

“Ordinary Concrete Mix Design”using Vitrified Fine Powder, Super Plasticizer and Evaluation of Properties

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Abstract - The vitrified industry inevitably generates wastes, irrespective of the improvements introduced in manufacturing processes. These wastes create a problem in present-day society; require a suitable form of management in order to achieve sustainable development. In this research study the fine aggregate has been replaced by vitrified waste powder accordingly in the range of 0%, 15%, 17%, 19%, 21%, 23%, 25% & 27% by weight for M-25 grade concrete. The wastes employed came from vitrified industry which had been deemed unfit for sale due to a variety of reason, including mechanical defects, or defects in the firing process. The results demonstrate that the use vitrified masonry rubble as active addition endows cement with positive characteristics as key mechanical strength and the economic advantages. Reuse of this kind of waste has advantages financial and eco-friendly, reduction in the number of natural spaces employed as refuse landfills. Indirectly, all the above contributes to a better quality of life for citizens and to introduce the concept of sustainability in the construction sector.

Keywords- Ordinary Concrete, Vitrified Fine Powder, Super Plasticizer, Compressive Strength,

I. INTRODUCTION

Indian ceramic production is 100 million ton per year. In this industry 15% to 30% waste material generates from total production. The waste generates at end process of manufacturing. This material was not recycling in any form at present. This is lead to serious environmental, dust pollution in west area of land. It is dangerous for human health and agricultural. It is necessary to dispose the vitrified waste quickly and use in the construction. This waste is piling up every day; there is pressure on this industry to find solution for the waste. This material use for replacement material offer cost reduction. Advantages of concrete technology we can reduce the consumption of natural resource. This waste material can replaced by cement, fine aggregate and course aggregate etc. In our paperis vitrified fine powder partially replaced with cement in previous. Now we are vitrified fine powder partially replaced with fine aggregate.

II. MATERIAL SPECIFICATION

Table: 1 –Material Specification of Concrete with Vitrified Fine Powder& Super Plasticizer

SR. NO.	Material	Specification
1	Cement	53 grade
2	Coarse Aggregate	20 mm to 4.75 mm
3	Fine Aggregate	4.75mm Sieve Passing
4	W/c Ration	0.44
5	Vitrified fine powder	600 micron passing
6	Super plasticizer	RADWOP AP337
7	Concrete	1:1.15:2.97

Table: 2 – Specific Gravity of Material

SR. NO.	Material	Specific Gravity
1	Cement	3.15
2	Vitrified Waste	3.09
3	Coarse Aggregate	2.86
4	Fine Aggregate	2.55
5	Super Plasticizer	1.16
6	Water	1

Table: 3 – Sieve Analysis

Sr. No.	Sieve Size	Fine Aggregate (% passing)	Coarse Aggregate(% passing)
1	20 mm	-	100
2	12.5 mm	-	97.83
3	10 mm	100	44.16
4	4.75 mm	90.67	2.89
5	2.36 mm	69.41	-
6	1.18 mm	47.41	-
7	600 micron	25.63	-
8	300 micron	2.88	-
9	150 micron	0.48	-

Table: 4 – Mix Proportions by mass (for 1M³ of concrete)

SR. NO.	Specification	Water	Cement	F.A.	C.A.	Super plasticizer
1	Concrete(M25)	191.6 liter	435.4 Kg/m ³	502.34 Kg/m ³	1296.04 Kg/m ³	2.0 % by weight of cement.
		0.44	1	1.15	2.97	

Table: 5 – Concrete Design Mix (M25) Proportion

SR. NO.	Mix Batch	Concrete Design Mix Proportions					% replacement
		Water	Cement	F.A.	C.A.	VFP	
1	B0	191.6	435.4	502.34	1296.04	0	0 %
2	B1	191.6	435.4	426.99	1296.04	75.35	15%
3	B2	191.6	435.4	416.94	1296.04	85.40	17%
4	B3	191.6	435.4	406.90	1296.04	95.44	19%
5	B4	191.6	435.4	396.86	1296.04	105.48	21%
6	B5	191.6	435.4	386.82	1296.04	115.52	23%
7	B6	191.6	435.4	376.78	1296.04	125.56	25%
8	B7	191.6	435.4	366.74	1296.04	135.60	27%

III. MANUFACURING PROCESS

Step 1:Homeworkof Mould: -In order to evaluation and compare compressive strength concrete with partially VFP replaced with fine aggregate, cube of size 150mm x 150mm x 150mm is casted in gunmetal cubes. The cubes were made so as to facilitate to removal of cubed specimen without any damage. Each cube was inspected to prevent any leakage during compaction and that the dimension of the cube was accurate within allowable limits. Before filling the concrete, the cubes were cleaned and the inner surface of the cube was greased to prevent sticking of the concrete to the sides of the cubes.



Figure: - 1.Vitrified Fine Powder (600 micron passing)

Step 2:Collaborating Of Concrete: -All the materials were stored at the room temperature after arrival at the laboratory. Sand and coarse aggregates used for investigational study were well washed to remove all the contaminations and then

allowed to dry. All the materials were poured in the concrete mixture in required proportion by mass batching except water. After 2 to 3 minutes of dry mix of the material, the water of required quantity was added in the mixture by mass and the mix was mixed again for 2 to 3 minutes. The mix was hand mixed and taken for the fresh concrete testing and casting of the specimens. Proper care was also taken that the testing on fresh concrete can be completed within proper time limit.

Step 3: Molding And Curing: -The fresh concrete was then poured in the cube after proper mixing. All the surfaces of the cubes were cleaned using the wire brush each and every time before pouring the concrete. The bolts of the cube were also changed after every four concrete batches to avoid any leak problem. After pouring the concrete in cubes, the cubes were put on the stage vibrator for proper compaction. The vibrator was then stopped and after finishing top surface of cube, the cubes were kept as it is for 24 hours. Care was taken to prevent the humidity vaporization and to maintain the humidity by covering the filled cubes with wet jute/gunny bags. The cubes were then opened next day by taking care that the surface of the concrete should not be disturbed. The samplings were then put for curing in water curing tank inside the laboratory to maintain proper temperature. The curing period was kept 7 to 28 days and for proper curing, the curing tanks were cleaned and water was changed at every 15 days. Concrete derives its strength by the hydration of cement particles. The hydration of cement is a long lasting process. The rate of hydration is fast to start with, but continues over a very long period of time at a decreasing rate. Ambient temperature is very much important in case of curing as hydration is very much affected due to change of this ambient temperature. For that curing tanks are kept inside the laboratory and where direct sun light is not reached. After 7 and 28 days of curing, the samplings were taken out from the curing tank and kept for drying the surfaces at normal temperature. The saturated and surface dry specimens were then taken for testing of hardened concrete.



Figure: -2. Cube Casting



Figure: - 3. Testing Of Concrete Cubes

IV. RESULT AND SUMMARY

Table: 6 –Slump Test and Compressive Strength of Cubes (150*150*150 mm) For M25 Mix at 7, 28 Days

Concrete Type	Average Compressive Strength [N/mm ²]			Slump Test (in mm)
	7 Days	28 Days	% variation with respect to B0 (0%)	
B0 (0%)	23.05	31.73	0	88
B1 (15%)	26.54	33.15	4.47 %	65
B2 (17%)	27.03	34.37	8.32 %	60
B3 (19%)	28.32	34.89	9.95 %	56
B4 (21%)	28.70	36.55	15.19 %	53
B5 (23%)	29.18	37.60	18.49 %	51
B6 (25%)	27.85	35.87	13.11 %	50
B7 (27%)	25.26	32.70	3.05 %	48

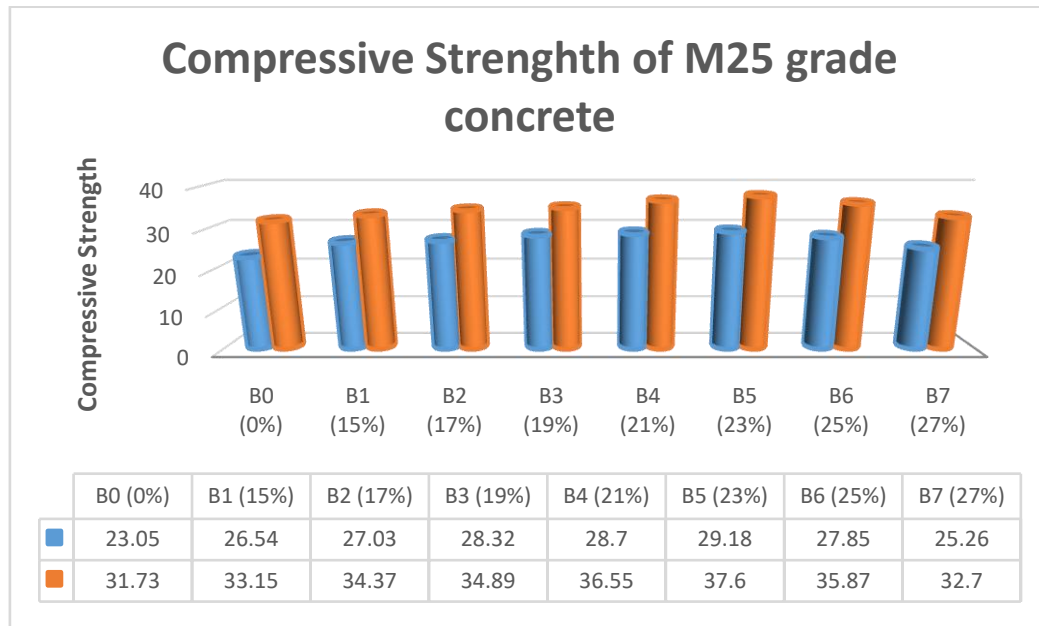


Figure: -4.Day V/S Compressive strength of cube at 7 & 28 Days

CONCLUSION

Based on experimental investigation concerning the compressive strength of concrete, the following observations are made:

- 1) As equaled to conventional concrete, on addition of vitrified fine powder its compressive strength gradually rises up to a certain limit but then gradually falls. The increase in strength of concrete is due to the fact that certain proportions of waste had been added to the concrete as very fine aggregate alternates. This is an expected outcome due to the high specific gravity of vitrified fine powder and also filler effect of vitrified powder because it has finer particles than fine aggregate. It is also possible different solution of safe disposal of vitrified waste.
- 2) The compressive strength have increased with the increase of vitrified fine powder content till 23% additional of fine aggregate and after that there is a decrease in its strength. With the inclusion of vitrified fine powder up to 23%, there is 18.49% increase in compressive strength for 28days curing as equaled to conventional concrete (without vitrified fine powder).
- 3) Consumption of ceramic waste or vitrified powder and its application for the sustainable development of the construction industry is the most effective solution and also speak the high value application of such waste.
- 4) It is the possible unusual solution of safe disposal of the vitrified waste powder thus stepping into scope of solving the environmental pollution by cement production; being one of the primary objectives of Civil Engineers.

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