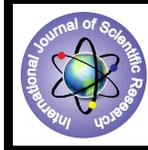


Experimental Investigation on Concrete Strength By Replacing Cement Sand and Coarse Aggregate With Different Substitutes



Engineering

KEYWORDS : Silica Fumes - black sand (fine aggregate) - tiles powder - crush tiles - compressive strength

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ABSTRACT

A lot of study is carried out on the concrete by different students and research scholars by replacing one or two ingredients of concrete, but very less study is noticed on the concrete by replacing all the ingredients of it, hence out of inspiration the authors have taken up the study under consideration. A brief study on the suitability of using silica fume, tiles powder and waste crush tiles as partial replacement for cement, fine aggregate and coarse aggregate respectively in concrete work has been carried out. A brief study has been carried out on concrete by partially replacement of cement by silica fume at about 8%. Tiles powder as fine aggregate at about 10% to black sand and waste crushed tiles as coarse aggregate at about 20% respectively. In this experiment compressive strength test has been conducted on sample. Results obtained were quite satisfactory with no compromise in strength requirements for M15, M25 M30 grade concrete. Also a normal concrete is cast by using conventional ingredients with locally available materials. And comparative study has been done between normal concrete and concrete cast by replacing various ingredients.

I. Introduction

Concrete is widely used in construction of buildings, bridges and other structures but now a days scarcity in aggregate creates a problem and rising the cost of aggregate, due to this heavy cost of materials civil engineers are trying to find the cheapest way for construction. So, we have to search for different materials to reduce the quantity of basic natural materials, in the concrete mix without changing any mix design procedure and considerations. Use of cheaper material without loss of performance is very crucial to the growth of developing countries. We cannot replace the whole basic material in the concrete, but we can replace with other materials to some extent. we can replacing the basic materials of concrete to some extent by the waste materials which are locally available like silica fume, waste tiles, demolition building materials, waste marble, by product etc which is a best method of disposing the waste materials. in this experiment we are using, silica fumes which is a by-product of silicon alloy manufacture, disposed ceramic tiles powder and waste ceramic crushed tiles. This study is concentrated mainly on low cost, easily available and high strength materials that possess the properties of materials used for concrete. are chosen to partially replace the basic materials of concrete. in this experimental study pozzolana portland cement is used and black sand is also used as a fine aggregate by casting the 12 cubes of 15cm x 15cm x 15cm, cement is partially replaced by silica fume at the rate of 8% , fine aggregate

(black sand) is partially replaced by waste ceramic tiles powder at the rate of 10% and coarse aggregate is partially replaced by waste ceramic crushed tiles at the rate of 20% due to this waste tiles workability of concrete is increase. Concrete mix for M15, M25, M30 grade is prepared with a water cement ratio of 0.50 and placed in mould for cubes of size 15cm x 15cm x 15cm in a fresh state. slump cone test and compaction factor test have been conducted. compressive strength test have been done on specimen in hardened state at 3, 7, 21 and 28 days by using of silica fume and waste tiles in a concrete has positively affect the compressive strength properties of concrete, increase the workability and reducing the cost.

II. Utilization of materials

A. Cement : The pozzolana Portland cement of 53 grade is used whose specific gravity is 2.9.

B. Silica fume : silica fume is a byproduct of silicon alloy and it is obtained from Mumbai. it is partially replace by cement whose specific gravity of silica fume is 2.29 .

C. Fine aggregate : black sand is used as a fine aggregate specific gravity of black is 2.81.

D. Waste tiles powder : waste tiles powder is use as a fine aggregate by partially replacement of fine aggregate. Specific gravity of tiles powder is 2.33 and Water absorption value is 2.44

E. coarse aggregate: coarse aggregate is used in this experiment under 20mm down size specific gravity of coarse aggregate is 2.74. impact value is 20.55%.

F. waste crushed tiles : waste crushed tiles are used as a partially replacement of coarse aggregate at the rate of 10% 20% 30%. specific gravity of crushed tiles is 2.39

III. MIX DESIGN

M15, M25, M30 grade of concrete was designed by following the specification given in the IS 10262: 2009. Water - Cement ratio (w/c) was selected as 0.45, 0.50, 0.55 based on conducting slump tests for different design trails. Mix proportion obtained for M15 mix is 1: 2.02 : 3.30, M25 mix is 1: 1.76 :3, M30 mix is 1: 1.51: 2.68.

IV RESULTS AND DISCUSSION

By using the different quantity of water content total 9 types of mixes were made for casting the cubes of concrete for determining the compressive strength of design mix specimen by replacing of cement with silica fume, fine aggregate with ceramic tiles powder and coarse aggregate with waste crushed tiles partially shown in table 1. For M15, M25, M30 design mix

TABLE 1 showing different percentage replacement

MIX	% of cement		% of fine aggregate		% of coarse aggregate	
	Cement	Silica fume	FA	tiles Powder	C.A	Crushed tiles
A0	100	00	100	00	100	00
M15	92	08	90	10	80	20
M25	92	08	90	10	80	20
M30	92	08	90	10	80	20

Before the casting it is necessary to fix the nominal water content by performing the slump cone test by different water content i.e 0.45,0.5,0.55. if the slump cone gets the true slump value it is very optimum water content for casting the cubes.

Workability:

Slump cone test was performed on fresh concrete, for all mixes having different percentages of replacing materials which are shown in Table 1 (A0 to A3). The slump value for different mixes are obtained as follows.

Table 2 showing slump values

MIX	% of REPLACING OF SILICA FUME	% OF REPLACING OF FA	% OF REPLACING OF C.A	SLUMPmm
A0	00	00	00	100
M15	8	10	20	95
M25	8	10	20	88
M30	8	10	20	80

TABLE. 2. Shows slump variation for different mixes. Slump values are not changing when silica fume is replaced in place of coarse aggregate waste crushed tiles are replaced in place of coarse aggregate. But, increase in percentage of tile powder in place of fine aggregate leads to the increase in slump value. From TABLE 2. Clearly observe that the workability is increasing for all mixes at different percentages of replacing materials. There is a huge change in slump value when only tile powder was replaced in place of fine aggregate. So, here tile powder is acting like admixtures, which are used to produce RMC mix

ii. Compressive Strength:

The compressive strength test is determined by using the compressive testing machine at 3, 7, 21 and 28 days on the concrete design specimen 4 cubes are casting.3 sample from each from each mix were tested and average of this mix is taken as compressive strength value of each mix. The compressive results are in N/mm². strength results are as follows

mix	% of replacing of silica fume	% of replacing FA	% of replacing of C.A	3 DAYS	7 DAYS	21 DAYS	28 DAYS
A ₀	00	00	00	8.74	14.13	18.93	21.13
M15	8	10	20	9.31	15.12	20.94	23.04
AO ₁	00	00	00	13.60	21.83	29.75	33.01
M25	8	10	20	13.95	22.66	31.38	34.52
AO ₂	00	00	00	16.30	25.57	35.13	38.27
M30	8	10	20	17.43	27.09	37.50	40.23

From above table it is clear that the use silica fume at about 8%, waste tile powder at about 10% and waste crushed tiles at about 20 %. gives a optimum result shown in table.

V. CONCLUSION

After completion of project we conclude that silica fume can be used in place of cement as a partial replacement in concrete. but we have to used silica fume in a limit for compressive strength value. Because silica fume gives a optimum result when it is use at about 8% to 10%, it increased the workability of concrete but require more time to set.

Waste tiles powder can be used in place of fine aggregate partially, it increase the workability of concrete but it does not get true slump value when it use in a beyond the limits. There are minor workability when crushed tiles are used in place of coarse aggregate.

The compressive strength of concrete has increased compared to normal concrete in all the three types of concretes, especially in M25 grade of concrete increment is noticed highest, therefore authors concludes that replacement of cement by silica fume, replacement of fine aggregate by waste ceramic tile powder, and coarse aggregates by waste tiles chips is advantageous in concrete technology and this type of concrete can be used in structures.

REFERENCES:

- [1] IS 10262-2009 : Indian Standard "Guidelines for concrete mix design proportioning" - code of practice
- [2] Sensale GR., Strength development of concrete with rice husk ash, Cement and Concrete Composites,28(2), 2006, 158-160
- [3] Mohammad IqbalKhana and RafatSiddiqueb, Utilization of silica fume in concrete: Review of durability properties, Resources, Conservation and Recycling, 2011, 57, 30-
- [4] Dayalan, J, Beulah, M, "Effect of Waste Materials in partial replacement of cement fine aggregate and coarse aggregate in concrete", International Journal of Inventive Engineering and sciences, ISSN:2319-9598, Issue-4, March 2014
- [5] Zeena Adel Mohammed, "Effect of partial replacement of fine aggregate on some engineering properties of concrete"
- [6] Lalji Prajapati, N. patel, V.V. Agarwal, "Analysis of The Strength And Durability Of The Concrete With Partially Replaced By The Ceramic Slurry Waste Powder", International Journal of EmergingTechnology and Advanced Engineering, ISSN 2250-2459, Volume4, Issue 3, March 2014