



## REPLACEMENT OF SAND WITH FLY ASH

<sup>1</sup>Himanshu chaurasia, <sup>2</sup>Kunal dave, <sup>3</sup>Kunal panchal, <sup>4</sup>Mohit barsiwal, <sup>5</sup>Mayank sisodiya, <sup>6</sup>Kanishk, <sup>7</sup>Sudhir Panwar, <sup>8</sup>Dr.Omprakash Netula

<sup>1,2,3,4,5,6</sup>B-TECH, <sup>7</sup>Assistant professor, <sup>8</sup>Professor & H.O.D

Department of Civil Engineering

Jaipur Engineering College and Research Centre, Jaipur, India

**ABSTRACT:** -The study presented in this chapter shows that the fly ash can partially replace the sand in cement concretes. This type of fly concrete has lower density and manufacturing cost. it reduced coarse aggregate content and increases durability than those of cement concrete. The large production of fly ash in India, which is more than 200 million tons per year at present which could increase to about 900 million tons per year over the next 20 years –need application that consume far more quantities than today’s applications allow. In this FA as substitute material (partial to total) for aggregate system (both fine and coarse) in concrete is attractive.

**Index term:-** Replacement of sand with fly ash, slump test, compression test.

### I.INTRODUCTION

About 100 MT fly ash is generated in India, every year from thermal power plants. To satisfy the growing need for power, more and more Thermal Power plants are required to be set up. This would add nearly double amount of fly ash to the system by 2010 requiring about one lakh acres of land as landfills for fly ash. Good quality natural sand is scarcely available and its sources are limited. Hence, urgent steps must be taken to find environmentally and economically viable alternative for partial replacement of the sand. To reduce the requirement of landfill area and make system more sustainable, it is very important to increase the use of generated fly ash into concrete. Most of the fly ash available in the Nagpur (Vidarbha) region is low lime fly ash but still only about 13% of fly ash is utilised. Major applications are targeted against the use in coal mine filling and in manufacture of fly ash bricks. Low lime fly ash has less than 5 % CaO, and about 70 % of fly ash is occupied by  $(\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$ .  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  react with the free lime available in concrete to form CSH and CAH gel. These gels provide extra cementing

material and also fill the pores in concrete. The reaction between  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  with  $\text{Ca}(\text{OH})_2$  is given below.

$\text{Ca}^{++} + 2(\text{OH})^- + \text{SiO}_2 = \text{CaO} - \text{SiO}_2 - \text{H}_2\text{O}$  (CSH gel) and  $\text{Ca}^{++} + 2(\text{OH})^- + \text{Al}_2\text{O}_3 = \text{CaO} - \text{Al}_2\text{O}_3 - \text{H}_2\text{O}$  (CAH gel)

During the last few years, cement companies have started using fly ash in manufacturing cement, known as ‘Portland Pozzolana Cement’, however in Indian scenario the overall percentage utilization remains very low and most of the fly ash is dumped at landfills. Fly ash is generally used as replacement of cement, as an admixture in concrete and in manufacturing of cement. Concrete containing fly ash as partial replacement of cement poses problems of delayed early strength development. All the previous studies have reported effect of sand replacement by fly ash on concrete and mortar with Ordinary Portland Cement. As Government of India is encouraging the use

of Portland Pozzolana Cement, PPC is used in the present study. Concrete containing fly ash as partial replacement of fine aggregate will have no delayed early strength development, but rather will enhance its strength on long-term basis. Also fine aggregate occupies about 25% to 40% of total volume of concrete, and hence provides great opportunity to utilize the waste materials, like fly ash for replacement in big volumes. The need of fly ash utilization arises out of the fact that good quality natural river sand required in concrete and in the cement mortar is depleting day by day, and scarcity of good quality sand is felt by all metro and mega cities in India for cement mortar and concrete production. Hence, this study explores the possibility of replacing part of fine aggregate with fly ash as a means of incorporating significant amounts of fly ash and reducing the consumption of natural sand.

## II.METHODOLOGY

The test performed are:-

### 3.1 Slump test:

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used an indicator of an improperly mixed batch. The test is popular due to simplicity of apparatus and simple procedure.

### 3.2 Compression test:-

the cube specimen were tested for compressive strength at the end of 7 days and 28 days . the specimen were tested after the surface were dried . the load was applied on the smooth sides without shock and increased continuously until the failure of specimen. The maximum load withstand by the specimen is noted, mean compressive strength is determined.

Compressive strength of concrete depend on many factors such as water cement ratio, cement strength, quality of concrete material, quality control during production of concrete etc. compressive strength of concrete cube test provides an idea about all the characteristics of concrete . by this single test one can judge that whether concreting has been done properly or not. Concrete compressive strength for general construction varies from 15 Mpa to 30 Mpa and higher in commercial and industrial structures.

## III.MATERIAL REQUIRED

TABEL NO :- 1

S.NO	MATERIAL	AMOUNT(in kg)
1	Fly ash	2.82
2	Cement	8.32
3	Sand	11.3
4	Aggregate	26.32

## IV. RESULT

TABLE NO :- 2

S.NO	DAYS	COMPRESSIVE STRENGTH at 28 days (MPA)
1	3	7.2
2	7	14.7
3	28	20.5

3,7, and 28 days of Compressive strength of mortar mixes made with and without fly ash was determined at curing. . From the test results, it could be seen that the compressive strength of fly ash concrete mixes with 20% fine aggregate replacement respectively with fly ash were found to be surprisingly higher than respective control mixes at all ages.

This increase in strength can be attributed to the replacement of fine aggregate with fly ash, which encourages the pozzolanic action and fills gaps between cement and sand. This additional strength allows either reduction of thickness of section of cement mortar or reduction in cement quantity for the same thickness. At the early age, fly ash reacts slowly with calcium hydroxide liberated during hydration of cement, and does not contribute significantly to the densification of the cement mortar matrix. Cement mortar with fly ash shows higher strength at all ages because inclusion of fly ash as partial replacement of sand encouraged pozzolanic action irrespective of its low calcium content at the same time acted as a filler material and dandified the cement mortar.

## V.CONCLUSION

The following conclusions could be drawn from the present investigation.

1. Compressive strength of mortar mixes in which fine aggregate (sand) was replaced by fly ash (by weight) could be higher than the control mortar mixes at all the ages. The difference in strength between the fly ash mortar mixes and control mortar mixes could be more distinct after 28 days. This may produce high strength mortars at lower cost.

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