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Experimental Study of High Strength Concrete (M70) Using Manufactured Sand

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Abstract:
Concrete is the most widely used construction material. About 35% volume of concrete is comprised of sand. Current practice shows that for formulating HSC use of natural sand is common all over sites. But day by day natural sand deposits are decreasing due to tremendous use. Hence some alternative to develop required strength as natural sand is a current challenge. In the present study, the attempt is made to design mix for HSC of M70 grade concrete for various water to cement ratios using proper proportion, admixtures, and manufactured sand with required workability concrete mix design of M70 grade was done according to Indian Standard code Concrete cube specimens were tested for evaluation of compressive strength. Also For design mix of HSC, the silica fume (SF) used at various percentage replacement levels i.e. 10%, 12%, and 14% respectively with cement whereas superplasticizer (SP) is used at 1%, 1.2%, and 1.4%. Different trial combinations were made using percentage variation of SF and SP with including total replacement of river sand with manufactured sand. After proper curing it is tested in laboratory. The compressive strength results are obtained at lower water to binder ratio i.e. at 0.27**.** The concrete exhibits excellent strength with 100% replacement of natural sand, so it can be used in concrete as viable alternative to natural sand

Index Terms SilicaFume, Superplasticizer, Water to binder ratio, ManufacturedSand, M70,HSC.

1. INTRODUCTION

Concrete has been in use as a major building material ever since its inception. The main cause of concern is the nonrenewable nature of natural sand and the corresponding increasing demand of construction industry, therefore looking for an alternative to river sand has become a necessity. The cheapest and easiest alternative to natural sand is manufacturing sand by crushing rocks/stones in desired size and grade by suitable method. Sand produced by such means is known as manufactured/ crusher/artificial sand. This paper presents the results of experimental investigation of fully replacement of natural sand by manufactured sand. In the present paper, the attempt is made to design mix for HSC of M70 grade concrete using proper proportion, admixtures, and manufactured sand with required workability. To compare the compressive strength and workability of concrete of manufactured and natural sand in varying proportion of silica fume, super plasticizer, water/binder ratio.

2. LITERATURE REVIEW

Some of the previous study or literature data is presented as below

[1] B. Krishna Kumari Bai and M. Kanta Rao (2015) did detailed study on the effect of fly ash, SF and its combinations on strength and durability properties on HPC. Fly ash was replaced with cement by various percentages i.e., 5%, 10%, 15%, 20%, 25% and SF as addition of 10% by weight of cement for w/b ratio 0.32. For M80 grade concrete.

[2] M. Mazloom et. al. (2004) has done the experimental work on short and long term mechanical properties of HSC at different levels of silica fume. The mixes were made, having fixed water to binder ratio which is 0.35. The cement is replaced by silica fume at 0%, 6%, 10% and 15% percentage levels.

[3] Vinayagam (2012), presented information about simplified mix design procedure for HPC by relating BIS and ACI code methods of mix design and available literature on HPC. According to this method, mixes M80 and M100 were made. The M80 and M100 mixes were tested for compression, split tension, flexure and workability experimentally. By combining the BIS and ACI code method, the design mixes gives very good results.

3. SCOPE OF THE STUDY

- Design mix of high strength concrete above M70 grade using manufactured sand.
- Durability properties for HSC of M70 grade using manufactured sand.
- Effect of dust content on the compressive strength of the concrete.
- Effect of humidity during concrete work and relatively to compressive strength.

4. MATERIALS FOR EXPERIMENTATION WORK

4.1.Fine Aggregate

Manufactured sand is used for making mortar and concrete and for polishing and sandblasting. Quality of sand used for this purpose varies according to local supply. There are four different

samples collected from different locations. From that best sample is used for mix design of HSC. The grading zone of the aggregate was zone II as per Indian Standard specifications.

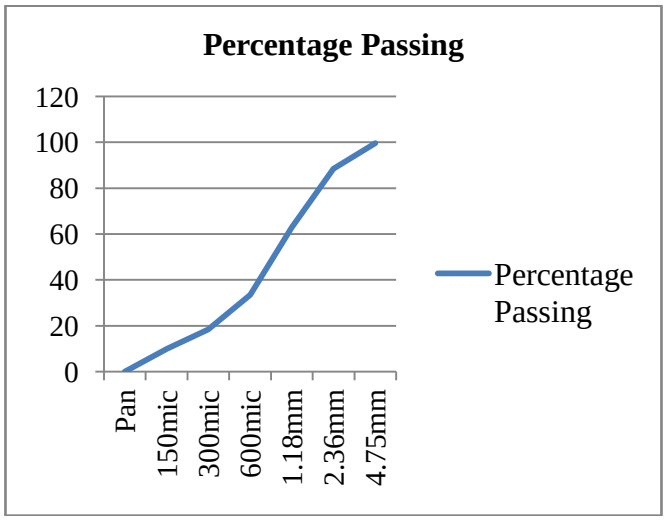

Figure.1. Sieve Analysis of Fine Aggregate

The fig.1 shows the results of sieve analysis, giving s-shape curve required for zone selection. The sample would unable to give the required properties. So for more specific gravity result, there should be minimum silt content in the manufactured sand.

4.2 Coarse aggregate

Coarse aggregate used has angular shape having maximum size 20mm. The specific gravity and water absorption was found to be 2.94 and 1.47% respectively Sieve analysis giving fineness modulus 5.67

4.3 Mineral Admixture

Silica fume as a mineral admixture giving specific gravity 2.21 is partially replaced with cement. In
this study proportion used is 10%, 12% and 14% respectively about cementitious material. Silica fume reacts with water forms finer paste as compare to cement paste.

4.4 Cement

In this research work Ultrarech OPC 53 grade cement is used. The specific gravity of cement is 3.15. Ordinary Portland cement of 53 grades conforming to IS: 12269-1987 has been used throughout the experimentation.

4.5 Chemical Admixture

The BASF's MasterGlenium ACE 30JP superplasticizer having specific gravity of 1.10 was used to achieve the desired slump flow value for HSC. The superplasticizer use at three different percentage levels (i.e. 1%, 1.2% and 1.4%). According to IS10262:2009, maximum percentage of superplasticizer is used is 2%. But trials should make from 1% superplasticizer by mass of cementitious material.

4.6 Water

Fresh portable water, which is free from acid and organic substance, was used for mixing the concrete.

5. MIX PROPORTION AND MIX DETAILS

Concrete mix proportion is designed as per IS 10262:2009 "Concrete mix proportioning- guidelines". Amount of silica fume replaced is 10%, 12% and 14% of cementitious material and superplasticizer used is 1%, 1.2% and 1.4% of cementitious material at W/B ratio 0.30, 0.28, 0.27. First trials are made for each w/b ratio. But for w/b ratio 0.30 and 0.28 fails to give target strength for M70 grade HSC. Hence, reduction of w/b ratio to 0.27 which achieve the target strength for M70 grade HSC concrete. Amount of silica fume replaced is 10% of cementitious material and super plasticizer used is 1.2% of cementitious material.The mix proportion for w/b ratio 0.27 is given in table 1

Table.1. Mix proportion for M70

Grade	M70
Water/binder ratio	0.27
Cement as binder(Kg/m^3)	584.185
Fine Aggregate (Kg/m^3)	650.958
Coarse Aggregate (Kg/m^3)	1135.73
Silica Fume (Kg/m^3)	58.42
Super plasticizer(Kg/m^3)	7.01

6. CONCLUSIONS

- Limiting strength value for M70 grade concrete after 7 and 28 days should be 65% (50.86 N/mm^2) and 99% (77.46 N/mm^2) of its target mean strength respectively. It can be seen that the obtained compressive strength results of M70 grade concrete using manufactured sand are more than the limiting strength values.
- The specific gravity of manufactured sand with dust and without dust is 2.23 and 2.74 respectively which is responsible for compressive strength of concrete.
- By using IS 10262:2009, mix combinations are prepared for M70 grade concrete having varying w/b ratio as 0.30, 0.28 & 0.27, SF(10%, 12% and 14%) and SP(1.0%, 1.2% and 1.4%).
- The maximum compressive strength obtained for w/b ratio - 0.27, 10% SF and 1.2% SP proportion is 79.56 N/mm^2.
- Optimum mix proportion of M70 grade concrete is obtained for w/b ratio - 0.27, 10% SF and 1.2% SP.
- It is possible to achieve the compressive strength of HSC up to M70 grade using manufactured sand, by following the IS10262:2009 code specifications

7. REFERENCES

[1]. **B.Krishna Kumari Bai and M.Kanta Rao,** Strength And Durability Properties of High Performance Concrete Incorporating Silica Fume And Fly Ash, International Journal of Engineering Sciences & Emerging Technologies, July 2015, Volume 8, Issue 1, pp: 23-29 ©IJESET, ISSN: 22316604.

[2]. **M.Mazloom a, A.A. Ramezanianpour** Effect of silica fume on mechanical properties of high-strength concrete, Cement & Concrete Composites 26 (2004) 347–357, Elsevier publication.

[3].**P.Vinayagam,** Experimental Investigation on High Performance Concrete Using Silica Fume and Super plasticizer, Vol. 1, No. 2, July 2012, International Journal of Computer and Communication Engineering

[4]. Bureau of Indian Standards **IS 10262:2009**

[5]. Bureau of Indian Standards **IS 456:2000**