Research Paper Engineering

Strength Suitability Study of Silica Fume Cum Waste Ceramic Tiles Added Concrete

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ABSTRACT

Basic material of concrete becoming costly and scarce day by day, to prevent this cost and scarcity of concrete materials, there is a need to use the waste materials in concrete by partially replacing the basic materials of concrete due this reuse of waste materials construction become safe and environmental friendly. In this experimental study authors we have used the silica fume partially replacing to cement at the rate of 6%, waste tiles powder to fine aggregate at the rate of 5%, and waste crushed tiles chips to coarse aggregate at the rate of 10%. The main motive of this experimental study is to serve the purpose of encouraging housing developers in investing these materials in house construction. By using of these waste materials as they are affecting in the strength development and cost saving to a great extent beside having so many other advantages. Absolutely these waste materials effects on properties of concrete positively. Compressive strength value is determined in this experimental study to ascertain the usage.

KEYWORDS : Waste crushed tiles, silica fume, fine aggregate(black sand)

Introduction

During the last three decades, great strides have been taken in improving the performance of concrete as a construction material concrete is back bone of construction materials.concrete is used in all over the world but due to scarcity and increasing cost of it. it is create lot of problems.waste materials are very harmfull to enviroment when it disposed off. so engineers are going to examine by partially replacing the basic materials of concrete by waste materials from industries and household. silica fume is a by product of slicon alloy. The ceramic waste from ceramic and construction industries is a major contribute to construction and demolition waste, representing a serious environmental, technical and economical problem of society nowadays. The major sources of ceramic waste are ceramic industry, building construction and building demolition. It has been estimated that about 30% of the daily production in the ceramic industry goes to waste. This waste is not recycled in any form at present. However, the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces.in this experiment we are replacing the cement partially by silica fume at the rate of 6%, pozzolana portland cement is use of 53 grade, fine aggregate are partially replacing by waste ceramic tile powder at the rate of 5% black sand are use as a fine aggregate and coarse aggregate are partially repalce by waste crushed tiles at the rate of 10% . Concrete mix for M15, M25, M30 grade is prepared with a water cement ratio of 0.45,0.50 0.55 and placed in moulds for cubes of size 150 mm x 150mm x150mm.12 cubes are casting for design mix. compressive strength value are determined on the cubes at 3, 7,21 and 28 days.

II. MATERIALS USED

A. Cement:

The pozzolana Portland cement of 53 grade whose specific gravity of cement is 2.90, normal consistency of the cement was found as 28% and the initial and final setting times were found as 120 min and 240 min respectivelywas used.

B.Silica fume :

silica fume is a by product of silicon alloy and it is obtained from Mumbai it is partially replacement specific gravity of silica fume is 2.29

C. Coarse aggregate:

The coarse aggregate with 20 mm nominal size having specific gravity 2.74 was used.

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

E. Crushed Tiles:

Broken tiles were collected from the solid waste of ceramic manufacturing unit. Crushed them into small pieces by manually and by using crusher. And separated the coarse material to use them as partial replacement to the natural coarse aggregate. Specific gravity of the crushed waste tiles is 2.39.

F. Tiles powder:

From the crushed waste tiles, powder passed through 4.75 mm IS sieve to use as partial replacement to the fine aggregate. Specific gravityof tile powder is 2.68.

III. MIX SELECTION

In order to cast the cubes for determining the compressive strength value of M15, M25 and M30 grade of concrete was designed by following steps given in the code book 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 : 3.3, M25 is 1:1.76:3, M30 is 1:1.512.68

IV. EXPERIMENTAL EXAMINATION

Total 9 type of mixes were prepared by partially replacing the basic materials of concrete. silica fume are replaced by cement partially, waste tiles powder are partially replaced by fine aggregate and waste crushed tiles are partially replaced by coarse aggregate the 12 cubes are cast of 150mm x 150mm x 150mm

V. SLUMP CONE

slump cone test are conduct before the casting to select the optimum water content in fresh state.slump cone test is used to determine the workability of fresh concrete. the apparatus used for doing slump test are slump cone and tamping rod.

Table 1: table showing the values of slump for different grades of concrete

mix	% replacement of silica fume	% 0f replacing fine aggregate	% replacing of coarse aggregate	Slump (mm)
A0	0	00	00	100
M15	6	5	10	88
M25	6	5	10	83
M30	6	5	10	73

VI. COMPRESSIVE STRENGTH

Table 2: compressive strength development of different concrete mix in N/mm2

Mix	cement content (% of silica fume content)	fine aggregate content(% of ceramic powder content)	coarse aggregate content (% of crushed tiles content)	3 days	7 days	21 days	28 days
A0	00	00	00	8.74	14.13	18.77	21.68
M15	6	5	10	7.89	12.82	17.72	19.52
A1	00	00	00	13.6	21.53	29.158	33.48
M25	6	5	10	12.07	19.64	27.15	29.83
A2	00	00	00	16.43	25.77	35.88	38.87
M30	6	5	10	14.97	24.32	33.68	36.63

it is the capacity of material or structure to withstand loads tending to reduce size, as opposed to tensile strenght, which withstands loads tending to elongate. out of many test applied to concrete this is the utmost important test which gives an idea about important characteristics of concrete by this single test one judge that whether concreting has been done properly or not. for cube test of specimens cubes of size 150mm x 150mm x 150mm have been done. these specimens are tested by compression testing machine after 3,7,28 days of curing. load should be applied gradually at rate of 140kg/cm^2 per minute till the specimen fails. Compressive strength determines by load at failure divide by area of specimen.

VII. TEST RESULTS AND DISCUSSIONS

A. Fresh State

1) Mix Character: Due to superfine nature of SF particles, SF concrete has shown more cohesiveness than standard pozzolana Portland cement concrete. All the mixes have exhibited satisfactory character in relation to segregation and bleeding. But with the increase in percentage of SF, the stickiness in concrete was observed. 2) Workability*:* In all the mix, the compacting factor, i.e, workability increases as percentage of SF is increased from 6%8% till 10%. SF concrete is just as susceptible to poor workmanship as ordinary concrete and all normal site operations should be performed to the optimum requirements

VIII. conclusion:

1. After completing all the experimental programme we suggest that crushed tiles can be used in place of fine aggregate and coarse aggregate for manufacturing of concrete and it can be used as structural concrete.
2. By using tile powder in place of fine aggregate leads to increase in workability of concrete.
3. Tile powder act as admixture in concrete, which can be used in ready mix concrete (RMC).
4. Ceramic waste can effectively be used as alternative & supplementary materials in concrete.
5. From the study it can be concluded that increasing the tile chips percentage more than 30% decreases the strength of concrete.
6. At 6% silica fume replacement the strength of the concrete is decreasing compared to normal concrete but still it is not very less hence authors feel that this type of concrete can be used for structural construction.

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