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EFFECTS OF SILICA FUME ON THE PROPERTIES OF CONCRETE

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ABSTRACT - *The use of silica fume in concrete had a major influence on industries. The ability to commercially produce concrete with silica fume of flowable nature but also remain cohesive, which in results produces high early and later age strength and also provide resistance to aggressive environmental condition. This is an experimental study on the nature of silica fume and its effects on the properties of fresh as well as hardened concrete. The partial replacement of cement by using silica fume the strength parameters of concrete have been studied. Firstly the strength parameters of conventional concrete without replacement were studied then strength parameters with partial replacement by silica fume have been studied by placing cubes on compression testing machine (CTM). Silica fume were used to replace cement by 0% to 15% by weight for concrete cubes . The results showed that partial replacement of cement with silica fume had significant effect on the compressive strength of cubes. The compressive strength of concrete increases as we increases the content of silica fume and the optimum value of compressive strength is obtained at replacement of 7.5% and after 7.5% it starts decreasing under the load condition.*

Keywords: Silicafume, cement, Partial replacement, Compressivstrength

1. INTRODUCTION

Concrete is a composite material composed of Portland cement, fine and coarse aggregates mixed with water. It is the construction material used worldwide. Concrete is the only important building material which can be delivered to the job site in the plastic state. This unique quality of concrete makes it desirable as a major building material because it can be moulded to any shape or form.

Concrete provides a wide range in surface textures and colours as well and can be used for construction of wide variety of structures. Other useful major qualities of concrete as a building material include its strength, durability and economy depending on the materials used in the mixture. Two of the major components of concrete are cement paste 25% and aggregates 75% both by volume. The first one consists of cement and water while the second is usually composed of fine and coarse aggregates. Silica Fume is a highly efficient pozzolanic material having greater fineness and surface area compare to that of cement. Silica fume is ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of particles spherical in shape with average particle diameter of 0.1 micron. The use of silica fume as a pozzolana in concrete has increased worldwide over the past few years because when it is used properly, it can enhance various properties of concrete both in the fresh as well as in hardened state.

2. MATERIALS

Portland cement- Portland cement referred as (Ordinary Portland Cement) is the most important type of cement and is a fine powder produced by grinding Portland cement clinker. The OPC is classified into three grades, namely 33 Grade, 43 Grade, 53 Grade depending upon the strength of 28 days. The cement as determined from various tests conforming to Indian Standard IS

Silica fume- Silica fume also known as micro silica is an amorphous (non-crystalline) polymorph of silicon dioxide. It is an ultrafine powder collected at the time of production of the silicon and ferrosilicon alloy as a by-product. It is extremely fine particles with size less than 1 micron and having an average diameter of about 0.1 microns, which is about 100 times smaller than average cement particles.

Coarse aggregate-

The aggregate which is retained over IS Sieve 4.75 mm is termed as coarse aggregate.

Aggregates constitutes the bulk of a concrete mixture and the dimensional stability of concrete is given by aggregate. The 75% of the body of the concrete is provided by aggregates and hence its influence is very important. Therefore they should meet certain requirements for the concrete to be strong, workable, durable and economical. The aggregates used must be in proper shape and size also it should be hard, strong and well graded.

Fine aggregate-

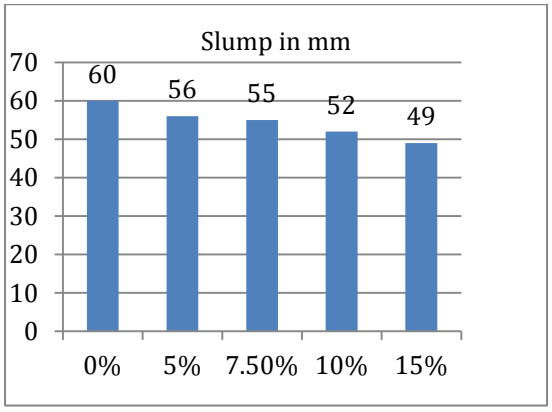
Fine Aggregates are the aggregates most of which pass through 4.75 mm IS sieve. According to size, the fine aggregate may be described as fine, medium and coarse sands.

3. RESULTS AND DISCUSSIONS

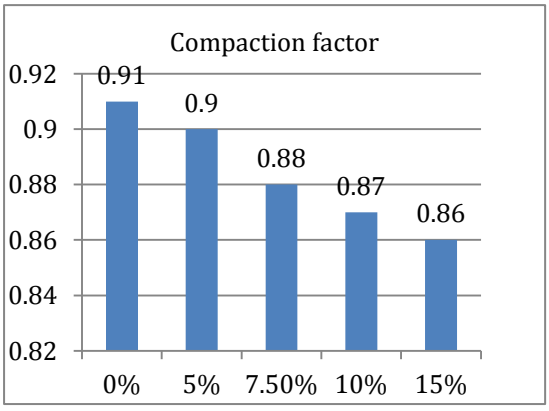
The presentation of results obtained from various tests conducted on concrete specimens cast with and without silica fume are shown here.

The experiment was setup to know the effects of silica fume on workability & compressive strength of concrete. This experiment program is done by casting of concrete cubes, curing and testing of silica fume concrete specimen at different ages

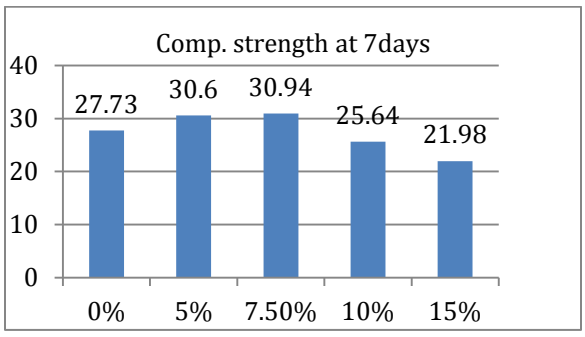
Results for concrete with w/c0.45



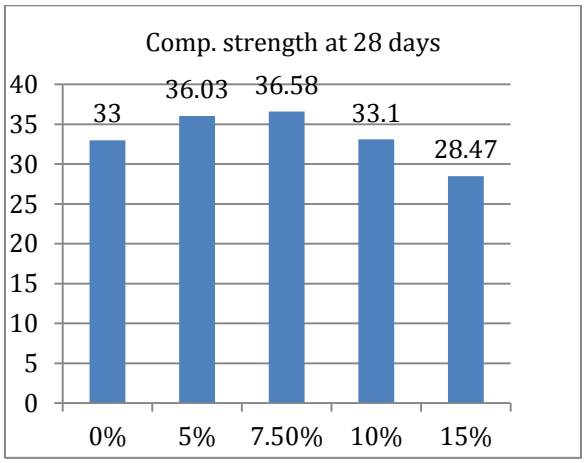
Graph 1 slump values



Graph 2 compaction factor

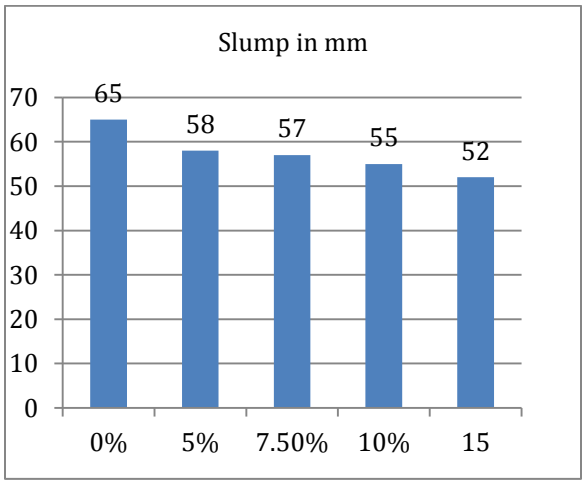


Graph 3Compressive strength at 7 days in Mpa

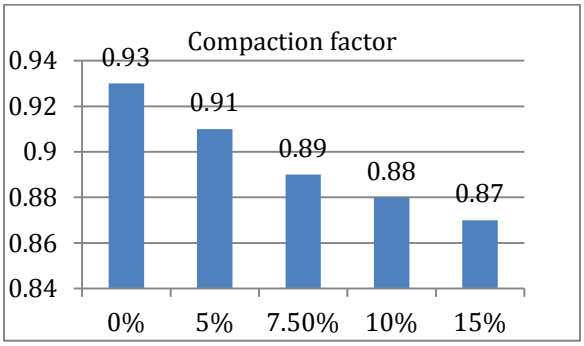


Graph 4Compressive strength at 28 days in Mpa

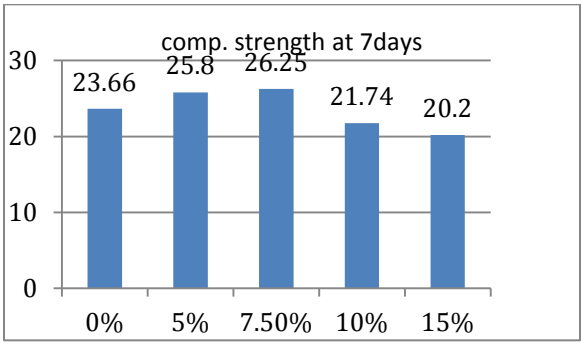
Results for concrete with w/c0.45



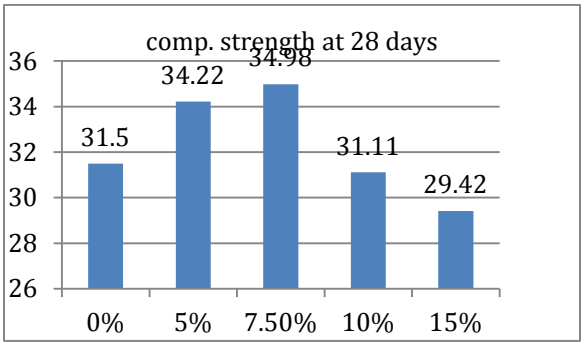
Graph 5 slump values



Graph 6 compaction factor



Graph 7 Compressive strength at 7 days in Mpa



Graph 8 compressive strength at 28 days in Mpa

4. CONCLUSION

After adding 7.5% silica fume in the mix, there is an increase in the strength of cube after 7 days and 28 days as compared to concrete without replacement. The Compressive strength of silica fume concrete increases with increase in percentages of silica fume in the mix and then decreases after reaching 7.5% replacement. The optimum strength of cube is gain at 7.5% replacement for all 7 and 28 days. For w/c 0.45 the compressive strength at 7days is 11.5 % and 28 days is 10.8% more than compressive strength of conventional concrete. For w/c 0.5 the compressive strength at 7days is nearly 11 % and 28 days is also 11% more than compressive strength of conventional concrete.

The addition of Silica fume reduces the property of bleeding because the free water available is used for wetting the large surface area of the silica fume and hence the free water left in the mix also decreases. With increasing the cement replacement by silica fume the workability decreases because of the stickyness and cohesiveness in the mix.

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