

# EXPERIMENTAL STUDY ON SILICA FUME AND MARBLE DUST BY PARTIALLY REPLACED IN REINFORCED CONCRETE BY CEMENT AND SAND

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**Abstract** – Global construction organization use a lot of materials like cement, sand, and aggregate etc. In previous years it is very important to lesser the price of construction materials. Day by day the price of cement and sand are at peak so that countries rich and influence people can afford construction. The development of new era and using low budget materials that can be replace cement and sand by fully or partially in civil work. Cement and sand plays a major role in construction field. Thus, cement is massively expensive due to transportation from required locations. Due to large production of cement the global warming is harmed at higher rate in atmosphere by carbon dioxide. To save the environment and reduce the price by alternative materials such as silica fume and marble dust an innovative idea for such further generation by partially replacing cement by silica fume and river sand by marble dust. Since the replacement Silica fume is used to replace cement in percentages of 6%, 12 percent, 18 percent. Sand is replaced by marble dust in percentages of 8%, 18%, 28%, respectively. This experiment is carried out by flexural and compressive strength test are obtained.

**Key Words:** Silica Fume, Marble Dust, Compression Test, Flexural Test etc

## 1. INTRODUCTION:

All the materials used in many construction fields is mostly concrete. For any kind of construction works such as tunnels, bridges, high rise buildings etc. Concrete is required. As the importance of concrete for construction the replacement should be at similar alternative. Each and every material has its own importance for overall performance of construction. Such ingredients like cement, sand, aggregates etc are required for concrete. As the natural materials are consumed at higher rate CO<sub>2</sub> are produced at peak in atmosphere. The river sand is also plays every crucial role in concrete strength such as cement. So the cement and river sand are replaced by silica fume and marble dust artificially produced materials are partially replaced and this study performance are carried out on M25 concrete.

## 2. MATERIALS:

### 2.1. CEMENT:

As per IS 8112:1989 ordinary Portland cement 53 grade (OPC-53). Cement used was of ACC cement. The properties of cement are given table below.

Sr. No	Property	Unit	Value obtained	Value as IS 8112:1989
1	Normal consistency	%	30	-
2	Initial setting time	Min	50	Not less than 30 min
3	Final setting time	Hrs	7	Not more than 600 min
4	Fineness	%	9	Not more than 10% residue
5	Sp. Gravity	-	3.0	-

### 2.3. FINE AGGREGATE:

As per code IS 383:1970 are referred for locally procured. Physical properties of sand is given table below. Physical Properties of Fine Aggregate

Sr.No	Property	Value
1	Type	Natural sand
2	Sp. Gravity	2.65
3	Fine modulus	2.4
4	Zone	2

### 2.3. COARSE AGGREGATE:

Maximum size of coarse aggregate is 20mm were used. IS 383:1970. Coarse aggregate properties are given table below.

Physical Properties of Coarse Aggregate

Sr.No.	Property	Value
1	Shape	Angular
2	Fine modulus	-
3	Sp. Gravity	3.0
4	Max. Size	20mm
5	Water absorption	0.7%

### 2.4. SILICA FUME:

Condensed silica or micro silica are referred silica fume. They are waste by product produced by element silica. Pozzolan elements acts as filler materials in fine materials, hence increases the varieties properties of concrete. The different physical properties of silica fume are given below table.

Properties of Silica Fume

Sr.No	Property	Value
1	Color	Grey
2	Particle size	-
3	Specific surface	-
4	Sp. Gravity	0.7%

### 2.5. MARBLE DUST:

Marble dust is produced by marble manufacturing plants by cutting, shaping and polishing of marbles. In our country marble are top tier exporters of marble, every year million tones of marble dust are produced in process of making marbles in plants. The wastage of marble can cause reduction in permeability of soil and polluting substance over the ground water when discharge from catchment area. Thus, usage of marble dust in construction field would be massive help to protect environment from dumpsites of marble and also reduce the numbers of mining of natural resources of sand. The properties of marble dust are below table.

Properties of Marble Dust

Sr.No	Property	Value
1	Color	White
2	Form	Dust
3	Sp. Gravity	2.57

### 2.6. WATER:

Water is the most important element in concrete and in construction. Water is responsible for hydration in cement concrete. The quality and quantity should be determined and carefully observed for helping in generating strength and durability in cement. Nominal consumption of water is suitable for cement concrete.

### 3. MIX DESIGN AND PROPORTIONS:

As per provisions IS 10262:2009 Mix design of M25 are made. The process of mix by adding water cement ratio. Following table below is obtained in research.

Mix Design Proportions

	Cement	Water	FA	CA	W/C
Ratio	1	0.5	2.0	3.0	0.55

Proportions above are considered by using silica fume and marble dust as per code, the different proportions are obtained in research. Water cement ratio is considering 0.55 for each every proportion.

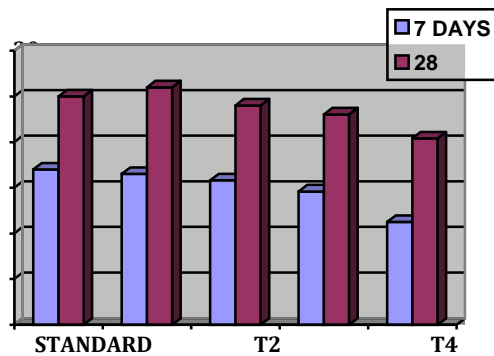
Mix Proportions

Material	Cement	Silica fume	Marble dust	Fine aggregate	Coarse aggregate
Standard	100%	0%	0%	100%	100%
T1	94%	6%	8%	92%	100%
T2	88%	12%	18%	82%	100%
T3	82%	18%	28%	72%	100%

### 4. METHODOLOGY:

#### 4.1 COMPRESSION TEST:

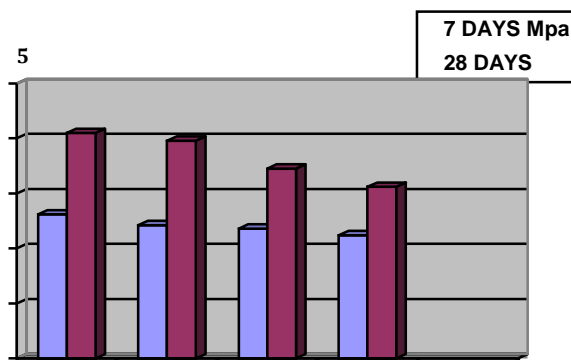
The strength to resist deformation caused by external forces and measured as per IS code for compressive strength for materials. Casting cubes of 150x150x150mm size. Cubes are prepared and cured for 7 and 28 days for compressive strength. Samples were tested in compression machine of 200KN. Loads at which failures occurs.



Total 30 cubes were examined for all proportions. 6 cubes were casted for standard proportions. For Each proportion 3 cubes were casted for following 7 and 28 days. Each cube were cured in water tank for respective days and dried for 2 hrs after taking out from tank. Test is carried out.

#### 4.2. FLEXURAL STRENGTH:

150X150X700mm size of beams was taken. Beams were properly cured for 7 and 28 days as per IS: 516-1959. 1 standard beam was casted and other 4 beams were compared for flexural strength. The test was conduct on universal testing apparatus. Below graph shows comparison between different mix for 7 and 28 days of beams.



#### 5. CONCLUSION:

The investigations carried out as per research conclusion are;

Using silica fume can reduce weight of cubes. Thus, dead load of concrete can be reduced.

The price of silica fume is pretty low than cement up to 8% can be replaced.

Marble dust can be alternative of river sand upto 12% and water consumption 24% is more

It affects workability, strength and durability.

Flexural strength gives low result when silica fume increased by 8% after replaced by cement.

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