# Experimental Investigation on Concrete With Partial Replacement of Fine Aggregate By Granite Powder

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***Abstract-*** *This project report summarizes the strength behavior of concrete with partial replacement of fine aggregate by Granite fine. Granite fines are the byproduct of granite industries while cutting huge granite rocks to the desired shapes. The granite powder from factory is carried by the water and stored in tanks. After evaporation of water the granite dust remained in the tank. Then it is transported and disposed on the land. The major problem of disposing the fines in land leads to various environmental hazards like pollution in air and land. The granite fines exhibit the properties of fine aggregate such as size, fineness and filler capabilities.*

*Concrete is prepared with granite fines as a partial replacement of fine aggregate in different proportions namely 5%, 10%, and 15%. The various tests to be conducted on concrete such as compressive strength, split tensile strength and flexural strength at 7 days, 14 days and 28 days. The tests values are computed and compared with the conventional concrete.*

***Keywords***- Ordinary Portland cement, Fine aggregate, coarse aggregate & granite fines

## I. INTRODUCTION

Concrete is the most popular building material in the world. Construction Industry contributes huge amounts to Indian economy and concrete is one of the best materials used in construction. The ingredients used in it include Cement, Sand, Gravel and Water. Now-a-days sand is not easily available. The world wide consumption of sand as fine aggregate in concrete production is very high, and several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing needs of infrastructural development in recent years. A situation that is responsible for increase in the price of sand, and the cost of concrete.

Expensive and scarcity of river sand which is one of the constituent material used in the production of conventional concrete. The use of Crushed Granite Fine (CGF) as an alternative to natural sand. The granite fines used as 5%, 10% and 15% as a partial replacement for natural sand in the production of concrete.

## II. MATERIAL PROPERTIES

### MATERIAL USED

- Cement
- Coarse Aggregate
- Fine Aggregate
- Replacement granite fines (partial Replacement of fine aggregate 5%, 10%, and 15%)
- Water

### 2.1 CEMENT:

The ordinary Portland cement (OPC) 53 grade cement is used in the project work.

Physical Properties of Cement

The most common cement used is an ordinary Portland cement. The Ordinary Portland Cement of 53 grades conforming. Many tests were conducted on cement; some of them are consistency tests, setting tests, soundness tests.

TABLE I. PHYSICAL PROPERTIES OF CEMENT

| Sl. No | Physical Properties Of OPC 53 Grade Cement | Results |
|---|---|---|
| 1 | Specific Gravity | 3.12 |
| 2 | Standard Consistency | 30% |
| 3 | Initial Setting Time | 30 min |
| 4 | Final Setting Time | 9Hours 30mins |

### 2.2. COARSE AGGREGATES

Aggregates are the important and large used constituents in concrete. They give bond to the concrete, reduce shrinkage and effect economy. One of the most important factors for producing workable concrete is good gradation of aggregates. Crushed granite of 20mm maximum

size has been used as coarse aggregate. Analysis of combined aggregates confirms to the specifications for graded aggregates.

TABLE II. PROPERTIES OF COARSE AGGREGATE

| Sl.No | Description | Value |
|---|---|---|
| 1 | Specific Gravity | 2.91 |
| 2 | Impact Value | 39.02% |
| 3 | Water absorption | 3% |
| 4 | Crushing Test | 12.6% |
| 5 | Flakiness Test | 20.1% |
| 6 | Elongation Test | 26.0% |
| 7 | Abrasion Test | 14.1% |

**2.3. FINE AGGREGATE:**

Sand collected from nearby river is used for this project. The various properties of sand are tabulated in Table III.

TABLE III. PROPERTIES OF FINE AGGREGATE

| Sl.No | Description | Value |
|---|---|---|
| 1 | Specific Gravity | 2.66 |
| 3 | Sieve analysis | Zone iii |

**2.4. GRANITE FINES (GF);**

TABLE IV. PHYSICAL PROPERTIES OF GRANITE FINES

| Sl. No | Physical Properties Of Granite fines | Results |
|---|---|---|
| 1 | Specific Gravity | 2.62 |
| 2 | Sieve analysis | Zone iii |

**2.5. WATER**

Water is the important ingredient of concrete as it actively participates in the chemical reaction with cement. Potable water with pH value 7 is used for mixing and curing throughout the experiment.

## III. EXPERIMENTAL INVESTICATION

**MIX PROPORTIONING**

The grade of concrete M30 is used further proportion of 1:1.1.08:2.84respectively.

Characteristic compressive strength required at the end of 28 days is 30 N/mm$^2$

**SLUMP CONE TEST**

To determine consistency of concrete, Slump test was conducted with varying water content and a particular w/c is fixed according to the slump of 85mm from graph plotted. The various w/c for different proportions of sand with granite fine

**CASTING OF SPECIMEN**

As the aggregate of size less than 20 mm and greater than 12.5 mm are used, cubes mould of 150x150x150 mm are used. Cylindrical mould of size 150 mm diameter and 300 mm height and beam mould of size 500x100x100mm are used for casting specimen.

**PRODUCTION OF CONCRETE**

Cube Moulds, Cylindrical mould and beam mould of were used. They were lubricated with engine oil in order to reduce friction and to enhance removal of cubes from the moulds. They were then filled with concrete in three layers and each layer was tamped 25 times. The moulds containing the cubes were left for 24 hours under a room temperature for the cubes to set before removing the mould. The cubes were removed after 24 hours and were taken to curing tank

**CURING OF CUBES**

The method use for curing in this work is the total immersion of the cubes in water for specific age of 7, 14, and 28 days from the day of casting.

**COMPRESSIVE STRENGTH TEST**

The compressive strength of concrete is one of the most important properties of concrete. Comparative strength if $M_{30}$ grade of concrete for the partially replacement of cement and coarse aggregate by crushed was found. In this test 150x150x150mm concrete cubes were cast, by using 30 N/mm$^2$ concrete. The mixing was done by cubes were remolded and placed under water and cured for 28 days. Then the cubes were tested for their crushing strength at 7, 14 and 28 days.

**SPLIT TENSILE STRENGTH TEST**

The test is carried out in a cylindrical specimen of 150mm diameter and 300mm length. The cylindrical specimen is placed horizontally between the loading surface of a compression testing machine and the load is applied until failure of cylinder, along the vertical diameter.

**FLEXURAL STRENGTH TEST**

Flexural strength is a measurement that indicates a material's resistance to deforming when it is placed under a load. The values needed to calculate flexural strength are measured by experimentation, with rectangular samples of the material placed under load in a Two-point testing setup.

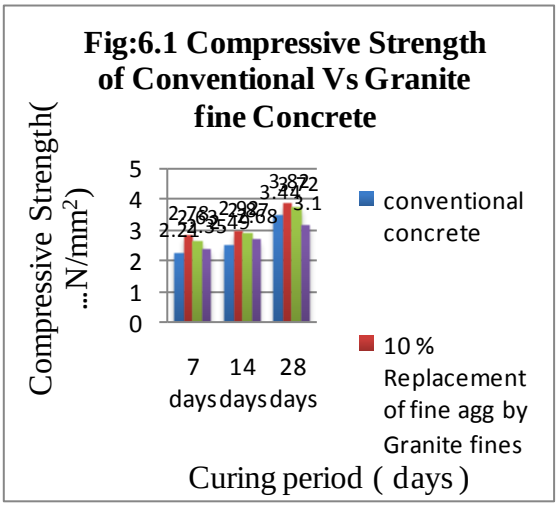
**TEST ON HARDENED CONCRETE**

1. The Compressive Strength
2. The Split Tensile Strength
3. The Flexural Strength

## IV. RESULT AND DISCUSSIONS

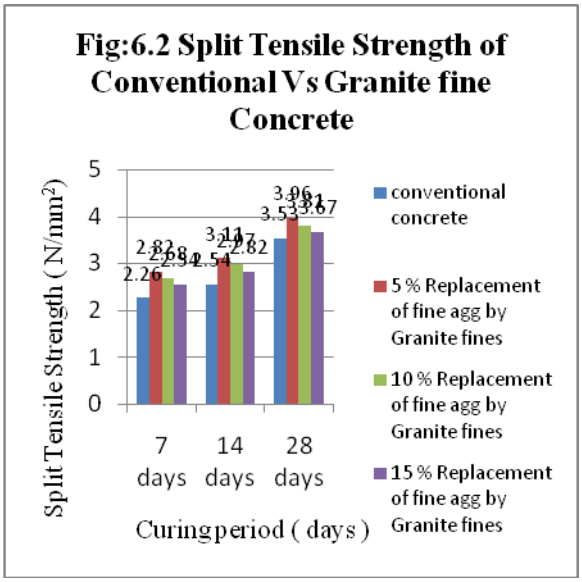
### 4.1 THE COMPRESSIVE STRENGTH ON CUBES

| S.NO | Mix (%) | Average compressive strength ($N/mm^2$) | | |
|---|---|---|---|---|
| | | 7 days | 14 days | 28days |
| 1 | 0 | 19.11 | 24.00 | 33.33 |
| 2 | 5 | 20.44 | 26.22 | 34.66 |
| 3 | 10 | 21.77 | 27.55 | 36.00 |
| 4 | 15 | 20.88 | 24.44 | 34.66 |



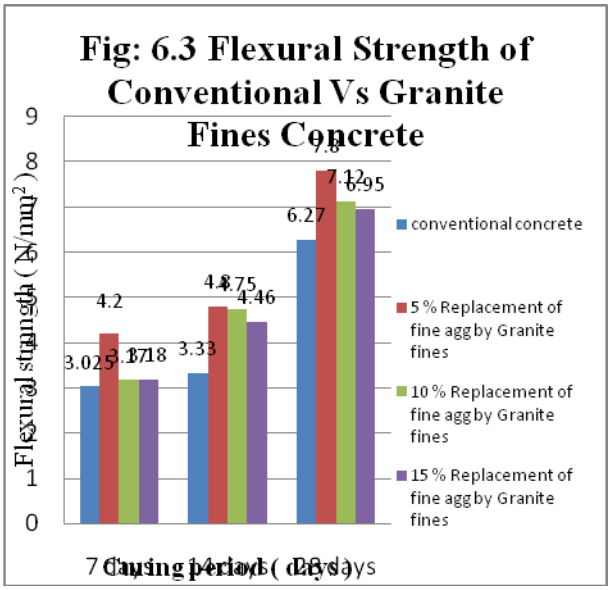

### 4.2 THE SPLIT TENSILE STRENGTH ON CYLINDER

| S.NO | Mix (%) | Average split tensile strength ($N/mm^2$) | | |
|---|---|---|---|---|
| | | 7 days | 14 days | 28days |
| 1 | 0 | 2.26 | 2.54 | 3.53 |
| 2 | 5 | 2.82 | 3.11 | 3.96 |
| 3 | 10 | 2.68 | 2.97 | 3.81 |
| 4 | 15 | 2.54 | 2.82 | 3.67 |




### 4.3 THE FLEXURAL STRENGTH ON BEAM

| S.NO | Mix (%) | Average strength($N/mm^2$) | | Flexural |
|---|---|---|---|---|
| | | 7 days | 14 days | 28days |
| 1 | 0 | 3.025 | 3.33 | 6.27 |
| 2 | 5 | 4.20 | 4.80 | 7.80 |
| 3 | 10 | 3.17 | 4.75 | 7.12 |
| 4 | 15 | 3.18 | 4.46 | 6.95 |




## IV. CONCLUSION

This project report suggests that the specimen cast with 5% replacement of fine aggregate by granite fines gives better compressive strength of 1.62% increased, Split tensile

strength of 0.52% increased and Flexural strength of 1.39% increased. When to compare to conventional concrete. With addition of admixture.

The specimen cast with 10% replacement of fine aggregate by granite fines gives better compressive strength of 2.96% increased, Split tensile strength of 0.37% increased and Flexural strength of 0.80% increased .When to compare to conventional concrete.

The Replacement of granite fine at 15% gives less result when compare to conventional concrete. The management of waste granite powder is a main goal of this project. The granite fine concrete has better strength at 10% replacement. The Replacement of granite fine in concrete gives more Economical and provides better performance.

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