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"Self Healing and Ductile Concrete Mix Designs by using Silica Fume"

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Abstract - In this project the comparative study of Self Healing and Ductile Concrete Mix Designs by using Silica Fume With the conventional concrete mix design , As the cement production increases in the content of carbon dioxide in atmosphere which causes air pollution and harm the nature and due to which global warming and climatic change occurs in atmosphere. therefore by replacing cement content with silica fume in concrete mix design somehow prevent the atmosphere therefore in this project the cement content is replaced by silica fume by varying percentage and the comparative analysis of conventional concrete with concrete mixed with silica fume is done and observed that when we added 15% of silica fume to total weight of cement, there is a increased in compression and hence the tensile strength increases and therefore ductility of concrete also increases and the cracks are reduced in concrete. From this work concluded that, High strength of concrete can be achieved by adding silica fume concrete. The repairing ability of the concrete is in the silica fume concrete. Silica fume filled the voids in concrete and cracks in concrete are quickly healed.

Key Words: Concrete mix design, Workability test, Normal Consistency Test and Compressive Strength test

1. INTRODUCTION

Concrete is an essential building material which is widely used in the construction of infrastructure such as buildings, bridges, highways, dams, and many other facilities. In the world's concrete has become the most versatile, durable and reliable construction material. The world-wide demand for Cement to meet infrastructure developments indicates that concrete will continue to be a chosen material of construction in the future. On the other hand, Portland cement concrete industry has grown enormously in recent years, it will continue to grow as the result of continuous urban development.

It is well known that cement production depletes significant amount of natural resources and releases large volumes of carbon-dioxide. Cement production is also highly energy-intensive, after steel and aluminum. After the automobile industries and sector the Cement production from factories has become the second only after the automobile as the major generator of carbon dioxide into atmosphere which polluted the atmosphere and due to which climatic change and global warming phenomenon occurs. In addition to that, large amount of energy is also consumed for the cement production. As cement used for construction purpose producing the harm to atmosphere, Hence it is inevitable to find an alternative material of cement used for construction purposes.

Self-healing in concrete is actually an old and a well known phenomenon for concrete as it possesses some natural autogenous healing properties. As due to ongoing hydration of clinker minerals or carbonation of calcium hydroxide (Ca(OH)2), cracks may heal in concrete after some time. However, autogenous healing in concrete is limited to small cracks and it is only effective when water is availableand is difficult to control.

1.1 Approaches to Self-Healing

Self-healing in cementations materials can be classified into three groups:

- Intrinsic healing,
- Capsule based healing
- Vascular healing,

2. LITERATURE REVIEW

Chanand et. al (2004) did analysis to check the impact on bond characteristics between the matrix of RPC and steel fibre due to silica fume, which incorporates pull-out energy and bond strength to break the bond between the two materials. A typical and most popular test named Fibber pull-out tests was received to test the bond between RPC matrix and steel fibres. After the results, it was seen that on silica fume addition addition of silica fume as a cementations material can increase and enhance the facial properties of fiber-matrix like bond strength and pull-out energy, significant increment in fiber pullout energy was observed. From the results of the bond strength and pullout energy test, the perfect silica fume concrete extent was seen to be in 20% and 30% under the given conditions of the test program. At this silica fume dose, the bond quality and the fiber pullout energy were the most elevated among all cases.

3. RESULTS AND DISCUSIONS

MIX PROPORTION

In this project Use of well graded particles in concrete mix design conceptually produces a dense matrix which is affected by the use of mineral admixtures silica fume, or by using the low water-to-cement ratios. To get a highly durable self-healing concrete, the different cubes have been prepared by varying the percentage of Silica Fume (SF) content in concrete mix of 0%, 5%, 10%, and 15%. The concrete mix design is done to produce a self healing concrete mix , The different cubes of varying percentage of silica fume have been prepared by adding Bacteria Liquid (BL) 10ml, 20ml and 30ml. Without any admixture the conventional concrete mix design is done for comparing the concrete strength and concrete durability properties with silica fume concrete and bacterial concrete. It was observed that Micro cracks are produced in the concrete mix specimens when applying 90% and 70% of ultimate compressive strength to concrete specimen after 28 days of curing. In compression testing machine as the load is applied the concrete mix specimens are tested for compressive strength at 7 ,14 and 28 days. The physical properties of the materials used in concrete mix as the coarse aggregates, cement and fine aggregates are determined by means of conducting standard tests as per IS codes . M25 grade of concrete was used for testing.

Sample	days	0 %	5%	10%	15%
1		15.20	19.30	20.30	22.10
2		16.45	18.80	19.70	22.50
3		22.30	24.00	26.25	29.17
4		22.80	23.85	25.60	28.20
5		26.75	28.45	31.35	34.40
6		27.15	27.75	30.45	33.20

Table -1: Compressive strength with silica fume

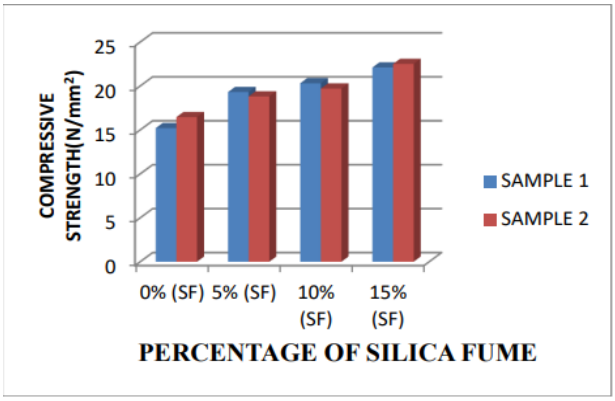

Chart 1 - 7 Days of compressive strength

Chart -1: 7 Days of Compressive Strength

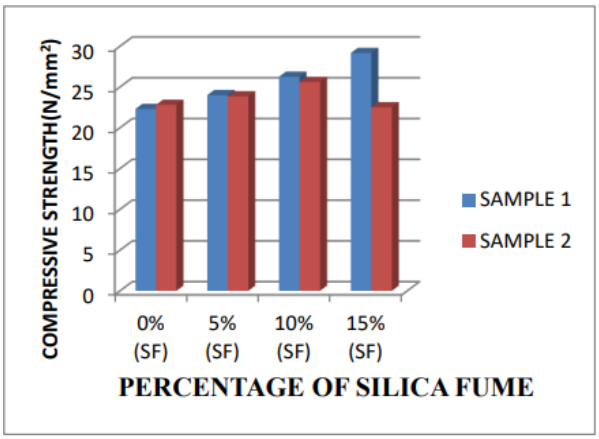

Chart 2 - 14 Days of compressive strength

Chart -2: 14 Days of Compressive Strength

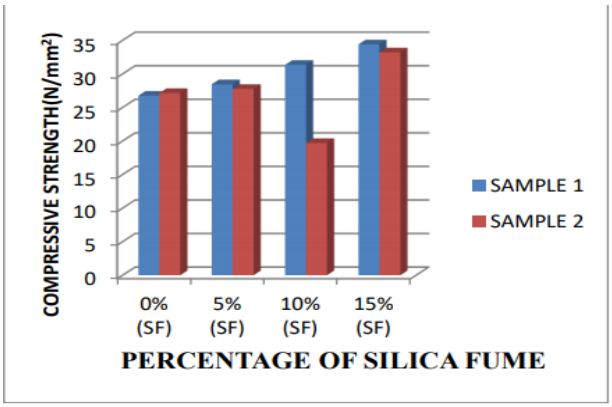

Chart 3 - 28 Days of compressive strength

Chart -3: 28 Days of Compressive Strength

3. CONCLUSIONS

In the above project the Silica fume concrete was tested for compressive strength of concrete for ultimate loading. It was found that the concrete mix has given maximum strength at 15% addition of silica fume the concrete had good workability and the hardened concrete had good durability. The above study described that very minute silica particles are available in the microstructure of concrete, and these observations are attributed to the self healing of the pre-existing cracks, it is due to mainly by hydration of anhydrous particles (Silica fume) on the crack surfaces. When we added 15% of silica fume to total weight of cement, there is a increased in compression and hence the tensile strength increases and therefore ductility of concrete also increases and the cracks are reduced in concrete.

From the above work concluded that, High strength of concrete can be achieved by adding silica fume concrete. The repairing ability of the concrete is in the silica fume concrete. Silica fume filled the voids in concrete and cracks in concrete are quickly healed.

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BIOGRAPHIES

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