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Experimental Study on concrete with Partial Replacement of Cement and Fine Aggregate by Fly Ash and Marble Dust

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Abstract- The use of conventional concrete when used in large quantity takes more cost as compared to adapted concrete using the waste marble dust which is found from marble industries and fly ash found from thermal power plant. Also the compressive strength of concrete using marble dust and fly ash increases up to a certain extent which proves to be more economical. Cement is used in construction and it emits CO_2 in very huge amount which is harmful for environment. As the cement content in concrete going to be decrease so the sustainable development of environment takes place which in turn makes effective in terms of health of people.

Keywords: Ordinary Portland Cement, Coarse Aggregate, Fine Aggregate, Fly Ash & Marble Dust**.**

INTRODUCTION

Concrete is a hardened building material the mostly used in construction and it is obtained by mixing cement, water, coarse aggregate, fine aggregate and sometimes admixtures in required proportions. The Ordinary Portland Cement (OPC) is one of the main ingredients used for the manufacture of concrete and has no alternative in the civil construction industry. Unfortunately, manufacture of cement involves emission of large amounts of carbon-dioxide gas into the atmosphere, a major contributor for green house effect and the global warming. G.Latha [7], his study investigated the fresh and hardened properties of concrete when cement was partially replaced by waste marble powder the compressive strength of the concrete increase by 10 to 15%. Prof. P.A Shirule (2012) reported that in addition of 10 % Marble powder increases the split tensile strength up to11.7 % during 28 days. Kartikey (2013) reported that in M15, M20 and M25 replacement of cement by fly ash up to 20% shows greater strength than replacement up to 40% or 60%. Raman (2016) reported that addition of marble powder increases water cement ratio and decreases initial and final setting time.

OBJECTIVE

The objectives of this study are:

1. To compare the change in compressive strength of concrete blocks due to addition of fly ash and marble dust.
2. To calculate the compressive strength behavior of different percentage of Marble Dust, fly ash mix with concrete and at different curing period.
3. To inspect the difference between manufacturing cost of conventional and adapted concrete.
4. Utilization of waste product marble dust and fly ash to reduced pollution and save environment.

MATERIALS

Following material are used in study as under:

Cement

(a) Cement is a binding material which is in gray color.
(b) The cement and water mix in fix proportion form a paste which binds the other materials together as the concrete hardens.
(c) Ordinary Portland cement is most commonly used in construction generally.

(d) For preparation of concrete the ordinary Portland cement are available in different grade like OPC-33, OPC-43 and OPC-53 in the market.

Fly ash

(a) Fly ash is a by-product of the burning of coal in thermal power plants.
(b) The production has increased of Fly Ash up to 900 million tons per year.
(c) When fly ash is using in concrete it reduced bleeding and segregation problem which is generally found in fresh concrete.
(d) When cement is replaced by fly ash it is results in a reduction in the temperature rise in hardened Concrete.

Fine Aggregate (Sand)

(a)The sand used in the concrete work should be according to Indian Standard Specifications IS: 383-1970.
(b) The sand should be sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm.

Coarse Aggregate

(a) The coarse aggregate is the crushed stone which has more compressive strength obtained from rock bed.
(b) The coarse aggregates is retained on IS sieve of 4.75 mm. The shape, size, and composition of coarse aggregate have more significant in workability, durability, shrinkage and strength.

Marble Dust

(a) Marble dust is waste materials which are produced during the process of cutting of marble.
(b) In each year approx 175 million tones of marble dust are produced as waste materials.

METHODOLOGY

Step 1 Problem identification
Step 2 Selection of Material: Cement, Fly ash, Marble Dust, Fine aggregates, Coarse aggregate.
Step 3 Checking physical properties of testing material.
Step 4 Mix Design as per code I.S 10262-2009
Step 5 Selecting different proportion of cementious material.
Step 6 Preparation of concrete cube of sizes 150 mm x 150 mm.
Step 7 Curing of concrete cube blocks.
Step 8 Testing of concrete blocks in compression testing machine or universal testing machine at time interval 7days, 14 days & 28 days.
Step 9 Finally computation of results.

Mix Proportion

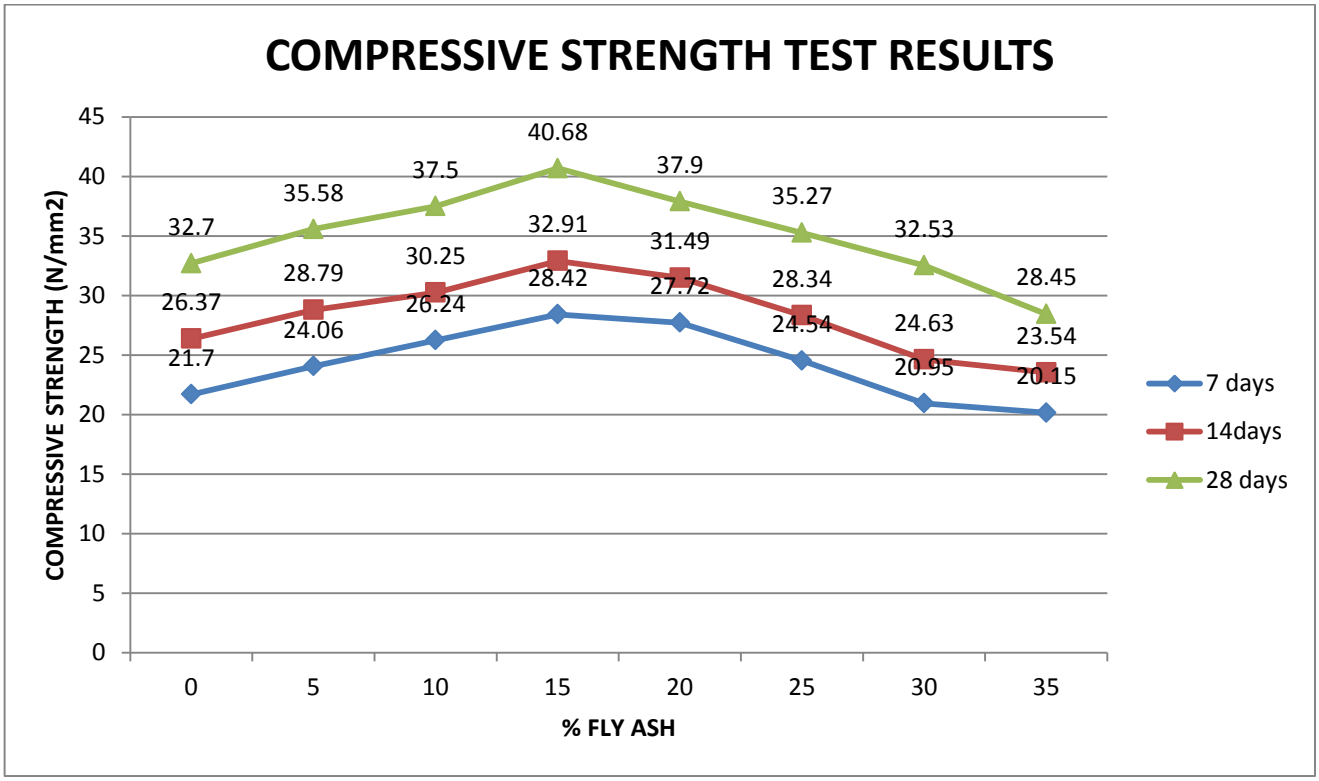
All the cube samples were prepared using design M30 grade of concrete. Mix design was done based on code I.S 10262-2009 & MORT&H. The Table below show mix proportion of M30 (Kg/m^3).

S.No	Materials	Quantity (Kg/m^3)
1	Cement (OPC)	413
2	Fine Aggregate	812.75
3	Course Aggregate	1076.23
4	Water	186

RESULTS

Table 1 :- Compressive Strength of Concrete Cubes with various percentages of Fly Ash.

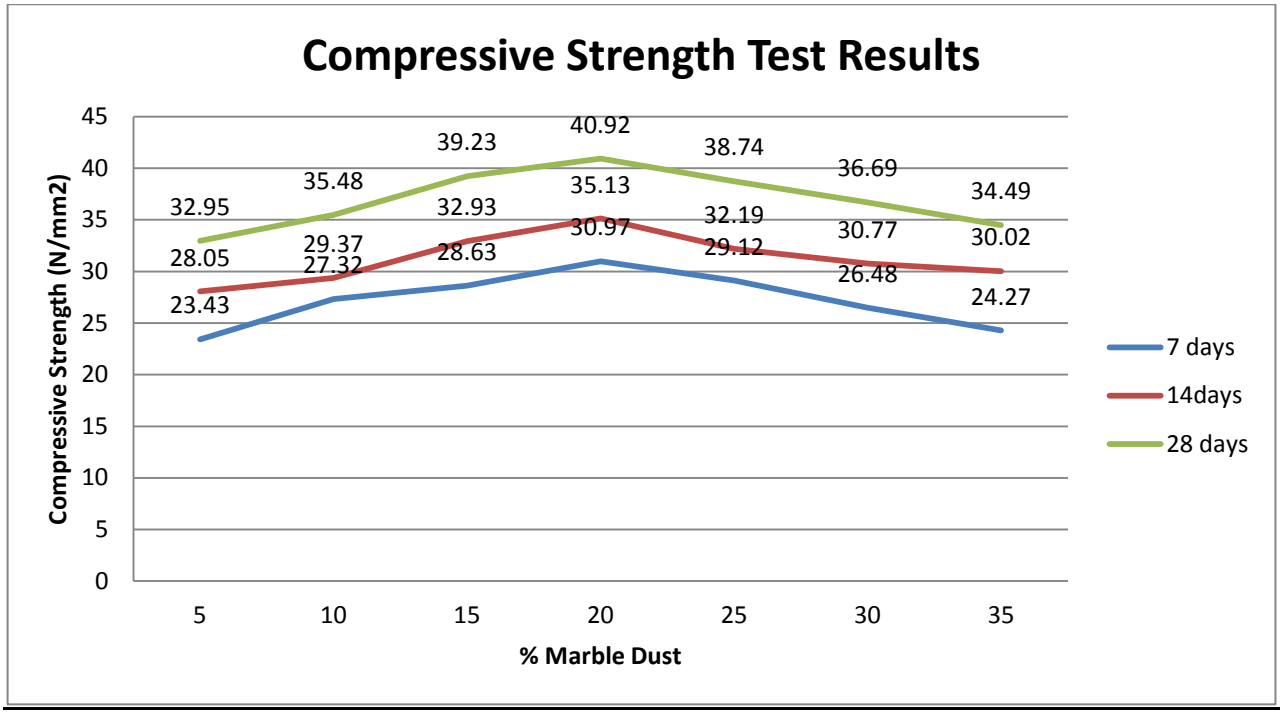
Cube	Cement	Sand	Coarse Aggregate	Fly Ash	W/C Ratio	Compressive Strength N/mm^2		
	(%)	(%)	(%)	(%)		7 days	14days	28 days
Cube1	100	100	100	0	0.45	21.7	26.37	32.7
Cube 2	95	100	100	5	0.45	24.06	28.79	35.58
Cube 3	90	100	100	10	0.45	26.24	30.25	37.5
Cube 4	85	100	100	15	0.45	28.42	32.91	40.68
Cube 5	80	100	100	20	0.45	27.72	31.49	37.9
Cube 6	75	100	100	25	0.45	24.54	28.34	35.27
Cube 7	70	100	100	30	0.45	20.95	24.63	32.53
Cube 8	65	100	100	35	0.45	20.15	23.54	28.45



Graph1:- Compressive Strength of Concrete Cubes with various percentage of Fly Ash

Table 2 :- Compressive Strength of Concrete Cubes with various percentages of Marble Dust.

Cube	Cement	Sand	Coarse Aggregate	Marble Dust	W/C Ratio	Compressive Strength N/mm2		
	(%)	(%)	(%)	(%)		7 days	14days	28 days
Cube 1	100	95	100	5	0.45	23.43	28.05	32.95
Cube 2	100	90	100	10	0.45	27.32	29.37	35.48
Cube 3	100	85	100	15	0.45	28.63	32.93	39.23
Cube 4	100	80	100	20	0.45	30.97	35.13	40.92
Cube 5	100	75	100	25	0.45	29.12	32.19	38.74
Cube 6	100	70	100	30	0.45	26.48	30.77	36.69
Cube 7	100	65	100	35	0.45	24.27	30.02	34.49



Graph2:- Compressive Strength of Concrete Cubes with various percentage of Marble Dust.

CONCLUSION

The Maximum compressive strength 40.68 N/mm^2 is found during test at the addition of 85 percent cement and 15 percent of fly ash. Also found compressive strength 40.92 percent which is maximum when added 20 percent of Marble dusts and 80 percent of sand aggregate. The cost of adapted concrete is 76 Rs per cube (Marble dust) and 76.50 per cube (Fly Ash) which is low as compare to cost of conventional concrete 77.45 Rs per cube. So, the cost of concrete has been cheap as compare to conventional cost. Finally this research can help in decrease the land pollution if we use this type of waste materials in construction.

REFERENCES

1. IS 456:2000 (plain and reinforced concrete).
2. M.S. Shetty "CONTRETE TECHNOLOGY", 3rd Edition, S. Chand & Company Limited, Delhi, 1992.

3. V. Corinaldesi, G. Moriconi, T.R. Naik, Characterization of marble powder for its use in mortar and concrete United States, Construction and Building Materials. 24 (2009) 113–117.
4. M.S. Hameed, A.S.S. Sekar, Properties of green concrete containing quarry rock dust and marble sludge powder as fine aggregate. India, ARPN Journal of Engineering and Applied Sciences 4 (4) (2009) 83–89.
5. IS10262:2009 (concrete mix proportioning– guidelines).
6. SSRG international journal of civil engineering (ssrg-ijce)-volume 3 issue 8- august 16.
7. International journal of engineering trends and technology (ijett)-volume 44 number 5-feb 17.
8. International journal of science technology and engineering |volume 2|issue 6| December 15
9. International research journal of engineering and technology|volume:3 | issue :07| July 16
10. Concrete Engineering, Research Papers
11. Pooja J.Chavhan et al Int. Journal of Engineering Research and Applications 2248-9622, Vol. 4, Issue 4(Version 1), April 2014, pp.377-381
12. International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974

