# Improvement in Compressive Strength of Concrete By Adding Micro Silica

[1]Kausthibh A. Pashankar
Dept. of Civil Engineering
JSPM's RSCOE, Polytechnic,
Tathawade, Pune-411033

[2] A. S. Patil
Lecturer Civil Engineering Dept.
JSPM's RSCOE, Polytechnic,
Tathawade, Pune-411033

[3] Prof. P. M. Thorat
Asst. Prof. Civil Engineering Dept.
SRTTC-FOE, Khamshet, Pune-410405

***Abstract*—*India is a developing country. Many construction projects are going on and many projects are proposed in near future. If we evaluate some of the projects in past, we find that they cannot sustained due to lack of enough considerations towards the sustainability of these projects during the planning stage. The first testing of silica fume in Portland-cement-based concretes was carried out in 1952. The biggest drawback to exploring the properties of silica fume was a lack of material with which to experiment. Early research used an expensive additive called fumed silica, an amorphous form of silica made by combustion of silicon tetrachloride in a hydrogen-oxygen flame. Silica fume on the other hand, is a very fine pozzolanic, amorphous material, a by-product of the production of elemental silicon or ferrosilicon alloys in electric arc furnaces. Before the late 1960s in Europe and the mid-1970s in the United States, silica fumes were simply vented into the atmosphere*

*In the recent past, there have been considerable attempts for improving the properties of concrete with respect to strength and durability, especially in aggressive environments. High performance concrete appears to be better choice for a strong and durable structure. A large amount of by-product or wastes such as fly-ash, copper slag, silica fume etc. are generated by industries, which causes environmental as well as health problems due to dumping and disposal.*

*Proper introduction of silica fume in concrete improves both the mechanical and durability characteristics of the concrete. This paper present improvement in compressive strength of concrete by adding micro silica fumes.*

***Keywords*— *Silica fume, Cement, pozzolanic*. *silicon tetrachloride***

## I. INTRODUCTION

Now days the construction industry uses concrete to a large extent for various construction purposes. In 2013, about 3.97 billion tons of cement was produced around the world. Based on this estimated value and considering average cement content of 11% and 70% of the cement-based product shared market, another statistic estimated that on average, approximately 1 ton of concrete is produced each year for every human being in the word.

The amount of concrete used is twice that of steel, wood, plastics, and aluminium combined. Concrete is used in infrastructure and in buildings. The overall grading of the mix, containing particles from 300 nm to 32 mm determines the properties of the concrete. The properties in fresh state (flow properties and workability) are for instance governed by the particle size distribution, but also the properties of the concrete in hardened state, such as strength and durability, are affected by the mix grading and resulting particle packing. One way to further improve the packing is to increase the particle size spectrum, e.g. by including particles with sizes below 300 nm. Possible materials which are currently available are ground minerals like limestone and silica fines such as silica flour, micro-silica and nano-silica.

Because of extensive use of concrete worldwide, it is necessary to evaluate the environmental impact of this material. Additionally, to ensure the future competitiveness of concrete as a building material, it is essential to improve the sustainability of concrete structures.

## II. METHODOLOGY

Methodology study deals with different phases of the project throughout the year 2019-2020.

The coarse aggregate consisted of 19-mm maximum size basalt with a specific gravity of 2.6 and a fineness modulus of 6.87. The fine aggregate consisted of river sand with a maximum characteristic size of 4.75 mm, a fineness modulus of 2.45 and a specific gravity of 2.6. Aggregates, Cement and SF have been mixed by hand succession with appropriate proportions for dry mix followed by addition of water sufficiently to achieve uniform and high workable mix. The concrete has been placed in 150 mm cube, 150mm diameter with hand compaction by tamping rod. Curing regime has been taken as 24 hours in mould with hessian clothes at (20 – 24)0C followed by underwater curing until the day of testing.

In hardened state 7 days and 28 days compressive strength of cubes have been measured.


Figure 1

**Table No. 1**

| S N | Description | Quantity (kg) | Rate per unit | | Amount (rupees) |
|---|---|---|---|---|---|
| 1 | Cement (53 grade) | 50.77 | 320 | 1 bag | 320 |
| 2 | Coarse aggregate | 158 (half brass) | 2600 | 1 brass | 1300 |
| 3 | Fine aggregate | 84 (half brass) | 2800 | 1 brass | 1400 |
| 4 | Micro silica | 2.5 | 125 | 5 kg | 125 |
| | | | | **Total** | **3145** |

## III. RESULTS

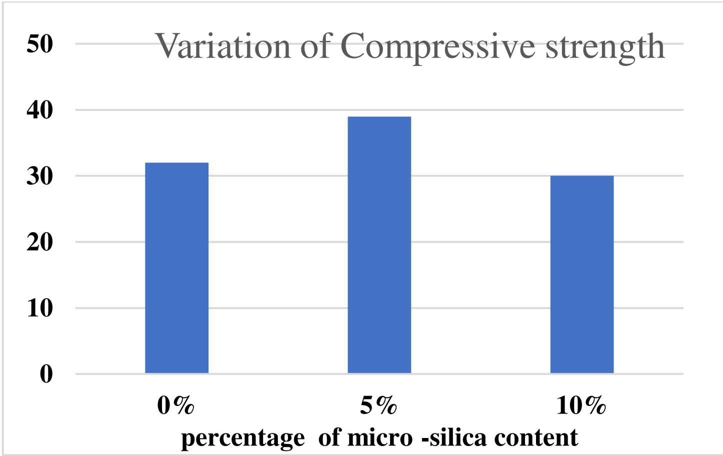
Results on Concrete Cubes - Concrete cubes were tested in compression by using universal testing machine. Following are the results of compressive strength of concrete for 7 days and 28 days are;

The abbreviations used in above table such as M1, M2, M3 represents 'M' as mix and 1,2,etc as its number of proportions. Micro silica proportions are taken in percentage of the weight of cement required for one concrete cube. For each mix proportions, 18 cubes were casted. 9 cubes of them were tested after 7 days and remaining 9 cubes were tested after 28 days.

**Table No. 1**

| Cubes | Microsilica | 7 days strength (P/A) N/mm$^2$ | | 28 days strength (P/A) N/mm$^2$ | |
|---|---|---|---|---|---|
| M1 | 0 % | 10 | | 32 | |
| | | 12.22 | 13 | 33.23 | 32 |
| | | 16.22 | | 28.45 | |
| **M2** | **5 %** | **22.45** | | **38.23** | |
| | | **25.35** | **22.3** | **39** | **39** |
| | | **19.11** | | **36.64** | |
| M3 | 10 % | 18.22 | | 28.4 | |
| | | 20.23 | 21.1 | 28.6 | 30 |
| | | 24.85 | | 32 | |

**Table No. 2**




## IV. CONCLUSION

- This project is conducted to evaluate the optimum values of microsilica to be used in concrete.
- On the basis of final observations we evaluated that the strength of concrete increases by adding gradually micro silica in mix proportion
- Hence we succeeded in improving the compressive strength of concrete by using micro silica.

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