



A REVIEW PAPER ON THE EFFECT OF MICRO SILICA ON PROPERTIES OF CONCRETE

Vidhu Sharma¹, Dilip Rawat², Abhishek Singh³

¹Student, ²Asst. Professor, ³Student

Department of Civil Engineering

Meerut Institute of Engineering and Technology, Meerut, India

Abstract: The development of infrastructure represents the overall development of the country, and concrete plays a major role in it. Since we realized its importance as a construction material, there are several kinds of research that have been done to enhance the strength and performance of concrete. Most of the concrete used today contains some amount of cementitious materials which are generally byproducts. Industrial byproducts like Silica Fume are utilized to enhance the strength and other properties of concrete. Silica Fume (micro silica) is an admixture that is used as a partial replacement for cement. The cement can be replaced from 0% to 15%. This paper aims to investigate the effects of the partial replacement of ordinary portland cement with Silica Fume on the compressive strength of concrete.

Index Terms: Silica Fume, Cement, Concrete, Compressive Strength

INTRODUCTION

In recent decades construction activities have increased, which has resulted in increased demand for concrete. Concrete is the most widely used construction material, and is the second most utilized substance after water. It is composed of cement, fine aggregate, coarse aggregate and water. Among these, cement is the most expensive and most important material. Nowadays using admixtures in cement has become a common practice. As the addition of admixtures not only reduces the overall cost of concrete but also helps in achieving the desired properties in concrete. One such admixture is Silica Fume (Micro Silica). It is an ultrafine material and is used as a replacement for cement. Usually, we replace 0% to 15% of cement by weight. This partial replacement of cement with Silica Fume significantly affects the compressive strength of concrete.

LITERATURE REVIEW

Silica Fume is widely used in the construction field and industry as partial replacement because it enhances the properties of concrete as desired. Before this study, many researches have been done to increase the efficiency of concrete with partial replacement with Silica Fume. Some of the notable researches done on the subject are mentioned as literature review.

3.1 S. Jagannp & T.R. Neelakantan(2021)-

This paper involves the study of properties and durability of concrete at two different grades containing silica fume with various replacement percentages. The investigative study was performed for M25 and M40 grades of concrete with 0%, 5%, 10%, 15% replacement levels of cement by Silica Fume at 7, 14, 28, and 90 days. The result is found is increase in the percentage of Silica Fume decreases the workability, the strength of the concrete increases irrespective of the grades of the concrete. Increase in the percentage of Silica Fume also increases resistance to acid.

3.2 H. Katkhuda et.al.,(2019)-

The main objective of this paper was to determine the isolated effect of Silica Fume on tensile compressive and flexural strength of concrete by replacing the weight of cement by Silica Fume percentage of the Silica Fume was replaced by 0%, 5%, 10%, 15%, 20% and 25% for a water-binder ratios ranging from 0.26 to 0.42. The compressive strength and tensile is almost same but the flexure strength of concrete depended on the water cement ratio which increase 15% for water cement ratio 0.26 and 0.30 and 20% for water cement ratio 0.34, 0.38 and 0.42

3.3 Piotr Smarzewski (2019)-

This paper presents the experimental investigation on the changes in mechanical properties of HPC caused by replacing the cement by Silica Fume percentage of 0%, 5%, 15%, 20% and 25 % by weight. At 10% replacement the compressive strength increased by 13% of the referral cubes. Also there was a 26% increase in the tensile splitting strength and a 5% increase was reported in the static modulus of elasticity. The calculated characteristic length indicates that the high-performance concrete with 15% SILICA FUME content is the most brittle. The Silica Fume replacement should not exceed 10%.

3.4 Madhanasree R. M.1, A. Joe Paulson, et.al.. (2016)-

This paper presents an experimental investigation influences of Silica Fume on concrete by replacing the weight of cement by Silica Fume percentage of 0%, 12.5%, 13% and 13.5% on the strength of M20, M25 and M30 grades. The optimum Silica Fume replacement level was found to be 13% as the highest compressive strength was reported by 13% replacement of cement by Silica Fume by weight.

3.5 Vikas Srivastava et.al., (2012)-

This paper presents the result of an experimental investigation carried out to find out suitability of Silica Fume in the production of concrete. It was found out that optimum replacement level of Silica Fume is 5% by weight. The cement was replaced by Silica Fume percentage of 5%, 10%, 15%, 20%, 25%, 30% and 35%. Silica Fume inclusion increases compressive strength significantly and increase in compressive strength depends upon replacement level. A marginal improvement was observed in the workability of concrete. Beyond the optimum Silica Fume level i.e. 5% replacement the workability of concrete increased but the compressive strength is found to be decreased.

3.6 Faseyemi Victor Ajileye (2012)-

The article presents the investigation on the mechanical properties of concrete by replacing the weight of cement by Silica Fume percentage of from 0 to 25% in steps of 5% by weight, mix proportioning was based on 1:2:4 mix ratio. Then the result is found is cement replacement up to 10% with Silica Fume leads to increase in compressive strength, (16.15% to 29.24%).

3.7 Dilip Kumar Singha Roy, Amitava Sil (2012)-

This paper features experimental study on the effect of Silica Fume on the properties of concrete by replacing the weight of cement by Silica Fume percentage of 10%. The maximum compressive strength is found for 10% replacement of cement with Silica Fume and the values are higher than those of the normal concrete whereas split tensile strength and flexural strength of the Silica Fume concrete are increased by about 38.58% and 21.13% respectively over those of the normal concrete when 10% of cement is replaced by Silica Fume.

3.8 N. K. Amudhavalli & Jeena Mathew (2012)-

This paper features experimental study on the nature of Silica Fume and its influences on the properties of fresh and hardened concrete by replacing the weight of Portland cement by Silica Fume percentage of 0%, 5%, 10%, 15% and 20%. The normal consistency increases about 40% when Silica Fume percentage increases from 0% to 20%, the optimum 7 and 28-day compressive strength and flexural strength have been obtained in the range of 10-15 % Silica Fume replacement level.

3.9 S. Bhanjaa, B. Sengupta (2004)-

This paper is directed towards the experimental study to determine the isolated effect of Silica Fume on the Tensile strength of concrete. The range of water cement ratio was 0.26-0.42. The cement was replaced by Silica Fume percentage of 0%, 5%, 10%, 15%, 20%, 25%. There was a significant improvement in the compressive strength as well as tensile strength of concrete. The optimum Silica Fume replacement level is found to be ranging from 5-10%.

3.10 Abdullah A. Almusallam et.al.,(2004)-

The article presents the investigation on the mechanical properties of concrete by replacing the weight of cement by Silica Fume percentage of 7.3%, 16.7%, 11.9%, and 12.0%. The compressive strength of concrete specimens prepared with calcareous limestone aggregate was the lowest and the incorporation of Silica Fume improved both the compressive and split tensile strengths of concrete.

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