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## STRENGTH STUDIES ON CONCRETE WITH SILICA FUME AND ASBESTOS SHEET PIECES

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### ABSTRACT

*The environment is changing quickly, as we all know, and building construction is essential to this progress. A closer look reveals that the use of concrete has increased, which contributes to the depletion of natural resources. We considered replacing part of the concrete's proportions with the following steps in order to preserve our natural resources. In order to save natural resources like coarse aggregate, we are employing silica fume as an additive in this case to partially replace cement in the following percentages: 0%, 5%, 7.5%, and 12.5%. We are substituting 30% of the coarse aggregate with asbestos sheet pieces. Test for compressive strength and split tensile strength for 28, 56 and 90 days.*

**KEYWORDS:** Silica Fume, Asbestos Sheet Pieces, Compressive strength, Split tensile strength.

## 1. INTRODUCTION

Concrete is made of cement, water, and aggregates (such sand and gravel) and solidifies over time to serve as a study material. Together, these elements create a hardened, long-lasting product that may be used for a variety of building tasks. Because of its strength, adaptability, and capacity to take on various shapes, concrete is a substance that is frequently utilized in the infrastructure and building sectors. It is used in a variety of construction projects since it is inexpensive, strong, and can be molded into nearly any shape. It is a building material made by carefully mixing water, aggregates, and cement.

The ultrafine powder known as silica fume, or microsilica or condensed silica fume, is a by-product of the production of silicon and ferrosilicon alloys in electric arc furnaces. Once mostly a waste product, it became a valuable and widely utilized supplemental cementitious material (SCM) in concrete until environmental restrictions in the 1970s required its collection.

Due to serious health risks, the use of asbestos sheets as coarse aggregate in concrete is a very troublesome

and mostly obsolete method in contemporary building. In the past, asbestos fibers were added to cement products (such as asbestos cement sheets) to increase their durability, strength, and resistance to fire. Usually, though, this was accomplished by adding asbestos fibers to the cement matrix rather than by substituting entire asbestos sheets for coarse aggregate.

## 2. OBJECTIVES

1. To assess the impact of using silica fume in place of some of the cement on the fresh and hardened qualities (such as split tensile strength and compressive strength) of concrete mixtures.
2. To speculatively evaluate the impact on concrete's mechanical qualities (such as compressive strength and split tensile strength) of replacing coarse aggregate with up to 30% waste asbestos cement sheets.

## 3. MATERIALS

**3.1 Cement:** For mortar and concrete building, cement—a finely ground binding material—is necessary. It solidifies when combined with water, binding aggregates like sand and gravel to create long-lasting structures. Cement, which is made out of limestone, clay, and other minerals, gives structures and infrastructure the strength and stability they require.

**3.2 Fine aggregate:** Sand or crushed stone are common examples of fine aggregate, which is a construction material composed of tiny particles that may be sieved through a 4.75 mm screen.

**3.3 Coarse aggregate:** Coarse aggregate is a building material with bigger particles that range from 4.75 mm to 50 mm. It usually consists of crushed stone or gravel. It gives the concrete mix bulk, strength, and longevity by forming its structure. In the end, coarse aggregate improves a structure's overall stability and ability to support loads.

**3.4 Water:** Water is necessary for several construction processes, such as curing, making mortar, and mixing cement. The total performance of a project is impacted by the water quality, which has a direct effect on the durability and strength of cement concrete and mortar.

**3.5 Silica fume:** The ultrafine, amorphous (non-crystalline) by-product silica fume, sometimes referred to as microsilica, is produced in electric arc furnaces during the synthesis of silicon and ferrosilicon alloys. It has a very high concentration of amorphous silica and is composed of spherical particles that are much smaller than cement particles.

**3.6 Asbestos sheets:** These sheets' ridged or wavy surface makes them durable and sturdy.

## 4. EXPERIMENTAL RESULTS

### 4.1 Compressive strength

Compressive strength is the ability of a material to withstand loads that would otherwise cause it to shrink or crush. It is ascertained by progressively increasing the force exerted on a specimen until it fractures, typically through deformation. This characteristic is crucial in building, particularly for concrete, as it establishes the maximum weight that a structure can safely hold. In most cases, the cubes are assessed after 28, 56, and 90 days

**Table 1: Compressive strength results of concrete with 30% of Asbestos sheet pieces with coarse aggregate replacement and different percent of silica fume**

Sl.no	30% of Asbestos Sheets pieces+% of Silica fume	Compressive strength results, N/mm <sup>2</sup>		
		28 days	56 days	90 days
1	0%	49.23	53.16	57.09
2	30% ASP+5%SF	57.96	62.59	67.25
3	30% ASP+7.5%SF	61.69	66.72	71.56
4	30% ASP+12.5%SF	57.07	61.58	66.21

#### 4.2 Split tensile strength

The maximum load at failure is then used to calculate the splitting tensile strength, which provides a helpful indication of the concrete's ability to withstand cracking in concrete buildings for 28, 56, and 90 days as well as its resistance to tensile pressures.

**Table 2: Split tensile strength results of concrete with 30% of Asbestos sheet pieces with coarse aggregate replacement and different percent of silica fume**

Sl.no	30% of Asbestos Sheets pieces+% of Silica fume	Split tensile strength results, N/mm <sup>2</sup>		
		28 days	56 days	90 days
1	0%	4.83	5.27	5.61
2	30% ASP+5%SF	5.84	6.31	6.78
3	30% ASP+7.5%SF	6.36	6.89	7.34
4	30% ASP+12.5%SF	6.14	6.62	7.15

#### 5. CONCLUSION

Cement can be partially replaced with silica fume in several percentages: 0%, 5%, 7.5%, and 12.5%. Coarse aggregate can be partially replaced with asbestos sheet pieces at 30%. The following conclusions are derived from the casting and mechanical property testing of various concrete specimens based on these percentages:

1. Normal concrete compressive strength for 28, 56 and 90 days are 49.23, 53.16 and 57.09 N/mm<sup>2</sup>, respectively.
2. Compressive strength result for the combination of 30% asbestos sheet pieces utilized as a partial replacement for coarse aggregate and with 7.5% silica fume as a partial cement replacement, for 28, 56 and 90 days is 61.69, 66.72 and 71.56 N/mm<sup>2</sup>.
3. The normal concrete split tensile strength result for 28, 56 and 90 days is 4.83 and 5.27 and 5.61 N/mm<sup>2</sup>.
4. Split tensile strength result for the combination of 30% asbestos sheet pieces utilized as a partial replacement for coarse aggregate and with 7.5% silica fume as a partial cement replacement, for 28, 56 and 90 days is 6.36, 6.89 and 7.34 N/mm<sup>2</sup>.

## 6. REFERENCES

- [1].K. Chandramouli, N. Pannirselvam, J. Sree Naga Chaitanya, G. Hymavathi. Experimental investigation on AR glass fiber reinforced concrete with silica fume, 6th International Conference on Recent Advances in Material Chemistry, 68, 2022, Pages 136-138.
- [2].Malhotra, V.M. Role of Supplementary Cementing Materials in Reducing the Risk of Alkali-Aggregate Reaction. Cement and Concrete Composites, 23(3), Jun 2001, Pages 223-231.
- [3].Mehta, P.K. Durability of Concrete with Supplementary Cementing Materials. Cement and Concrete Composites, 24(1), Feb 2002, Pages 1-6.
- [4].Siddique, R. Properties of Concrete Containing Silica Fume. Journal of Advanced Concrete Technology, 4(1), Feb 2006, Pages 1-14.
- [5].Wang, C.C., Lee, W.T., Lee, Y.M. Effects of Silica Fume on the Properties of High-Strength Concrete. Construction and Building Materials, 20(9), Nov 2006, Pages 790-795.
- [6].Zhang, M.H., Gjorv, O.E. Microstructure and Pore Structure of Silica Fume Concrete. Cement and Concrete Research, 21(5), Sep 1991, Pages 807-814.
- [7].Toutanji, H.A., El-Korchi, T. Performance of Concrete Incorporating Silica Fume and Metakaolin. Cement and Concrete Research, 30(2), Feb 2000, Pages 289-295.
- [8].Khan, M.I., Siddique, R., Khan, M.S. Influence of Silica Fume on Mechanical and Durability Properties of Concrete. Journal of Materials in Civil Engineering, 20(8), Aug 2008, Pages 553-561.
- [9].Ramezani pour, A.A., Malekpour, S., Ramezani pour, A.M. Effect of Silica Fume on Permeability and Mechanical Properties of High Strength Concrete. Construction and Building Materials, 23(1), Jan 2009, Pages 140-146.
- [10]. Sachin , Akash Batra , Pappu Sharma.Comparative Studies on Asbestos Sheet Waste Powder as Partial Replacement of Cement in Concrete Production,International Journal for Research in Applied Science & Engineering Technology(IJRASET),6(7),June 2018.
- [11]. Sajjad Hossain, Md. Ashraful Alam, Md. Motaher Hossain, Ismail Hossain.Studies on Anwar Ispat Waste Cement Sheet Powder (C.S.P) as Partial Replacement of Sand in Concrete Block Production ,Proc. 3rd International Conference on StructuralEngineering Research (iCSER 2022) ,27-30 Nov 2022.
- [12]. K.Chandramouli , N.Pannirselvam ,J.Sree Naga Chaitanya, andG.Hymavathi.Experimental Investigation on Self Compacting Concrete with Silica Fume,International Conference on Smart Materials and Structures ICSMS),2810(1),June 22 2023.
- [13]. K.N.JANARDHANAN.Experimental study on compressive strength of concrete by partial replacement of waste asbestos sheet,International Journal On Engineering Technology and Sciences – IJETSTM,4(10), October - 2017.
- [14]. Peiris, D. A. C. D. P. a ,Weerasinghe, T. K.Study on use of Environmentally Friendly Alternative Fiber materials for Asbestos Roofing sheets in Sri Lanka,OntarioInternational Development Agency International Journal of SustainableDevelopment,2019.