Replacement Of Cement With Flyash In Concrete

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Abstract- *Fly ash is used as a cementitious material in the concrete. Fly ashes are the waste product of thermal power plant. To fulfill the need pf electricity which produces many tonnes of fly ash. To utilize this waste many scientific experiment are done this. now a day fly ash are used as a cement replacement material in concrete. The fly ash has been used at lands ranging from 10%, 20% & 30% by mass of cementitious material component. Its amount is varied as per specification limit & geographic location & climate. The compressive strength of concrete at different proportions of cement being replaced by fly ash has been checked and result has been found effective and applicable. Hence a comparative study is done and use of fly ash as a cement replacement in concrete can be analyzed 7 compared. This paper studies the variation is compressive strength of different grades of concrete at different percentages of fly ash and at different curing periods.*

Keywords- Concrete, Fly Ash Replacement, Fine Aggregate, Coarse Aggregate, Admixtures.

I. INTRODUCTION

Large quantity of fly ash are available around the world wide atlow cost and the use of high volume fly ash seems to offer thebest solution to rising cement demand fly ash can be used in aconcrete mixture which will be maximize the technical,environmental and economic benefits of fly ash use withoutsignificantly impacting the rate of construction or impairing thelong term performance of the finished product. Many technicsare used to improve quality of fly ash. In this investigation, flyash was used as a mineral admixture which not only improvedthe properties of concrete but also resulted in a reduction in thecost of concrete.

Many experiment are performed on the replacement of cement by Fly ash in the concrete. At each % of replacement of fly ash The compressive strength of concrete block was checked,and each result is effective and applicable. The global demand of concrete is significantly increasing due to its infrastructure growth world wide.

The use of fly ash in the concrete increase the workability of the concrete. In concrete cement can be replaced by Fly ash up to 40-45%.

In India now a days, the concept of smart city is growing very faster. As the main emphasis is on green and sustainable development. Infrastructure is the basic arm and smart material is essential to achieve that feat properly. Smart material is a one which gives better results in low economy. The use of blended cements have shown sharp results in resisting the sulphate attack on concrete. Fly ash which shows pozzolanic properties is being used as a partial replacement in concrete and is produced as a waste material from pulverized coal manufacturing units which is then grinded to the fineness less than that of cement for Hence, there borne a need to carry out an extensive researchoncompressive strength of different gradesof concrete, differentproportions of fly ash and different curing periods. Hence, a comparative study can be done and use of fly ash as a cementreplacement in concrete can be analyzed and comparedthroughvarious methods.

II. LITERATURE REVIEW

Marthong C and AgrawalT.P(2012) [1], have stated that the normal consistency increases with increase in the grade of cement and fly ash content. Setting time and soundness decreases with the increase in grade of cement. Use of fly ash improves the workability of concrete and workability increases with the decreases in the grade of cement. Bleeding in fly ash concrete is significantly reduced and other properties like cohesiveness, pumping characteristics and surface finish are improved.

YashSrivastava and Ketan Bajaj [2] studied the performance of flyash in soil stabilization by replacing itwith different soil for 10 to 60%. His paper also deals with all the hardened properties as compressivestrength and flexural strength of HVFAC through prisms and cubes with 35%,50% and 75% replacementwith flyash. Their result was that up to 50% replacement can be done with overall only 12% increase incost.

P.Kumar Mehta [3]has studied HVFA i.e. using concrete with a replacement of 50% cement throughflyash by mass. He discussed the mechanisms of how incorporation of high volume of flyash improvedworkability, durability, minimized water demand and reduced sulphate attack and minimized cracking. Heclaimed that this technology will definitely help the developing countries like china and India.

Neelesh Kumar Singh, Rohit Kumar Shakya, PreritSaxena, Rishabh Sharma[4],the study emphasized on the replacement of cement by fly ash in 5%, 10%, 15%, 20% ratios. Without using any admixtures, their experiment concluded that 10% fly ash content gives more strength than other ratios. Increase in fly ash content results in lesser strength and more water requirement.

Indrajit Patel and C D Modhera [5] based their experimental work on the effect of polyester fibers in high volume fly ash concrete (HVFA). Trail mix for M25, M30,M35, M40 HVFA concrete were casted with 50,55 and 60% replacement by fly ash. The compressive strength for 0.25% of fiber was tested. It was observed that the 28-day compressive strength for M25 50% fly ash mix increased by 13% after adding fiber to HVFA concrete. For M30, the strength increased by 20%.

For M35 and M40, strength increased by 15%. As the fly ash content was increased from 50% to 60%, there was reduction in strength by 3-5% for all the trail mixes. The strength and slump values for all the mix were within the desired standard limits. The optimum compressive and flexural strength was obtained at 55% replacement of fly ash for plain as well as polyester fiber concrete.

According to **Bendapudi S.C.K and SahaP (2011) [6],** a primary goal is a reduction in the use of Portland cement, which is easily achieved by partially replacing it with various cementitious materials. The best known of such materials is fly ash, a residue of coal combustion, which is an excellent cementitious material. In India alone, we produce about 75 million tons of fly ash per year, the disposal of which has become a serious environmental problem. The effective utilization of fly ash in concrete making is, therefore, attracting serious considerations of concrete technologists and government departments. The new Indian Standard on concrete mix proportions (IS 10262-2009) are already incorporated fly ash as a supplementary material to cement. Fly ash replacement of cement is effective for improving the resistance of concrete to sulfate attack expansion.

UjjwalBhattacharjee et al [7] demonstrated a simple framework for estimating the utilization potential of fly ash in India. The use of fly ash in cement production, road embankment construction, and brick manufacturing has been considered. The results for the projected levels of fly ash utilization show that, despite assuming quite optimistic levels of fly ash, the overall fly ash utilization is less than 25% of the total fly ash produced.

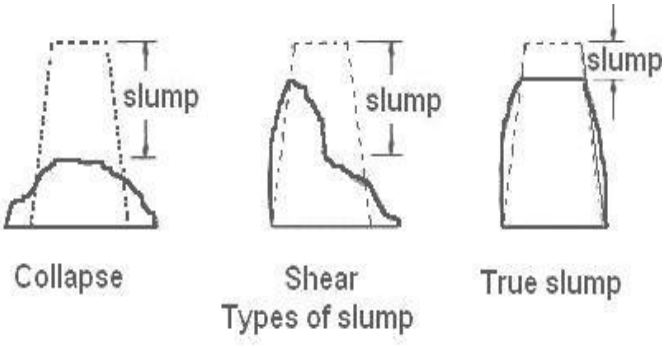
III. METHODOLOGY

TESTS ON CONCRETE

- SLUMP CONE TEST
- COMPACTION FACTOR TEST
- CHARACTERISCTICS COMPRESSIVE STRENTH TEST
- FLEXURAL STRENTH TEST

SLUMP CONE TEST:

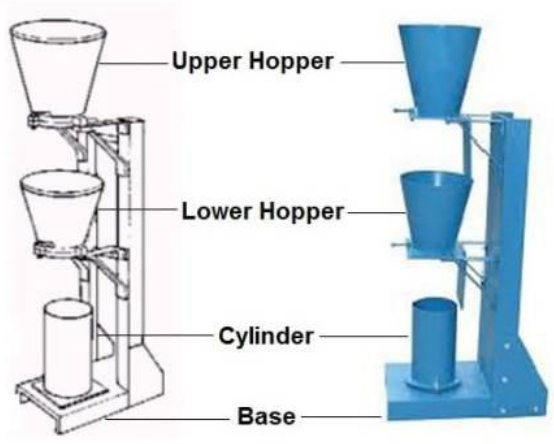
The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch.



COMPACTION FACTOR TEST:

The Compaction factor test is the workability test for concrete conducted in laboratory. The compaction factor is the ratio of weights of partially compacted to fully compacted concrete. It was developed by Road Research Laboratory in United Kingdom and is used to determine the workability of concrete.

The compaction factor test is used for concrete which have low workability for which slump test is not suitablecompacting factor test is intended for use primarily in laboratories, but it can also be used in the field. It is more precise and sensitive than the slump test and is especially useful for very low workability concrete mixes. It is typically used when concrete is to be compacted by vibration.



Compaction Factor Test on Concrete

Apparatus for compaction factor

CHARACTERISCTICS TEST FOR COMPRESSIVE STRENGTH:

According to Indian Standards, the compressive strength of concrete is given in terms of the characteristic compressive strength of 150 mm size cubes tested at 28 days (fck) (ACI standards use cylinder of diameter 150 mm and height 300 mm).The characteristic strength of concrete is defined as the strength below which no more than 5% of the test results are expected to fall.

Characteristic strength of concrete is the strength of concrete specimens casted and tested as per given code of practice and cured for a period of 28 days; 95% of tested cubes should not have a value less than this value.

Compressive strength machine

FLEXURALSTRENTHTEST:

flexural strength is an indirect measure of the tensilestrengthofconcrete.Itisameasureofthemaximumstresson the tension face of an unreinforced concrete beam orslab at the point of failure in bending. It is measured byloading(150x150 x 150) mmconcretebeam with aspanlengthatleastthreetimesthedepth.

Flexural test machine

TESTS OF CEMENT:

Specific Gravity, Finesse Test, Consistency, Initial and Final Setting Time, Compressive Strength and Soundness Test.

IV. RESULT

Concrete cubes of size (150×150x150) mm were casted and Tested forcompressive strength and prism size plate of (100x100x500) mm in normal water of with 10%,20%,30% replacement of fly ash for M35 and M45 grades of concrete.

Percentage (%) of fly ash	Grade M35 (Compressive strength in N/mm^2)		Grade M45 (Compressive strength in N/mm^2)	
	7 days	**28 days**	**7 days**	**28 days**
10	13.5	16.5	28.33	50.54
20	19.2	26.7	29.35	49.35
30	22.22	30.55	22.90	35.03

Table 1: It show the variation in compressive strength in different mixes with respect to curing time for given percentage (10%,20%& 30%) of fly ash.

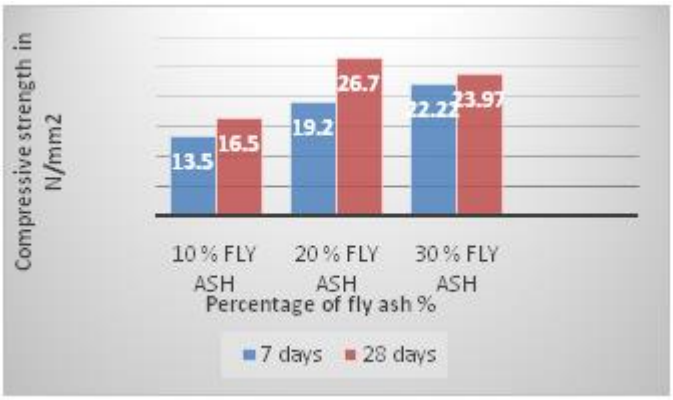


Fig 1 Compressive strength for M35

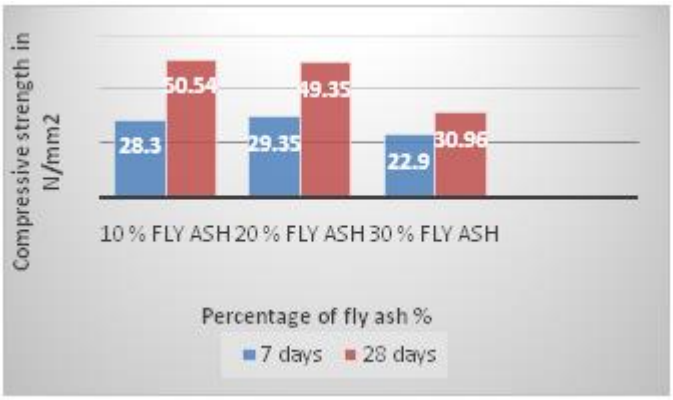


Figure 2 Compressive strength for M45

V. CONCLUSION

- The compressive strength of concrete will decrease when increase in percentage of fly ash.
- The workability of concrete will be upgraded.
- Over all cost is economical.

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