Partial Replacement of Cement in Solid Block by Silico Manganese Dust

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***Abstract*- Increase in industrial waste, increases threat to our society. It is very essential to dispose these wastes safely without effecting the sustainable environment. A manganese manufacturing industry produces a large amount of waste. This non-degradable refusal creates problem to our environment. We use this waste for casting solid blocks. This report deals with the partial replacement of cement by Silico Manganese dust in various percentages and finding the optimum percentage of Silico Manganese dust. This Silico Manganese dust is used as a component in solid concrete block and the compressive strength, water absorption and block density is studied.**

***Index terms*- Silico Manganese dust, Concrete Blocks, Compression Test, Block Density, Water Absorption**

I.INTRODUCTION

A concrete block is primarily used as a building material. It is a standard size rectangular blocks and are larger than brick masonry. Concrete blocks are manufactured in required shape and sizes and these may be solids or hollow blocks. Cement, aggregate, water is used to prepare concrete blocks. The cement aggregate ratio in concrete block is 1:6.

Aggregate used is of 60% fine aggregate and 40% coarse aggregate. The solid concrete blocks are used as load bearing units and shall have a block density not less than 1800 kg/m3. They are available in large sizes compared to bricks and the normal size of the block is 300 x 150 x 150 mm [IS: 2185(Part 1)-2005].

II. OBJECTIVES

The following are the objectives of the work:

1. To make high strength solid concrete block by partial replacement of cement with Silico Manganese dust.
2. Waste management of Silico Manganese dust by incorporating it with concrete block and produce low cost building blocks.

III. MATERIAL COLLECTION

The main material used in the study of solid concrete block are cement, fine aggregate, coarse aggregate, Silico Manganese dust. Silico Manganese dust are collected from various manganese manufacturing unit and are transported to laboratory. Silico Manganese dust is an industrial by-product obtained from the arc-furnace while extracting manganese from its ore. Silico Manganese dust waste is obtained from the production of ultra low carbon Silico Manganese .It has more binding property than cement. It is a very fine pozzolonic material produced during the manufacture of manganese by electric arc furnace. The manganese dust is formed when MnO gas produced in the furnace mixes with oxygen, oxidizes to MnO2. It condenses and forms manganese which is the major part of the smoke. These smokes are collected in a bag. The smoke collected in the bag is very fine and is called as manganese dioxide dust.

IV. PROPERTIES

In the following table the physical and chemical properties of Silico Manganese dust and cement are given. It is determined by conducting various tests on both cement and Silico Manganese dust.

TABLE I - Physical Properties of Cement and Silico Manganese Dust

Test	Result of Cement	Result of Silico Manganese dust
Fineness test	4.83%	3.91%
Normal consistency	33%	34%

Initial setting time	32min	20min
Specific gravity	2.89	4.58

TABLE II - Chemical Properties of Cement and Silico Manganese Dust

Content	Silico Manganese dust	Cement
Magnesia	1484 ppm	1000-4000 ppm
Iron	4963 ppm	5000-60000 ppm
SiO_2	92670.4 ppm	170000-250000 ppm
Lime	134896.7 ppm	620000-670000 ppm

V. TRAIL CASTING

TABLE III - 7 Days and 28 Days Compressive Strength for Various Percentage of Replacement

Percentage Replacement	7 Days Average Compressive Strength at Failure(N/mm^2)	28DaysAverage Compressive Strength at Failure(N/mm^2)
5%	7.03	10.60
10%	7.62	12.07
15%	7.84	12.51
20%	9.18	13.85
30%	7.70	12.58
40%	6.74	11.62
50%	5.77	9.40

The cubes of size 15 x 15 x 15 cm where casted in the mix ratio 1:3:6 (M 10) using 43 grade cement, M Sand and 6 mm coarse aggregate, slump test is done to obtain the water cement ratio as 0.50. Average compressive strength obtained after 7 days curing is 6.22 N/mm2 and for 28 days curing is 9.62 N/mm2. Hence obtained value is satisfactory

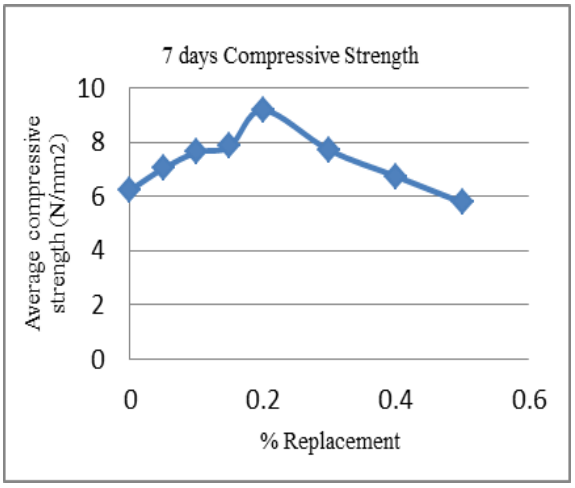

Fig.1 Graph – 7 Days Compressive Strength v/s Percentage Replacement

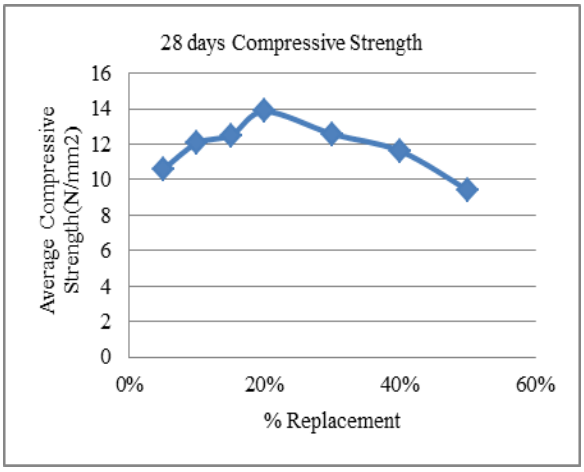

Fig..2 Graph- 28 days Compressive Strength v/s Percentage Replacement

From the results 20% replacement of cement by silico manganese dust is the optimum value, concluded to cast the solid block 20% replacement.

VI - SOLID BLOCKS TEST RESULT

Solid blocks of size 30cm X 15cm X 15cm were casted in the mix ratio 1:3:6 (M10) with the replacement of cement by Silico manganese dust as 20%, the cubes were tested for compressive strength test at 7 days and 28 days, water absorption and block density. Results are as follows:

Compressive strength of solid block with Silico Manganese dust is obtained as 13.33 N/mm2, water absorption is 2.08 and block density is 2196.29 kg/mm3.

TABLE IV - Comparison of Cost

Cost	Solid Block	Solid Block with Silico Manganese Dust
Cement	R.s 777.60	R.s 622.08
Fine aggregate	R.s 468.58	R.s 468.58
Coarse aggregate	R.s 328.86	R.s 328.86
Total cost of 100 blocks	R.s 1575.04	R.s 1419.52

Percentage of saving = 9.87 %.

VI – CONCLUSION

Solid blocks are casted successfully as per the IS code 2185:2005 (part 1) in the mould of size 30cm x 15cm x 15cm.

- Optimum value of cement by Silico Manganese dust was found as 20% through trials. Block density test were satisfactory but percentage of water absorption of solid blocks were found to be high. Hence should use water repelling admixtures to reduce the water absorption.
- Compressive strength of the solid block with Silico Manganese dust was found greater than that of ordinary solid blocks of same size. Compressive strength of ordinary solid blocks were obtained as 9.6 N/mm2 and solid block with Silico Manganese dust were obtained as 10.48 N/mm2.
- Comparison of cost estimation of normal solid blocks with Silico Manganese dust resulted in economical construction. From the result of estimation it was found out that the cost of 100 units of solid block with Silico Manganese dust was only Rs.1419.52 while that of 100 units of normal solid block was found as Rs.1575.04 And in conclusion, masonry of solid block with Silico Manganese dust can be recommended for housing projects as an alternative method that is cheaper than the normal solid blocks.

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