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EXPERIMENTAL STUDY ON THE BEHAVIOUR OF RC COLUMN USING SILICA FUME CONCRETE.

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Abstract:

Silica fume (SF) is a by-product derived from production of elemental silicon or alloys containing silicon and consists of a non-crystalline silica dust formed during oxidation of SiO vapor, which is primarily collected in bag house filters of electric arc furnaces. Silica fume consists of the fine particles with specific surface about six times of cement because its particles are very finer than cement particles. Hence, it has been found that when silica fume mixes with concrete the minute pore spaces decreases. Silica fume is pozzolanic, because it is reactive, like volcanic ash. Its effects are relate to the strength, modulus, ductility, sound absorption, vibration damping capacity, abrasion resistance, air void content, bonding strength. With reinforcing steel, shrinkage, permeability, chemical attack resistance, alkali-silica reactivity reduction, creep rate, corrosion resistance of embedded steel reinforcement.

Keywords: Silica fume, Chemical resistance, Reactivity reduction.

1. INTRODUCTION

In this investigation concrete is manufactured by usual ingredients cement; fine aggregate, coarse aggregate, water and mineral admixtures such as Silica fumes (SF) at various replacement levels. The study is to investigate the effects of binder systems containing different levels of silica fumes on time-dependent behavior of reinforced concrete columns. The total strain of concrete columns decreases at higher silica fumes replacement levels. Silica fume concrete (SFC) is used for concrete mixtures, which possess workability, strength, and high modulus of elasticity, high density, high dimensional stability, low permeability and resistance to chemical attack. The addition of silica fume (SF) has proved to improve both the compressive strength and durability of concrete. Also the presence of this admixture has been shown effective in increasing the electrical resistivity and the durability of concrete exposed to aggressive conditions like chloride containing environments.

The Silica fume can produce both chemical and physical effects, which cause meaningful changes in the microstructure of concrete, diminishing its permeability and improving its strength. It has been shown that the physical effect of Silica fume, at 7 days, has an influence on compressive strength. At 28days, both chemical and physical effects are significant. One of the most important characteristics of Silica fume in

this application is its small particle size, which is much smaller than anhydrous cement particles, with sizes of approximately 0.1–0.5 μ m and specific surface area of approximately 20000 m²-kg. Strength concrete refers to concrete that has a uniaxial compressive strength greater than the normal strength concrete obtained in a particular region. Strength concrete means good abrasion, impact and cavitations resistance. Using strength concrete in structures today would result in economic advantages. A scanning electron microscope (SEM) analysis of 16 years old concrete with addition of Silica fume shows that the microstructure of this material is more homogeneous and dense than the concrete without Silica fume. The high porosity of the matrix of the concrete without addition of Silica fume explains its lower strength and higher permeability to chloride ions.

2. LITERATURE REVIEW

The author has investigated the characteristics of silica fumes concrete. Proper introduction of silica fumes in concrete improves both the mechanical and durability characteristics of the concrete. The paper presents on results of research effort conducted at the American University in Cairo using Egyptian silica fumes in concrete. The program investigated various characteristics of silica-fumes concrete. The experimental program comprised six levels of silica-fumes contents (as partial replacement of cement by weight) at 0% (control mix), 5%, 10%, 15%, 20%, and 25%, with and without super plasticizer.

The author has carried out research on curing effects, strength and physical properties of high strength silica fume concrete. The physical properties of high strength silica fume concretes and their sensitivity to curing procedures are evaluated and compared with reference Portland cement concretes. The effects of poor curing procedures on the strength, and the skin properties, were found to be equally detrimental in the reference and in the silica fume concretes. The result presence of SF in a marked increase in strength, especially at 28 days, but also at 1day.The effects of poor curing procedures on the strength and skin properties of concretes were found to be equally detrimental in the reference and in the silica fume concretes.

The authors have presented on Long-Term compressive strength of silica-fume concrete Moreover, the compressive strength results obtained on concrete cores taken after a 4-year period from an experimental column built with a very high-strength concrete also confirmed that there was no tendency for strength loss in silica-fume concretes. From the results obtained on the seven field concretes under study, it is evident that silica-fume concrete exposed for 4-6 years to severe environmental conditions behaved as satisfactorily as the corresponding concrete without silica fume. No strength losses were noticed as in the case of a very high-strength concrete (85.4 MPa at 28 days) cast 4 years ago. It is interesting to note that, after 4 - 6 years of field exposure, these field concretes exhibit very low chloride-ion permeability, almost in the range of latex-modified concrete, or polymer-impregnated concrete.

3. RELATED WORK

This chapter presents the experimental study on the behavior of cubes and columns with silica fume concrete. This chapter gives a brief overview of the casting of specimens, test set-up and testing procedures.

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Experimental investigations were carried out on the M25 grade concrete specimens to ascertain the strength of silica fume concrete. The Compressive strengths of the concrete mixes using 0%,11%,13%,15%, and 17% replacement of cement with silica fume and the concrete mix without silica fume at 28 days are done. Ten columns tested among them control columns without silica fume replacement and eight columns with replacement of cement with silica fume.

Fig.1.Study Expriment

Fig.2.Cube

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To study the behavior of short columns under axial compression. This chapter presents the experimental results of the reinforced column with and without silica fume concrete. The performance of M25 grade concrete with different replacement levels of cement with silica fumes.

4. ANALYSIS

The Compressive strengths of the concrete mixes using 0%, 11%, 13%, 15% and 17% replacement of cement with silica fume are compared for 28 days.

Fig.3.Testing

The concrete mix using 13% replacement of cement with silica fume has higher compressive strength when compared to other concrete mixes with and without silica fume at 28 days. Hence ten columns are tested; two columns without silica fume replacement and eight columns with 11%, 13%, 15% and 17% replacement of cement with silica fume. Comparison of Failure pattern of the specimens with and without silica fume is presented. Tests were carried out on ten reinforced concrete column specimens cured for 28 days as per IS specifications. Testing was carried out on a universal testing machine of 1000 KN capacity. Specimens were vertically placed in universal testing machine for

compression. The tested columns were instrumented to measure the applied load, elongation along the column and compressive load.

CONCLUSION

In this project, the performance of M25 grade concrete with different replacement levels of cement with silica fume. Ten columns were tested; two control columns without silica fume replacement with water cement ratios of 0.42 and 0.50 and eight columns with 0%,11%,13%,15%, and 17% replacement of cement with silica fume. The Compressive strengths of the concrete mixes using 0%,11%,13%,15%,and 17% replacement of cement with silica fume are compared at 28 days. Based on the experimental study, the following observations are made.

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