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# Experimental Study on Pervious Concrete Using Fly Ash and Rice Husk Ash

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***Abstract— Pervious concrete is a mixture of gravel or granite stone, cement, water, little to no sand (fine aggregate). Allowing water to pass through concrete having high void or porosity is known as pervious concrete. When pervious concrete is used for paving, the open cell structures allow storm water to filter through the pavement and into the underlying soils. In other words, pervious concrete helps in protecting the surface of the pavement and its environment. In the present study, the effects on compressive strength of pervious concrete by replacement of cement by different percentages of fly ash and rice husk ash has been investigated. The goal is to achieve a maximum compressive strength characteristics of the pervious concrete by replacing cement by Rice husk ash and Fly ash which are waste products so that carbon-di-oxide emission is reduced using above seen while more in many a times of cement. This will be accomplished through extensive experiments on test cubes created for this purpose. Experiments include specific gravity tests, compression test.***

***Index Terms— Fly ash, pervious concrete, Rice husk ash, compression test***

## I. INTRODUCTION

Pervious concrete had its earliest beginnings in Europe. In the 19th century pervious concrete was utilized in a variety of applications such as load bearing walls, prefabricated panels and paving. Cost efficiency seems to have been the primary reason for its earliest usage due to the limited amount of cement used.

Pervious concrete uses less cement than conventional concrete. Cement production is one of the reasons for global warming by releasing carbon-dioxide in the environment. Therefore, formulation of concrete with different type of industrial waste can help in minimizing the environmental problems. The utilization of pozzolanic materials like fly ash and rice husk ash in concrete is growing in construction industry all around the world to reduce the CO2 release into the environment and reduce energy consumption.. Pervious concrete can be used in a wide range of applications, although its primary use in pavements which are in: residual roads, alleys and driveways, low volume pavements, low water crossings, sidewalks and pathways, parking areas, tennis courts, slope stabilization, sub-base for conventional concrete pavements etc. As more research on pervious concrete using supplementary cementations materials such as fly ash and rice husk ash.

## II. METHODOLOGY

*The experimental investigation carried out on pervious concrete by replacement of cement with fly ash and rice husk ash up to 20% by weight of cement. For all mix proportion* W/C ratio is constant 0.35. Pervious concrete contains cement, sand, aggregate, water, fly ash or rice husk ash specimens were casted in lab. Three cubes were casted on mould size 150*150*150mm for each concrete mix with partial replacement of cement by fly ash or rice husk ash for compression test. After 24 hours the specimens were de-molded and curing was done. For compression test specimen tested after 7, 14, 28 and 56 days.

## III. EXPERIMENTAL INVESTIGATION

### Characterization of Raw Materials

***Cement:*** The requirements of properties of cement are given in the following Indian standard IS: 4031-1998. In the present study, the ACC cement 53 grade is selected. The specific gravity is 3.15 and initial setting time is 142minutes

**Rice husk ash**: The performance of rice husk ash in concrete is of factors influencing the amount of silica added. Rice husk ash as a pozzalonic reactive material can be used to improve surface area of transition zone between the microscopic structure of cement paste and aggregate in the high- performance concrete. Its specific gravity is 1.28 and particle size is less than 45microns.

**Flyash***:* Fly ash is byproduct of the thermal power plants. Class F Fly ash was used having a lower content of CaO and exhibit pozzolonic properties. Specific gravity of fly ash is 2.1 as per Specific gravity Test IS: 2386Part III, 1963.

**Coarse aggregate**: Coarse aggregate obtained from local quarry units has been used for this study conforming to IS: 383-1970 is used; Maximum size of aggregate used is 12.5mm with specific gravity of 2.65 and water absorption is 0.3.

**Water**: The water used for experiments was potable water conforming as per IS: 456-2000.

**Admixture:** Concrete admixtures are added to change the properties of concrete to make it function as required. Admixtures are used to modify properties of both fresh and hardened concrete. In the present study Super plasticizer Glenium B233 is an admixture of a new generation based on

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modified polycarboxylic ether. It is free of chlorides and low alkali, it is compatible with all type of cements and provides high workability without segregation or bleeding.

## IV. DESIGN MIX

The mix proportion of pervious concrete is not same as conventional concrete. The mix proportion is based on ACI 2010.

**1. Mix proportion of Normal concrete**

| ***MATERIALS*** | ***TRAIL(kg/m3)*** |
|---|---|
| Cement | 350 |
| Water | 146 |
| 12.5 mm Aggregate | 1974 |
| Admixtures | 1.05 |

**2. Mix proportion with Fly ash**

| ***MATERIALS*** | ***TRAIL1 (kg/m3)*** | ***TRAIL2 (kg/m3)*** | ***TRAIL3 (kg/m3)*** |
|---|---|---|---|
| Cement | 315 | 297.5 | 280 |
| Water | 146 | 146 | 146 |
| 12.5 mm Aggregate | 1956 | 1947 | 1938 |
| Fly ash | 35(10%) | 52.5(15%) | 70(20%) |
| Admixture | 1.05 | 1.075 | 1.575 |

**3. Mix proportion with Rice Husk ash**

| ***MATERIALS*** | ***TRAIL1 (kg/m3)*** | ***TRAIL2 (kg/m3)*** | ***TRAIL3 (kg/m3)*** |
|---|---|---|---|
| Cement | 315 | 297.5 | 280 |
| Water | 146 | 146 | 146 |
| 12.5 mm Aggregate | 1956 | 1947 | 1938 |
| Fly ash | 35(10%) | 52.5(15%) | 70(20%) |
| Admixture | 1.05 | 1.075 | 1.575 |

**Compressive Strength Test (IS: 516-1959)**

For compression test, specimen of size 150mm*150mm*150mm were casted and tested in compression testing machine with reference of the test procedure given in IS: 516-1959.

The compressive strength test was performed on all seven mix designs. Seven cubes were cast from each mix design and the average compressive strength was taken. Four different periods were used to determine the rate at which cubes gained strength Day 7, Day 14, Day 28 & Day 56. The specimens were removed from the curing tank at the day of testing and wiped clean. The weight of each specimen was measured in weighing machine. The specimens were then placed under the center ring of the compression machine.

Moulded Cubes kept for 24 hours Demoulding of cubes

Compression strength test

## V. EXPERIMENTAL RESULT AND DISCUSSION

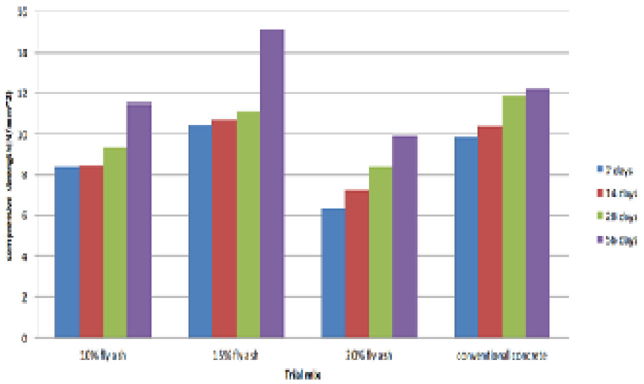


Figure showing Compressive strength details of different % of fly ash

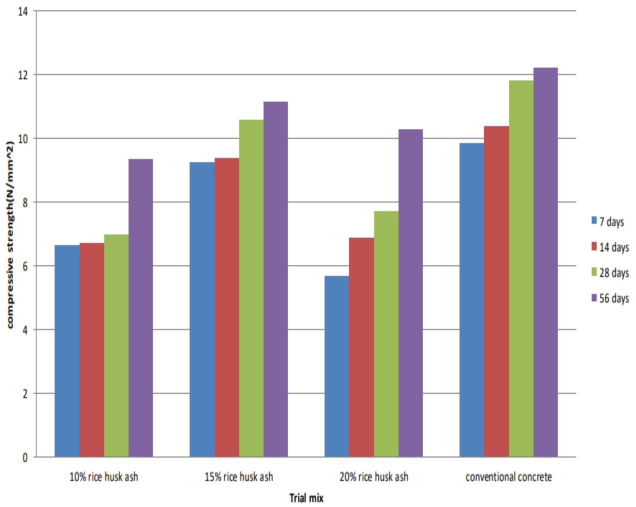


Figure showing compressive strength details of different % of rice husk ash

## VI. CONCLUSION

Based on the experimental investigation concerning the compressive strength of concrete the following observations were made.

- The compressive strength of pervious concrete increases upto 15% replacement of cement with fly ash beyond that it is starts to decrease compared to conventional pervious concrete.
- When compared to conventional pervious concrete, there is no appreciable strength increased when cement replaced by different percentage of Rice husk ash.
- The strength starts increasing with age whether it is for conventional pervious concrete or pervious concrete replaced by Rice husk ash or Fly ash.

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