

Practical Approach for Strength Comparison of Concrete Beam with M. S. In Torsion & Bending

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ABSTRACT: In present era vast development occurred in the field of concrete technology. Many scientists and researchers have been developed abundant techniques to improve strength and durability parameters of the concrete. A number of studies have been carried out to investigate the possibility of utilizing a broad range of materials as partial replacement material for cement in the production of concrete. The use of supplementary cementitious material in production of concrete can result in major saving of energy and cost. It also helps to improve strength, durability, impermeability and chemical resistance of concrete.

The present study investigates the effects of mineral admixture (micro silica) & chemical admixture (Super plasticizer) on strength properties of M-30 grade concrete. The experimental program is designed to investigate micro silica (silica fume) as partial cement replacement in concrete. The replacement levels of cement by micro silica are selected as 4%, 8%, 12%, 16% and 20% for constant water-cementitious material ratio of 0.45. For all mixes compressive strength is determined at 3, 7, 28 days for 150 X 150 X 150 mm size cubes. Also flexural strength and splitting tensile strength are determined at 28 days curing period. Current experimental study shows that 12% replacement of cement by micro silica gives higher compressive strength and higher splitting tensile strength whereas 8% replacement by micro silica gives higher flexural strength. The results show increase in compressive strength by 20 % and flexural strength of concrete specimen by 16.2%. This study has also shown that between 8 to 16 % replacement levels, silica fume concrete will develop strength sufficient for construction purposes. Its use will lead to a reduction in cement quantity required for construction purposes and hence sustainability in the construction industry as well as aid economic construction.

KEYWORDS: Concrete, supplementary cementitious material, micro silica (Silica fume), super plasticizer, strength, durability

I. INTRODUCTION

The Ordinary Portland Cement (OPC) is one of the main ingredients used for the production of concrete and has no alternative in the civil construction industry. Unfortunately, production of cement involves emission of large amounts of carbon-dioxide gas into the atmosphere, a major contributor for green house effect and the global warming, hence it is inevitable either to search for another material or partly replace it by some other material. The search for any such material, which can be used as an alternative or as a supplementary for cement should lead to global sustainable development and lowest possible environmental impact.

II. LITERATURE STUDY

As our aim is to develop concrete which does not only concern on the strength of concrete, it also having many other aspects to be satisfied like less porous, capillary absorption, durability. So for this we need to go for the addition of pozzolanic materials along with super plasticizer with having low water cement ratio. The use of micro

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silica is many, which is having good pozzolanic activity and is a good material for the production high strength and high performance concrete.

Research Work by Different Researchers As Follows:

Faseyemi Victor Ajileye; studied the strength properties of silica fume concrete. He carried out both preliminary and experimental investigation for study. For preliminary investigation micro silica and cement was subjected to physical and chemical analysis to determine whether they are in compliance with the standard used. He designed an experimental program to investigate silica fume as partial cement replacement in concrete. He observed that cement replacement up to 10% with silica fume leads to increase in compressive strength, for C30 grade of concrete. From 15% there is a decrease in compressive strength for 3, 7, 14 and 28 days curing period.

Ashok P. Kalbande; described project in detail and presents laboratory observation. Micro silica is used as a 10% replacement of cement by weight. Mixing the concrete and various test are conducted on fresh concrete i.e. Slump flow, V-Funnel, L-Box, U-Box and result are obtained. Using this concrete cube specimen are cast for testing different hardened properties of concrete. i.e. 3 Days, 7 Days, 14 Days, 28 Days Compressive strength of concrete.

Verma Ajay, Chandak Rajeev and Yadav R.K.; studied concrete is the most important engineering material and the addition of some other materials may change the properties of concrete. In their experiment 150x150x150 mm concrete cubes were cast using 1:1.5:3 mix proportion with w/c ratio of 0.50. Specimen with ordinary portland cement and ordinary portland cement with various silica fume level 0%, 5%, 10%, 15% were cast. He concluded that Silica fume increases the strength of concrete 25% more.

Pradhan; in his experimental work 5 (five) mix of concrete incorporating silica fume were cast to perform experiments. Those experiments were carried out by replacing cement with different percentages of silica fume at a single constant water-cementitious materials ratio keeping other mix design variables constant. The silica fume was replaced by 0%, 5%, 10%, 15% and 20% for water-cementitious materials (w/cm) ratio for 0.40. For all mixes compressive strengths were determined at 24 hours, 7 and 28 days for 100 mm and 150 mm cubes. Other properties like compacting factor and slump were also determined for five mixes of concrete.

Amudhavalli; presents a detailed experimental study on Compressive strength, split tensile strength, flexural strength of M-35 grade concrete with partial replacement of cement by silica fume by 0, 5, 10, 15 and by 20%. The tests are carried out at curing period of 7 and 28 day. Durability study on acid attack was also studied and percentage of weight loss is compared with normal concrete. Test results indicate that use of Silica fume in concrete has improved the performance of concrete in strength as well as in durability aspect.

Bhikshma; explained in his experimental investigation, the mechanical properties of high-strength concrete of grades M-40 and M-50, at 28 days characteristic strength with different replacement levels of cement with silica fume or microsilica of grade 920-D are considered. The investigations revealed that the use of waste material like silica fume improved the mechanical properties of high strength concrete which is otherwise hazardous to the environment and thus may be used as a partial replacement of cement.

III. METHODOLOGY

The primary aim of this experimental program is to study the effect of micro silica (silica fumes) content on the mechanical properties and non-mechanical properties of concrete. Micro silica is used as mineral admixture and effect of different amount of micro silica on the strength and durability related properties are studied. Also the effect of micro silica on the workability characteristic of concrete and its suitability for the construction industry is studied.

In this experimental program the strength parameters of concrete with varied doses of micro silica (silica fumes) are studied. The concrete mix selected for this is M-30.

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IV. OBJECTIVES OF PRESENT WORKS

1. To check the influence of micro silica (silica fume) on mechanical properties of concrete such as compressive strength, splitting tensile strength, flexural strength, Combine Torsion & Bending etc.
2. To check optimum replacement level of cement by micro silica (Silica Fume)
3. To develop economically viable concrete this will have higher compressive strength.

V. EXPERIMENTAL RESULTS

1. Results of Compressive Strength of Concrete cubes (150mm x 150mm x 150mm):

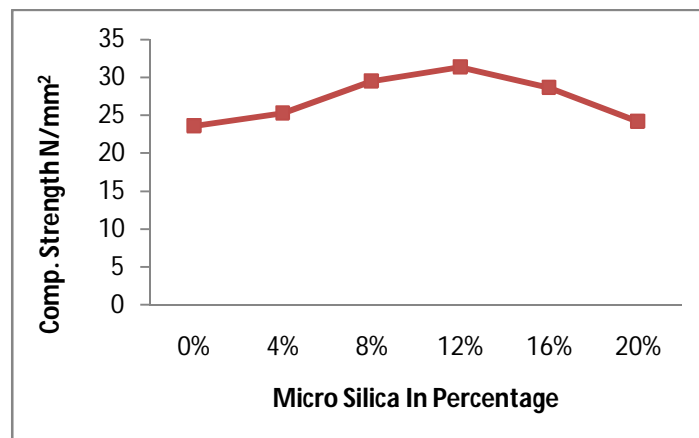
For compressive strength testing total 36 concrete cubes are casted. Six concrete mix samples are used viz., Normal M-30 concrete mix, Normal M-30 concrete mix with 4% M. S., Normal M-30 concrete mix with 8% M. S., Normal M-30 concrete mix with 12% M. S., Normal M-30 concrete mix with 16% M. S. and Normal M-30 concrete mix with 20% M. S.. Each cube is undergone compressive strength testing. Table gives the compressive strength test results at the end of 7th day. Table gives the compressive strength test results at the end of 28th day.

Table No. 5.1 Compressive Strength Vs % M. S.

Type Of Concrete	Compressive Strength (N/mm ²)	
	7 Days	28 Days
Normal Concrete	23.60	41.95
Normal Concrete + 4% M. S.	25.27	43.73
Normal Concrete + 8% M. S.	29.53	46.33
Normal Concrete + 12% M. S.	31.36	50.56
Normal Concrete + 16% M. S.	28.69	45.64
Normal Concrete + 20% M. S.	24.20	44.00

Graphical presentation of compressive strength of different mix proportions is tabulated in Table 5.1 given below. Under this title a graphical comparison done for compressive strength of concrete cubes of different mix proportions shown in figure (a). From this graphical presentation it is observed that compressive strength is goes on increasing as the percentage of M. S. / S. F. is increases. For 12 % M. S. + Normal Concrete highest value of compressive strength is observed.

a. Graph after 7 days curing

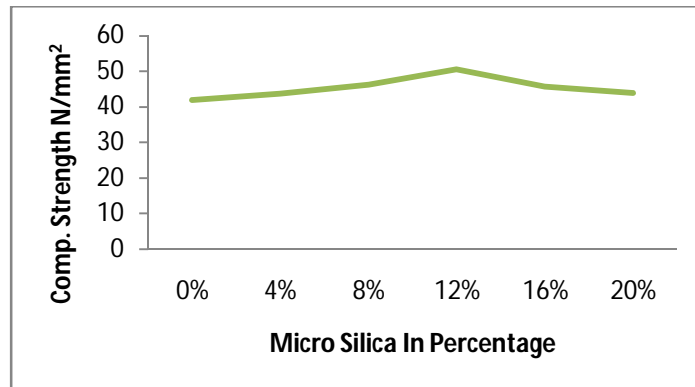


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b. Graph after 28 days curing



2. Test Results for Shear and Torsion Test:

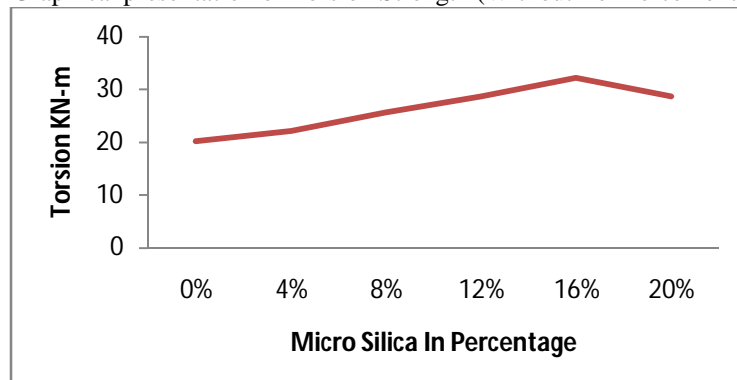
For torsion testing total 18 concrete Beams are casted. Six concrete mix samples are used viz., Normal M-30 concrete mix, Normal M-30 concrete mix with 4% M. S., Normal M-30 concrete mix with 8% M. S., Normal M-30 concrete mix with 12% M. S., Normal M-30 concrete mix with 16% M. S. and Normal M-30 concrete mix with 20% M. S.. Each beam is undergone torsion strength testing. Table gives the torsion strength (Without Reinforcement) test results at the end of 28th day.

Table No. 5.2. Torque in (kN-m) Vs % M. S. without Reinforcement

Percentage of M. S.	Average Torque in kN-m
0 % M. S.	20.22
4 % M. S.	22.10
8 % M. S.	25.60
12 % M. S.	28.69
16 % M. S.	32.16
20 % M. S.	28.69

Graphical presentation of torsion test of different mix proportions is tabulated in table No. 5.2 given below. Under this title a graphical comparison done for torsion strength (Without Reinforcement) of concrete beams of different mix proportions shown in figure (a).

a. Graphical presentation of Torsion Strength (Without Reinforcement)



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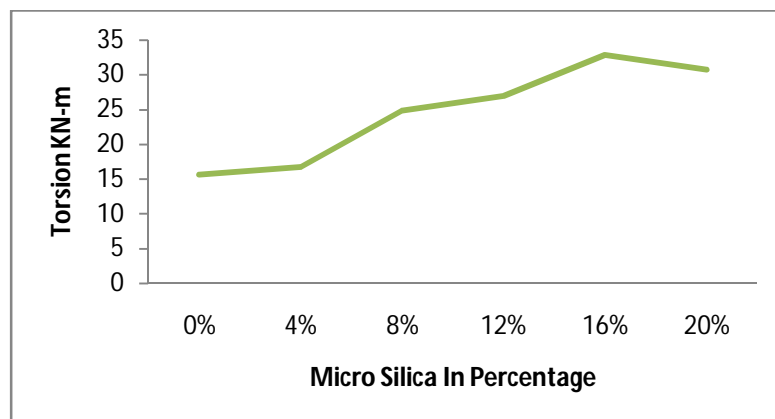
For torsion testing total 18 concrete Beams are casted. Six concrete mix samples are used viz., Normal M-30 concrete mix, Normal M-30 concrete mix with 4% M. S., Normal M-30 concrete mix with 8% M. S., Normal M-30 concrete mix with 12% M. S., Normal M-30 concrete mix with 16% M. S. and Normal M-30 concrete mix with 20% M. S.. Each beam is undergone torsion strength testing. Table gives the torsion strength (With Reinforcement) test results at the end of 28th day.

Table No. 5.3. Torque in (kN-m) Vs % M. S. with Reinforcement

Percentage of M. S.	Average Torque in kN-m
0 % M. S.	15.64
4 % M. S.	16.77
8 % M. S.	24.82
12 % M. S.	26.98
16 % M. S.	32.83
20 % M. S.	30.69

Graphical presentation of torsion test of different mix proportions is tabulated in table No. 5.2 given below. Under this title a graphical comparison done for torsion strength (With Reinforcement) of concrete beams of different mix proportions shown in figure (b).

b. Graphical presentation of Torsion Strength (With Reinforcement)



VI. CONCLUSION

1. From above discussion it is conclude that, all mechanical properties viz. compressive strength and Torsional strength are improved by using S. F.
2. The resistance of plain concrete dose shows pronounced effect on shear and torsion strength.
3. Torsional moment resistance of 16% addition of M. S. is very good as compare to other.
4. M. S. increases the compressive strength of concrete more than 20%.
5. Based on this current investigation, S. F. content can be used as partial replacement of cement up to some extent.

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