# A REVIEW PAPER ON EXPERIMENTAL STUDY OF FLEXURAL STRENGTH AND COMPRESSIVE BEHAVIOUR OF REINFORCED CONCRETE WITH FLY ASH AND STONE DUST

**Syed Adnan Farooq[1], Aakash RajeshKumar Suthar[2], Abbas Jamani[3]**

*[1]Syed Adnan Farooq, Ahmedabad*
*[2]Aakash RajeshKumar Suthar , Ahmedabad*
*[3]M.E. Civil Engineering Department Student, L.J.University, Ahmedabad, Gujarat*

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**Abstract –** *The experiment is to carry out the reduction of the usage of excessive cement and sand from the concrete. The main purpose of the study is to utilize the waste materials produced in different kind of construction fields such as blocks, and bricks and various productions of industries. Waste materials that can be used as replacement are fly ash and stone dust. The properties of the fly ash and stone dust are similar to cement and sand. Thus, it is not less properties compared to cement and sand. Hence, it is the best help to reduce the usage of cement and sand as for eco-friendly environment from nature pollution. The experiment shows the results of fly ash and stone dust cubes and beams specimen are tested with help of flexural and compressive Test. As the water absorption should not be lesser than 20% of its weight. Safe disposal of waste materials in an environmentally friendly behavior for research is recommended to study the cost and Quality. Concrete mixes are prepared for M25 grade concrete. Cement replacing by fly ash at percentage of 6%, 12%, 18% and 24%. Sand replacing by stone dust at percentage of 8%, 18%, 28% and 38%.*

***Key Words*: Fly Ash, Stone Dust, Eco–friendly, Compressive Strength, Flexural Strength**

## 1. INTRODUCTION:

As the development is acquired in many countries are rising the demand of construction require excessive main ingredients such as cement, sand, aggregates, admixtures and water. As the demand is at the peak for the cement and the river sand for many developing and developed countries demand. Since demand rising global disasters are acquired such as global warming and river dryness. Such cases considered as agricultural damage to the countries. This study is for the purpose of saving the earth from the alternative waste materials such as by replacing cement by fly ash a by- product of thermal coal plant and sand replacing by stone dust a by-product of crushing of stones.

### 1.1 FLY ASH:

Fly ash is the byproduct of the thermal coal plant coal ash. It was found in the Vancouver in 1970's. Typically replacement of ordinary Portland cement in concrete. It was temporary used in construction industries in 1970's. but by later in 1980's the benefits were understood greatly.

The usage of fly ash in India was adopted by 1996-1997. Use of fly ash was highly increased by 68 million tons in early 1980's. Since, until now the usage of fly ash increased by 100 million tons were used. India has increased in utilizing fly ash up to 60% by 2010-2015.

There are two types of fly ash. First class defines F class which is high silicate with low calcium properties derived from the burning of bituminous coal. Second defines C class which is low silicate with high calcium properties derive from burning of sub bituminous coal. Class F is pozzalanic with lesser or non cement value individual.

### 1.2 STONE DUST:

Stone dust is similar material like sand. Generally it is produced by crushing of stones. Use of stone dust in concrete not only benefits the quality of concrete but also saves the natural rivers of countries for future. By replacing aggregates with stone dust in concrete. The max comparison can be carried out by all other replacement levels.

### 1.2 CEMENT:

In civil engineering cement is the most important material for building constructions like bridges, conventional halls and stadiums etc. in narrow senses, binding material are used. Cement is adhesive substance of all type. When cement is mixed with water to get hardened in mass. The settling and hardening show hydration. The chemical properties of the cement with water that yields sub microscopic crystals material with a high surface. Due to their hydrating properties, cements will even settle and get harden under water, is known as hydraulic cement. Well known as Portland cement.

## 2. MATERIALS:

### 2.1. Cement:

53 ordinary grade Portland cement(OPC) is taken through IS code 12269-1939 is used. The specific gravity of 53 grade of cement is 3.1 g/cm^3.

### 2.2. Fine Aggregate:

The main material sand grading zone-2 of IS code 383-1978

Was used with specific gravity of 2.65 IS code: - 2386 part-3

Water absorption is 1.5% at 24 hours.

### 2.3. Coarse Aggregate:

Stone which are mechanically crushed size of 20 mm, data assumed by IS code 383-1978 are used. Specific gravity was found 2.5 and water absorption is 0.15% and 0.18% for 24 hours of 20mm aggregates.

### 2.4. Stone Dust:

Due to crushing of stones together stone dust is formed. Also found during of blasting of stones in quarries. Stone dust are generally are in white sand type which obtained through out M-sand and dust. Collection of stone dust are done by stone quarries and sold out to constructions sites. Stone dust is natural available material and easily obtained in present days. Large quantities are used in construction purposes. It is such in low cost that are why it is preferred in all type of construction. Stone dust is similar to sand. Same strength can be carried out as sand. Sieve of 4.75mm is passed for this experiment.

### 2.5. Fly Ash:

Fly ash are found as fine gray powder mostly in shape of spherical or glassy pieces are produced by coal thermal plant. Properties are pozzolanic for fly ash. It is reactive with lime from compound of cement. Commonly known as supplementary cementitious material. 2.1 Specific gravity is found.

## 3. MIX DESIGN:

Method of mixing of concrete with appropriate materials such as fly ash and stone dust. Strength required for the relative proportions in order to provide the durability in concrete construction. The mixture of five elements such as fly ash, stone dust, fine aggregates, coarse aggregates and water. As replacing of cement as per percentage of 6%, 12%, 18% and 24%. Sand replaced by percentage of 8%, 18%, 28% and 38%. M25 grade is the mix design which is adopted in this experiment. As per the Indian standard 10262:2019 and IS 456:2000 for mix design. The concrete mix are defined as concrete mix design.

## 4. METHODOLOGY:

### 4.1. Compressive strength test:

This experiment is for total 15 cubes. Cement replaced at level of 6%, 12%, 18% and 24% by fly ash. Sand replaced at level of 8%, 18%, 28% and 38% respectively. Mould 150mm x 150mm x 150mm size of cube is prepared for compressive test. 3 specimens are tested at particular days like 7, 14, and 28 days. Freshly casted specimen were left in mould for 24 hours and then de-moulded. After de-moulded cubes are submerged in water for curing until testing is done.

### 4.2. Flexural Strength Test:

This experiment is for total 15 beams. Cement replaced at level of 6%, 12%, 18% and 24% by fly ash. Sand replaced at level of 8%, 18%, 28%, and 38% respectively. Mould 150mm x 150mm x 700mm size of beams is prepared for flexural test. 3 specimens are tested at particular days like 7, 14, and 28 days. Freshly casted specimen were left in mould for 24 hours and then de-moulded. After demoulded beams are submerged in water for curing until testing is carried out.

## 5. RESULT:

### 5.1. Test Results of Compressive Strength Test:

Compressive strength test is performed on hardened concrete, the test results are measured throughout by compressive testing machine

| Mix % of FA & SD | 7 days (N/mm^2) | 14 days (N/mm^2) | 28 days (N/mm^2) |
|---|---|---|---|
| 0% of FA & 0%SD | 29.04 | 32.60 | 38.23 |
| 6% of FA & 8%SD | 29.50 | 32.80 | 38.53 |
| 12% of FA & 18%SD | 29 | 33 | 39 |
| 18% of FA & 28%SD | 27 | 32 | 37 |
| 24% of FA & 38%SD | 26 | 30 | 36 |

Table 5.1 Test Result of Compressive Strength Test of Fly Ash & Stone Dust

The test result of compressive strength testing were observed that the strength characteristic increased by partial replacement of 12% fly ash by cement and 18% stone dust replaced by sand in concrete.

### 5.2. Test Result of Flexural Strength Test:

Flexural strength test is performed on hardened concrete, the test results are measured throughout by flexural testing machine.

| Mix % of FA & SD | 7 days (N/mm^2) | 14 days (N/mm^2) | 28 days (N/mm^2) |
|---|---|---|---|
| 0% of FA & 0%SD | 2.91 | 3.09 | 4.74 |
| 6% of FA & 8%SD | 3.23 | 3.49 | 5.21 |
| 12% of FA & 18%SD | 3.56 | 4.24 | 5.36 |
| 18% of FA & 28%SD | 3.12 | 3.75 | 4.81 |
| 24% of FA & 38%SD | 2.68 | 3.26 | 4.78 |

Table 5.2 Test Result of Flexural Strength Test of Fly Ash & Stone Dust

The test result of flexural strength testing were observed that the strength characteristic increased by partial replacement of 12% fly ash by cement and 18% stone dust replaced by sand in concrete.

## 6. CONCLUSIONS

When 12% of the cement is replaced with fly ash and 18% of the sand is replaced with stone dust, the compressive strength of the concrete increases, and when any proportion of partial replacement is added, the compressive strength drops.

When 12% of the cement is replaced with fly ash and 18% of the sand is replaced with stone dust, the flexural strength of the concrete increases, and when any proportion of partial replacement is added, the compressive strength drops.

As a result, it has been show that 12% of fly ash may be replaced by cement and 18% of stone dust by sand in concrete.

These are one of the most cost-effective materials for partial replacement of fly ash and stone dust, both of which are readily accessible and waste products in the building sector.

It also lowers the building costs in terms of materials.

This technique of using waste materials as partial replacement materials may also help to decrease the amount of land used for dumping trash, and it is one of the ways to reduce environmental pollution by reducing the use of cement.

Because the cost of sand and its availability has become a major issue in the building sector, utilizing stone dust as a partial substitute material reduces sand use.

## 7. FUTURE WORK:

In this experiment research , M25 grade concrete was utilized and evaluated, and the grade of concrete may be raised and tested in the future, for example, M30, M40 and so on. Replacement of 11 percent, 12 percent, and 13 percent fly ash and 21 percent, 22 percent, and 23 percent stone dust may also be done using the percentages of fly ash and stone dust.

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