of M sand. Due to the forecast shortfall in deliver of herbal sand and increased creation practices time will come when M sand will play a extensive role as an element in concrete production.

1. Introduction

The Manufactured Sand (MS) is a by-product of the crushing and screening process inside the quarries. Quarry generates widespread volumes of quarry fines whilst crushing the rock into aggregates. It is also called beaten rock sand, stone sand, crusher sand and crushed first-rate aggregate. Quarry fines include a graded blend of coarse sand, medium sand and high-quality sand sized debris, plus clay/silt fraction known as the 'filler' grade. Filler grade fabric is defined through the industry because the fabric having less than zero.075mm (75 microns) in size.

The filler content material is especially critical as it has a primary effect at the technical properties. The difficulty at the passing seventy five m in specifications for natural sand for concrete is a reaction to the presence of deleterious clay minerals inside this fraction size. Clay minerals are liable to reason cracking, dusting and shrinkage in hardened concrete, and that they boom the water demand within the blend layout. When designing the concrete with herbal sand, it's far necessary to restrict the passing 75 m to a level that forestalls the opportunity of clay minerals being found in quantities that would bring about the potential problems described.

With the advent of manufactured sand, there has been a gradual reputation that lots of the passing 75 m materials are ground into number one minerals and not as clay minerals. These substances act as a rock flour or filler and feature benefits inside the concrete blend. The effect of this fabric on water call for still calls for careful monitoring and wishes to be considered in blend layout. The filler grade content material of these high-quality materials is reduced with the aid of washing it with water to produce a smooth, saleable 'sand' product.

1.3.1 Production of Manufactured Sand:

Manufactured sand is produced and used in numerous countries inclusive of Norway, USA, Australia, South Africa and India inside the areas plentiful with rock quarries. In USA limestone and granite account for 86% of the rock used to make synthetic sand, with the the rest made from basalt, dolomite, sandstone and quartzite, Ahn and Fowler (2001).

The high-quality (mineralogical, chemical and physical homes) of synthetic sand depends upon the type of rock quarries and the diploma of processing it has gone through.

David Manning (2004) claimed that igneous rocks produce approximately 10 to 30% quarry fines. Limestone such as dolomite and chalk quarries typically produces round 20 to twenty-five% of fines, while sandstone quarries produce as much as 35% of fines.

1.2 Objectives of Using Manufactured Sand:

- To minimize the waste.
- To generate sales.
- To reduce volumes gathering and taking up space in a quarry.
- To reduce the expenses of garage and disposal.
- To fulfill the consumer demand for products for which fines are a derivative
- To gain sustainability.
- To ensure landscape healing.
- To reduce the extraction of herbal sand.

1.3 SCOPE OF THE WORK:

The scope of the present work includes the study of the following topics:

- Mix layout for M 30 grade concrete with one hundred% substitute of natural sand with mineral sand.
- Study on Fresh homes like workability and hardened residences like compressive energy, cut up tensile energy and flexural power of concrete with the aid of changing a hundred% herbal with mineral sand.
- Experimental studies on structural behaviour like deflection, load carrying potential of RCC beams.

2. LITERATURE REVIEW

ShewaferawDinku Belay (2006) determined that the hardened residences of the concrete mixes with partial alternative of natural sand with synthetic sand carried out higher compressive power. Using manufactured sand in partial or full replacement to herbal sand does not reason any widespread price variation. He also stated that the use of manufactured sand is extra appropriate for high power concrete manufacturing.

M.Adams Joe, A.Maria Rajesh, P.Brightson, M.PremAnand American Journal of Engineering Research (AJER) Volume-02, Issue-12, pp-46-51have accomplished their research on Experimental Investigation on the Effect Of M-Sand in High Performance Concrete. They experimentally investigated the impact of M-Sand in structural concrete by way of changing river sand and develop a high performance concrete.

S.RukmangadharaRao et al. Int. Journal of Engineering Research and Applications , Vol. Five, Issue 12, (Part - 1) December 2015, pp.Eighty four-88, done his research on Study on Strength of Concrete Using Robo Sand as a Partial Replacement of Fine Aggregate. In that investigation workability and energy of concrete changed into evaluated by means of substitute of natural sand with the aid of Robo sand in proportions of zero%, 50%, seventy five%, and one hundred% is studied for M25and M35grade concrete cubes, cylinders and prisms.

E.Divya, R.Shanthini, and S.Arulkumaran have Studied on behaviour of concrete partly changing quartz sand as satisfactory combination. Their observe turned into done to assess the extra compressive, flexural strength with higher droop over traditional concrete in which sand is

replaced with 0%, 25%, 50% and one hundred% of quartz sand via weight with 1% super plasticizers. The research additionally revealed that there may be opportunity of replacing first-class combination with quartz sand in the production of structural concrete.

ShyamPrakash et al. (2007)says that synthetic sand satisfies the requirements great aggregates including strength, gradation, form angularity. It is likewise viable to supply synthetic sand falling into the preferred grade. They say that the mechanical homes of manufactured sand depend on the source of its uncooked material, i.e., figure rock. Hence the selection of the quarry may be very critical to first-class pleasant aggregate.

NimithaVijayaraghavan and A S Wayalhave studied onEffects Of Manufactured Sand On Compressive Strength And Workability Of Concrete. This examine includes experimental research of partial and full alternative of natural sand with the aid of synthetic sand. They in comparison the compressive electricity and workability of concrete with synthetic and natural sand in various proportions. The outcomes show that concrete with synthetic sand indicates higher compressive energy while workability reduced with increasing proportion of manufactured sand.

3. MIX DESIGN

DESIGN MIX ADOPTED M 30 :

TARGET STRENGTH OF MIX ADOPTED:

Target strength M25 mix adopted after 28 days

$f_{ck}^{'} = f_{ck} + 1.65\ s$

Standard deviation for M30 is 5N/mm^2 as per table 1

Target strength M30 mix adopted = 30 + 1.65 x 5

= 38.25 N/mm^2.

WATER – CEMENT FRACTION SELECTION:

The ratio of water to the cement for 20mm aggregate is 0.45 according to table 5 of IS 456:2000

Selecting a water to the cement ratio of 0.50 after few trail mixes.

WATER CONTENT SELECTION:

For a slump between 25 – 50 mm and for aggregate size of 20mm, maximum water content is 186lt according to table number 2 of IS 10262 – 2009.

Here we are assuming a target slump of 100mm,

So water content for a slump 100mm = 186 + (0.03 x 186) = 197.16lit

CEMENT CONTENT CALCULATION:

Water – cement ratio = 0.50

Cement content = $\frac{197.16}{0.50}$

= 394.32 kg/m^3> 320kg/m^3

Hence the cement content is within the limits

FINDING PROPOTIONS OF COARSE AND FINE AGGREGATE AMONG TOTAL AGGREGATES:

As per table number 3 of IS 10262 – 2009,

The portion of coarse aggregate for a water to the cement ratio of 0.5 is 0.62 considering 20mm coarse aggregate and fine aggregate of zone II.

Here the water – cement ratio is adopted is 0.5 only, so the portion of coarse aggregate is increased zero.

portion of coarse aggregate = 0.62 x 0.9 = 0.56

portion of fine aggregate = 1-0.56

= 0.44

MIX CONTROLS:

1. Concrete volume = 1m^3
2. Cement volume = $\frac{Mass\ of\ cement}{specific\ gravity\ of\ cement} x \frac{1}{1000}$

$= \frac{394.32}{3.12} \text{x} \frac{1}{1000}$

= 0.1263m^3

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3. Water volume = $\frac{mass\ of\ water}{specific\ gravity\ of\ water} x \frac{1}{1000}$

$= \frac{197.16}{1} x \frac{1}{1000}$

$= 0.197m^3$

4. Total volume of all aggregate = [a – (b + c + d)]

= 1- (0.126 + 0.197)

$= 0.677m^3$

Where

a = Concrete volume

b = Cement volume

c = Water volume

e = Total volume of all aggregate

d = admixture is not added, so d=0

5. Weight of coarse aggregate = e x volume of coarse aggregate x specific Gravity of CA x 1000

= 0.677 x 0.56 x 2.80 x 1000

= 1061.42 kg.

6. Weight of fine aggregate = e x volume of fine aggregate x specific Gravity of CA x 1000

= 0.677 x 0.44 x 2.51 x 1000 =747.67 kg

4. RESULTS AND DISCUSSIONS

Table 1 Mix proportions for M30 using Mineral Sand:

Water (lt)	Cement (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)
197.32	394.16	747.67	1061.42
0.50	1	1.89	2.69

Table 2: Mix proportions for M30 using Natural Sand:

Water (lt)	Cement (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)
197.32	394.16	795.34	1061.42
0.50	1	2.017	2.69

Table 3: Workability test results:

S.No	Type of aggregate	Slump valve (mm)
1.	Natural sand	140
2.	Mineral sand	120

Table 4: Compressive Strength results:

S.No	Age (days)	Compressive Strength (Mpa)		
		Natural Sand	Mineral Sand	Increase(+) /Decrease (-)in %
1	3	19.48	19.85	1.89
2	7	25.47	26.66	4.67
3	28	38.95	41.48	6.5

Table 5: Splitting Tensile Strength results:

S.No	Age (days)	Splitting Tensile Strength (Mpa)		
		Natural Sand	Mineral Sand	Increase(+) /Decrease (-)in %
1	3	2.28	2.38	4.38
2	7	2.1	2.45	16.67
3	28	2.54	2.63	3.54

Table 6 Flexural Strength results:

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S.No	Age (days)	Flexural Strength (Mpa)		
		Natural Sand	Mineral Sand	Increase(+) /Decrease (-)in %
1	3	4.4	3.96	-11.11
2	7	5.4	4.8	-12.5
3	28	5.67	5.75	1.41

Table 7: Hardened Properties of concrete:

Type of Property	Mineral Sand		Natural Sand		Increase(+)/decrease (-) in %	
	7days	28days	7days	28days	7days	28days
Compressive Strength of concrete (N/mm^2)	25.4	38.95	26.67	41.48	+4.67	+6.50
Split tensile Strength of concrete (N/mm^2)	2.45	2.63	2.1	2.54	+16.67	+3.54
Flexural Strength Of Concrete (N/mm^2)	4.8	5.75	5.4	5.67	-12.5	+1.41

Fig7.1 Comparison of Compressive strength of Natural sand and Mineral sand:

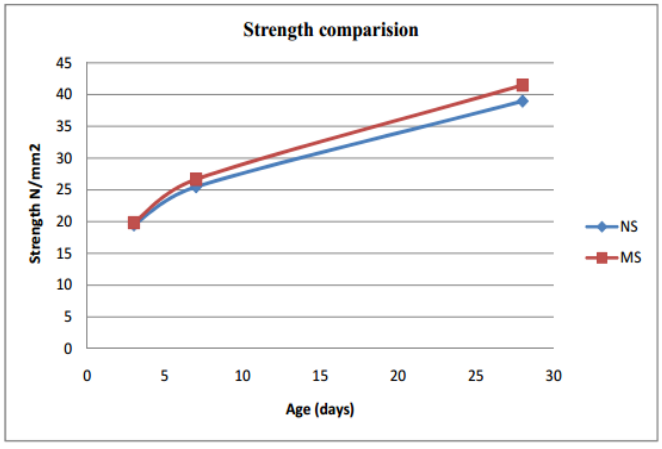


Fig7.2 Comparison of Tensile strength of Natural sand and Mineral sand:

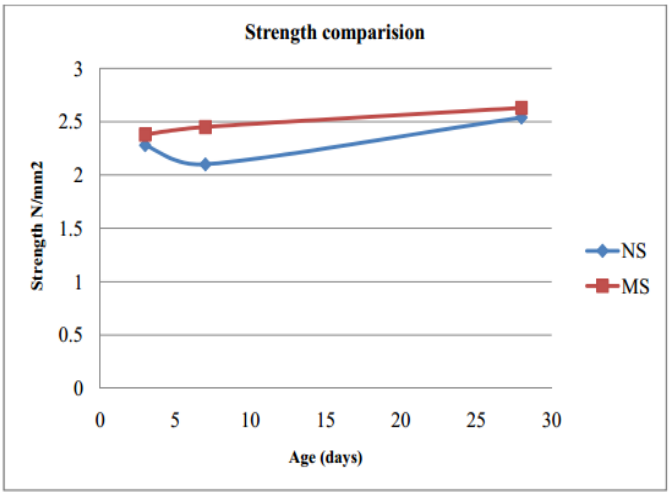
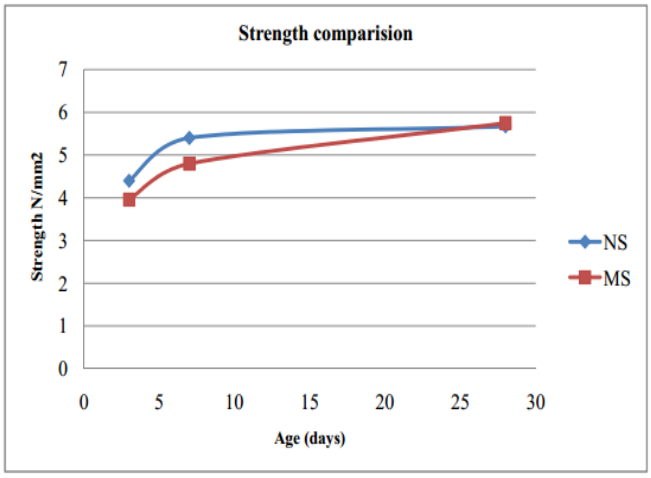


Fig7.3 Comparison of Flexural strength of Natural sand and Mineral sand:



5. CONCLUSION

From the above Results, it was generally concluded that the Mineral sand can be utilized as fine aggregate in concrete, which reduces the environmental impact, scarcity of Natural sand and cost of construction. Even though the Manufactured (Mineral) sand is already used in the market, there is a need to develop a new code for testing the Manufactured sand. Based on these experimental investigations, a new code can be developed for studying the effects of Manufactured sand in concrete.

The results of this thesis work will be helpful to:

- Construction industry to focus on Manufactured (Mineral) sand in order to produce comparable, even better quality of concrete.
- Environmental organizations seeking to understand interactions of minerals with the environment.
- Private, government organizations and construction firms that use the data for construction purposes in order to minimize the use of scarce resources of natural river sand.
- Educational institutions, which use the information for academic and research purposes.

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