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EXPERIMENTAL INVESTIGATION OF REPLACING M-SAND IN HIGH PERFORMANCE CONCRETE

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Abstract— HighConcrete is the most commonly used construction material in the world. The introducing of mineral admixtures in cement has gradually increased as due to advancement in concrete industry, as due to concern of cost saving, energy saving, environmental safety and maintenance of resources. High Performance Concrete (HPC) is the latest development in the concrete. It has become more popular these days and is being used in many prestigious projects. Study has been carried out to assess the strength properties of HPC by replacement of cement by Metakaolin with 20% and silica fumes of 20%. Natural Sand by M-Sand (Manufactured Sand) by three proportions that is 0%, 50% and 100% and water binding ratio of 0.29 evaluating its compressive strength The lessening in the sources of river sand and the requirement for reduction in the cost of concrete production has resulted in the increased need to identify substitute material to M sand as fine aggregates in the production of concretes. Engineers now wish to use alternate material to river sand used to produce high performance concretes to meet specific purposes such composite with greater workable, strength and long term properties. Metakaolin and silica fume is used as a partial replacement of cement which was treated as an economical and due to its pozzolonic action increases strength and durability properties of concrete.M-Sand is waste material from quarry industry not disposed properly in to the land used in the concrete replaced for the sand. The test results obtained indicates that M-Sand of marginal quantity as the partial sand replacement has beneficial effects on the mechanical properties. From the observation it was inferred that rise in percentage of fractional replacement of silica fume, metakaolin improve the compressive strength and revealed a better picturesque in terms of allied standard durability indicators of High Performance Concrete.

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I. INTRODUCTION

High Performance Concrete (HPC) is most recent growth in concrete, recently it has became the most popular, because this was used in so many prestigious projects like Nuclear power projects, flyover, skyscrapers and dams etc., HPC is the concrete used to improve the strength and durability properties of the concrete. it can be developed by an incorporating of some high reactive mineral admixtures like silica fume, fly ash, rice husk, Metakaolin, etc., are most commonly used, since the fineness property of all this admixtures are yields strength and durability properties of HPC over than the conventional concrete.

M-Sand is manufactured sand obtained from various industrial by-products such as quarry, granite. All over world the utilization of Natural River bed sand is very high in concrete as due to increase in development activities. In developed countries the use natural sand is quite high; in this situation developing countries are facing a shortage in available of natural sand. Due to the excess excavation of Natural sand from rivers can causes environmental problems. Therefore construction industries are identifying alternate material to reduce the dependence on natural sand by using artificially manufactured sand. The by-product of Granite powder is obtained from quarry, where this material cannot be used for other application except filling of low lying areas, and this can be used as replacement of natural sand in concrete. The only some part may be useful of dumping and remaining portion causes environmental problems. In this

study replacement of river sand is made by using M-Sand to assess strength properties of concrete.

II. OBJECTIVE

1. To know the strength properties of different water binding ratio of plain HPC with different percentage of M-Sand.
2. To measure the strength properties of HPC for different percentage of mineral admixture and M-Sand.
3. To reduce the water binding ratio by an addition of super plasticizer.
4. Comparison of strength properties for conventional and mineral admixture concrete.

III. EXPERIMENTAL PROGRAMME

Thirty sixspecimens were casted and tested in laboratory. M-sand is used in concrete by various proportions such as 0%, 50%, 100% to the weight of fine aggregate and studied the 14, 28 days compressive strength.

Test materials are given below:

A. Cement

Ordinary Portland cement (53 grade) whose specific gravity is 3.1, initial setting time is 45 minutes, final setting time is 200 minutes is used.

Table 1 physical properties of cement

Description	Test values
Type	OPC
Grade	53
Specific gravity	3.15
Fineness by 90 micron sieve	0%
Consistency	25%
Initial setting time	45 minuts
Final setting time	200 minutes
Compressive strength (3 days)	27.4 N/mm^2
Compressive strength (7 days)	37.6 N/mm^2
Compressive strength (28 days)	53.8 N/mm^2

B. Fine aggregate

In this study zone II sand is used whose specific gravity is 2.86, fineness modulus is 2.1, bulk density is 33% is used.

Table 2 Properties of aggregates

Properties	River sand	M-Sand	Coarse aggregate
Fineness modulus	2.1	2.83	4.76
Specific gravity	2.86	2.73	2.8
Bulk density	33%	-	-
% of voids	37.4	-	-
Density	-	-	-
Young's modulus	-	-	-
Thermal Properties	-	-	-
Organic impurities	Nil	-	Nil

C. Coarse aggregate

Coarse aggregate of size 20mm is used which has specific gravity 2.8, fineness modulus 4.76 as per IS 383.

D. Water

Portable water free from harmful oils, alkalis, sugar, organic impurities are used for proportioning and curing of concrete.

E. Super plasticizer

Polycarboxylate ether complies with IS:9103 1999 and BS:5075. This Super Plasticizer show extremely high water reduction in concrete with improved workability and increase in strength by almost 20-30% depending on use.

Table 3 Properties of PCE

Properties	Test values
	Polyethylene glycol copolymer
Specific gravity	1.110 ± 0.02
Chloride content	Nil
Air entrainment	Approximately 1%

F. Silica fume

Silica fume, also known as micro silica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production.

Table 4 Chemical properties of silica fume

Properties	Effect
Amorphous	Will not dissolve in concrete
Silicon dioxide	>85%
Trace elements	Depend upon type of fume

G. Metakolin:

Metakaolin is neither industrial by-product nor a natural available material. The particle size of metakaolin is smaller than cement particles, but not as fine as silica fume. The specific gravity of metakaolin is 2.65

H. Mix design

The following mix design is arrived:

Table 5 Mix Proportions Of Concrete

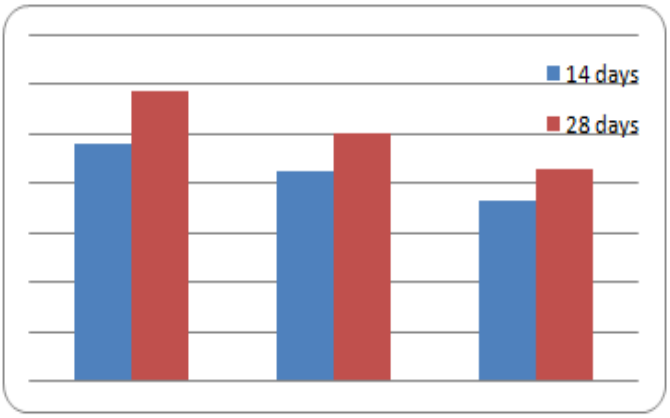
Samples	Admixtures (%)	M-sand (%)
S1 (conventional)	40%	0%
S2	40%	50%
S3	40%	100%

I. Compressive strength

The test was carried out for compressive strength of M_{40} grade of concrete. The compressive strength of high performance concrete with silica fume, fly ash and super plasticizer is given below:

Table 6 Compressive Strength Of Concrete

Samples	Compression strength N/mm^2	
	14 days	28 days
S1	48.25	58.74
S2	42.42	50.23
S3	36.56	42.90



Graph 1 Compressive Strength Of Concrete

IV. RESULTS AND DISSCUSSION

Workability of fresh concrete is determined by using slump test given below

Table 7 Workability Of Concrete

Samples	Slump Value(mm)
S1	85
S2	76
S3	72
S4	69

V. CONCLUSION

Based on the experiments done the following result is achieved.

1. Compressive tests were conducted and results are found to be high for S1 which is 100% of replacement of the normal sand.
2. But 50% replacement of the M-sand which is S2 also gives the required strength which is economical.
3. Now a days the normal sand rate is high so that m-sand is replaced partially with normal sand can also give the strength hence we can reduce the cost of the building.
4. The usage of silica fume and fly ash in concrete will reduce the environmental hazards. Since the disposal of by-products in environment is hazardous.

REFERENCES

[1] Mr. Sabale Vishal Dhondiram, Miss. Borgave Manali Deepak, Mr. Shinde Suraj Dadasaheb, Miss. Bhagwat Mayuri Dattatray. International Journal of Electronics, Communication & Soft Computing Science and Engineering. 2010.Volume 3, Issue 1.
[2] Raghavendra.R, Sharada.S, Ravindra.M.IJRET: International Journal of Research in Engineering and Technology Volume 4, May 2015.
[3] Er. Magudeaswaran, Dr. Eswaramoorthi. International Journal of Emerging Technology and Advanced Engineering Volume 3, Issue 1, January 2013.
[4] Dilip Kumar Singha Roy, Amitava Sil. International Journal of Emerging Technology and Advanced Engineering Volume 2, Issue 8, August 2012.
[5] N.K.Amudhavalli, Jeena Mathew. International Journal of Engineering Sciences & Emerging Technologies,Volume 3, Issue 1, August 2012.
[6] Mr.Magudeaswaran.P, Dr.Eswaramoorthi.P.Asian Journal of Research in Social Sciences and Humanities Issue 6, Special Issue .June 2016.
[7] Jay D patel, AJ Sheth, International Journal of Innovative Research in Advanced Engineering (IJIRAE) Volume 1, Issue 5 ,June 2014.
[8] P. Vinayagam International Journal of Computer and Communication Engineering, Vol. 1, No. 2, July 2012.
[9] Nadia salim , Dhirar T . M. AL- Taqani ,Vol . , No. ,2011.
[10] Debabrata Pradhan , D. Dutta. Int. Journal of Engineering Research and ApplicationsVol. 3, Issue 5, Sep-Oct 2013.
[11] K.Eswaramma, K.Rajasekhar International Journal of Advanced Technology in Engineering and Science Volume No.03, Issue No. 05, May 2015.
[12] M. Vijaya Sekhar Reddy, I.V. Ramana Reddy, N.Krishna Murthy. Journal of Science and Technology, VOL. 3, NO. 1, Jan 2013.