IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Volume-5, Special Issue-2, Dec 2017 E-ISSN: 2347-2693

# Experimental Investigation on Concrete with Replacement of Cement & Fine Aggregate by Fly Ash & Marble Dust

**Pradeep Kumar Goyal[1], Niraj Kumar[2], Devendra Kumar Sharma[3]**

[1*]Govt. Engineering College, Ajmer
[2]Aryabhatta College of Engineering & Research Center, Ajmer
[3]Aryabhatta College of Engineering & Research Center, Ajmer

**Available online at: www.ijcseonline.org**

***Abstract:-***The use of conservative concrete when used in large volume takes more cost as compared to modified concrete using the waste marble dust and fly ash obtained from thermal power plant. Also the strength of concrete using marble dust and fly ash increases up to a certain extent which proves to be more inexpensive. Cement is used in construction and it emits $CO_2$ in very large amount which damaging 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.

## Objectives

1. To compare the change in compressive strength of concrete blocks due to addition of fly ash and marble dust.
2. To evaluate the compressive strength behavior of different percentage of MD, fly ash and their mix at different curing period.
3. To inspect the difference between manufacturing cost of traditional and modified concrete.
4. Utilization of waste product viz. fly ash and marble dust.

## Literature Review

1. In year 2011, Mr. Mahzuz investigated that use of stone powder in place of sand increases the compressive strength of the concrete by 5 to 10%.
2. In year 2012, Mr. Divakar reported that in M20 replacement of sand up to 35% gives the satisfactory result.
3. In year 2013, Mr. Kartikey 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%.
4. In year 2015, Mr. Gaurav reported that addition of fly ash increases water cement ratio and decreases initial and final setting time.

## Materials Used

**Cement:-**

(a) Cement is a fine gray powder.
(b) The cement and water form a paste which binds the other materials together as the concrete hardens.

 

(c) Generally ordinary Portland cement is most commonly used in construction.
(d) Different grades of ordinary Portland cement OPC-33, OPC-43 and OPC-53 are available in the market and are used for producing concrete.

**Fly ash:-**

(a) Fly ash is a by-product of the combustion of coal in thermal power plants.
(b) Fly ash production has increased up to 900 million tons per year.
(c) Concrete using fly ash is generally reported to show reduced segregation and bleeding.
(d) Replacement of cement by fly ash results in a reduction in the temperature rise in fresh Concrete.

**Fine Aggregate (Sand):-**

(a)The sand used for the work should be conformed 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 crushed stone is generally used as a coarse aggregate.
(b) The aggregates which is retained on IS sieve of 4.75 mm is termed as a coarse aggregate.

**Marble Dust:-**

(a) Marble dust are generated as waste during the process of cutting of marble.
(b) It is estimated that 175 million tons of marble waste are produced each year.

## Methodology

**Step 1** Problem identification
**Step 2** Material Selection: Cement, Marble dust , Fly ash, Fine aggregates, Coarse aggregate.
**Step 3** Checking of physical properties of testing material .
**Step 4** Mix Design
**Step 5** Selecting different proportion of cementious material.
**Step 6** Preparation of concrete blocks.
**Step 7** Curing of concrete blocks.
**Step 8** Testing of concrete blocks.
**Step 9** Reporting of result.

## Mix Proportion

All the samples were prepared using design M30 grade of concrete. Mix design was done based on I.S 10262-2009.The Table below show mix proportion of M30(Kg/m3).

| S.No | Materials | Quantity (Kg/m3 |
|---|---|---|
| 1 | Cement (OPC) | 350 |
| 2 | Fine Aggregate | 812.75 |
| 3 | Course Aggregate | 1076.23 |
| 4 | Water | 186 |

## Results

 

| Cube | Cement | Sand | Coarse Aggregate | Fly Ash | Marble Dust | W/C Ratio | Compressive Strength N/mm2 | | |
|---|---|---|---|---|---|---|---|---|---|
| | (%) | (%) | (%) | (%) | (%) | | 7 days | 14days | 28 days |
| S1 | 100 | 100 | 100 | 0 | 0 | 0.45 | 22.9 | 26.37 | 33.3 |
| S2 | 95 | 100 | 100 | 5 | 0 | 0.45 | 25.04 | 28.79 | 36.29 |
| S3 | 90 | 100 | 100 | 10 | 0 | 0.45 | 26.23 | 30.25 | 38.3 |
| S4 | 85 | 100 | 100 | 15 | 0 | 0.45 | 28.59 | 32.91 | 41.55 |
| S5 | 80 | 100 | 100 | 20 | 0 | 0.45 | 27.83 | 31.49 | 38.8 |
| S6 | 75 | 100 | 100 | 25 | 0 | 0.45 | 24.49 | 28.34 | 36.05 |
| S7 | 70 | 100 | 100 | 30 | 0 | 0.45 | 21.25 | 24.63 | 31.58 |
| S8 | 65 | 100 | 100 | 35 | 0 | 0.45 | 20.15 | 23.54 | 30.31 |
| S9 | 100 | 95 | 100 | 0 | 5 | 0.45 | 24.7 | 28.05 | 34.75 |
| S10 | 100 | 90 | 100 | 0 | 10 | 0.45 | 26.24 | 29.66 | 36.5 |
| S11 | 100 | 85 | 100 | 0 | 15 | 0.45 | 29.35 | 32.93 | 40.1 |
| S12 | 100 | 80 | 100 | 0 | 20 | 0.45 | 31.8 | 35.13 | 41.8 |
| S13 | 100 | 75 | 100 | 0 | 25 | 0.45 | 28.36 | 32.19 | 39.85 |
| S14 | 100 | 70 | 100 | 0 | 30 | 0.45 | 27.5 | 30.77 | 37.32 |
| S15 | 100 | 65 | 100 | 0 | 35 | 0.45 | 25.1 | 30.02 | 35.13 |

## Conclusion

a. At the addition of 85% of cement and 15 % of fly ash maximum compressive strength is obtained i.e., 41.55N/mm$^2$.
b. At the addition of 80% of sand and 20% of marble dust maximum compressive strength is obtained i.e., 41.80 N/mm$^2$.
c. Cost difference b/w Traditional and Modified concrete
   Traditional concrete cost =76.34 Rs/ cube
   Modified concrete by fly ash =75.143 Rs/cube
   Modified concrete by marble dust=74.97 Rs/cube
   So, the cost of concrete has been reduced as compare to traditional cost.
d. Since the waste material has been used in this project investigation can helps in reduction of pollution.

## References

[1]. IS 456:2000 (plain and reinforced concrete).
[2]. IS10262:2009 (concrete mix proportioning– guidelines).
[3]. SSRG international journal of civil engineering (ssrg-ijce)-volume 3 issue 8- august 16.
[4]. International journal of engineering trends and technology (ijett)-volume 44 number 5-feb 17.
[5]. International journal of science technology and engineering |volume 2|issue 6| December 15
[6]. International research journal of engineering and technology|volume:3 | issue :07| July 16

 