# Experimental work on Partial Replacement of FLYASH and ASBESTOS in CEMENT CONCRETE


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# INTRODUCTION

## ASBESTOS

- Asbestos is a naturally occurring thin crystalline long fiber that when used for the preparation of concrete improves the fresh and hardened properties of concrete such as compressive and flexural strength.
- In the construction industry, it finds its application in heat and acoustic insulation, fireproofing, roofing, and flooring jobs.

- Asbestos is added to the concrete in two ways :
  I. Addition of asbestos fiber in cement
  II. Addition of asbestos fiber in concrete

**1.Asbestos in Cement**

- Most of the asbestos concrete components are made up of using asbestos cement due to the high risk of consumption of asbestos fibers through inhalation. Generally, 10-15% of the cementitious material is replaced with asbestos in the production process of cement.
- The long asbestos fibers or higher percentages of fibers produce higher strength properties. With the help of high curing pressure or forming pressures, increased density can be achieved which in turn produces higher strength properties. The higher density products are less porous and sometimes give the effect of improving chemical resistance properties.

**2.Asbestos in Concrete**

- As asbestos is a very hazardous material, use of raw asbestos fiber for the concrete mix at the site is not recommended. But under a controlled environment, the use of asbestos fiber in concrete is permissible.

# Effect of Asbestos on Concrete's properties

## 1. Compressive Strength

•Tests conducted on concrete with varying percentage of asbestos fiber show that the compressive strength of the concrete is most when 0.75% of cement is replaced with asbestos fibers. The strength of 0.75% fiber reinforced concrete is 40.89MPa whereas that of conventional concrete is 30 MPa.

- ❖ From the results, it can be clearly seen that there is an increase of 33% in compressive strength with the introduction of asbestos fiber in concrete to that of conventional concrete.

## 2. Flexural Strength

•Test conducted on concrete with varying percentage of asbestos fiber also show that the flexural strength of the concrete is most when 0.75% of cement is replaced with asbestos fibers. The strength of 0.75% fiber reinforced concrete is 6.27 MPa whereas that of conventional concrete is 5.13 MPa.

- ❖ By comparing the two, it can be clearly seen that there is an increase of 23% of flexural strength with the introduction of asbestos fiber in concrete to that of conventional concrete.

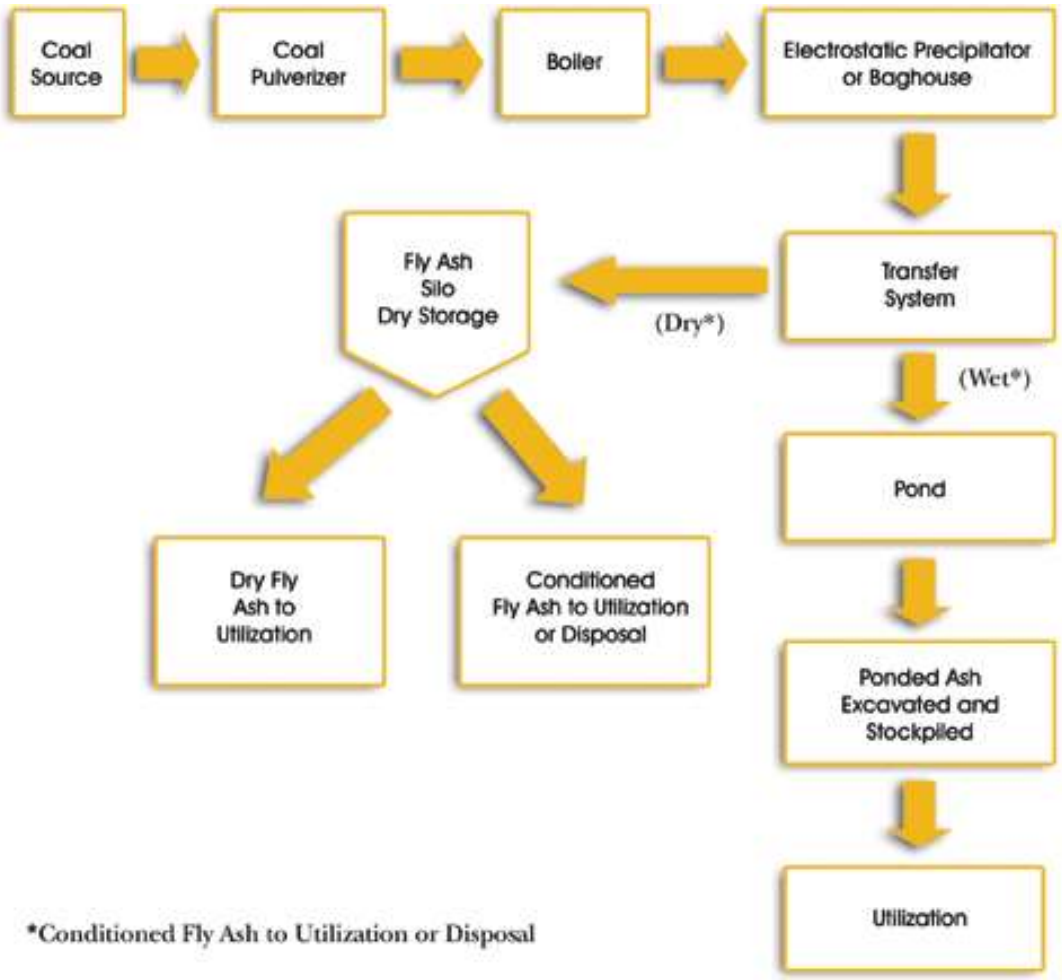
# FLY ASH

- **Fly ash** is the finely divided residue that results from the combustion of pulverized **coal** and is transported from the combustion chamber by exhaust gases.
- Fly ash has also been used as embankment pavements and mine fills and it has increasingly grained acceptance by the federal highway administration.
- There are different types of fly ash, Class F and Class C fly ash are the two types of fly ash defined by ASTM C-618. Class F fly ash is created when old anthracite and bituminous coal is burned, and it includes less than 10% lime (CaO). Fly ash from older lignite or sub bituminous coal burning is designated as Class "C" because it contains more than 20% lime (CaO).

**Class F Flyash**


**Class C Flyash**

# FLYASH Manufacture



# CHEMICAL COMPOSITION

| Oxyde (%) | Portland cement | Fly Ash |
|---|---|---|
| $SiO_2$ | 21.25 | 59.94 |
| $Al_2O_3$ | 4.33 | 22.87 |
| $Fe_2O_3$ | 1.85 | 4.67 |
| $TiO_2$ | 0.13 | 0.94 |
| CaO | 64.30 | 3.08 |
| MgO | 1.81 | 1.55 |
| $So_3$ | 3.70 | 0.35 |
| $K_2O$ | 0.71 | 2.19 |
| $Na_2O$ | 0.17 | 0.62 |
| l.o.i | 1.50 | 3.34 |


LITERATURE REVIEW

| S.No | Name of the Authors ,year | Title | Journal detail | Conclusion of author |
|---|---|---|---|---|
| 1. | **Jayanta Chakraborty, Sulagno Banerjee** | Replacement of Cement by Fly Ash in Concrete | SSRG International Journal of Civil Engineering ( SSRG – IJCE ) – Volume 3 Issue 8 – August 2016 | ❖Experiments on different times suggest that the compressive strength of concrete mixes decrease with increase presence of Fly Ash. It should be kept in mind that the optimum limit of mixing of Fly Ash is 45 % and more than that may not be safe for different concrete mixes. |
| 2. | **L.K. Crouch , Ryan Hewitt , Ben Byard** | High Volume Fly Ash Concrete | 2007 World of Coal Ash (WOCA), May 7-10, 2007, Northern Kentucky, USA | ▪The ultimate compressive strengths for the HVFA mixtures were similar to or greater than those of the TDOT Class A mixtures. The HVFA C ash mixture had greater compressive strengths at all ages, due to the pozzolanic and cementing properties of the fly ash. The compressive strengths of the HVFA F ash mixture were similar to those of the TDOT mixture after approximately three weeks |

| S.No | Name of the Authors ,year | Title | Journal detail | Conclusion of author |
|---|---|---|---|---|
| 3. | N. G. Patoliya,<br>Dr. Anurag Misra. | Characteristics study of high volume fly ash concrete | Narmada, Water Resources, Water Supply and Kalpsar Department, Government of Gujarat,Applied Mechanics Department, MNIT, Jaipur.<br>Volume 2,Issue 11, November -2015 | ➢The increase in compressive strength with lower water content is visible in 28 d ays compressive strength curves (Fig.6.3) also. Here though the fly ash concrete indicated lower strength at early ages. However, compressive strength of fly ash concrete is almost equal or little less than that of the control mix but it can be expected that by 90 days after casting it will be higher than the compressive strength of the control mix. |
| 4. | E Susanti ,<br>H Istiono ,<br>I Komara | Effect of fly ash to water-cement ratio on the characterization of the concrete strength | Department of Civil Engineering, Faculty of Civil, environmental, and planning, Institut Teknologi Adhi Tama Surabaya, East Java, Indonesia.(2010) | • Modulus of fracture and modulus elasticity for both NC and NFA is comparable to the compressive strength which illustrates the similar behaviour.<br>•The application of FA using high-volume mixture as a replacement of cement reduces CO2 emission that impact to the safety environment and energy conservation. |

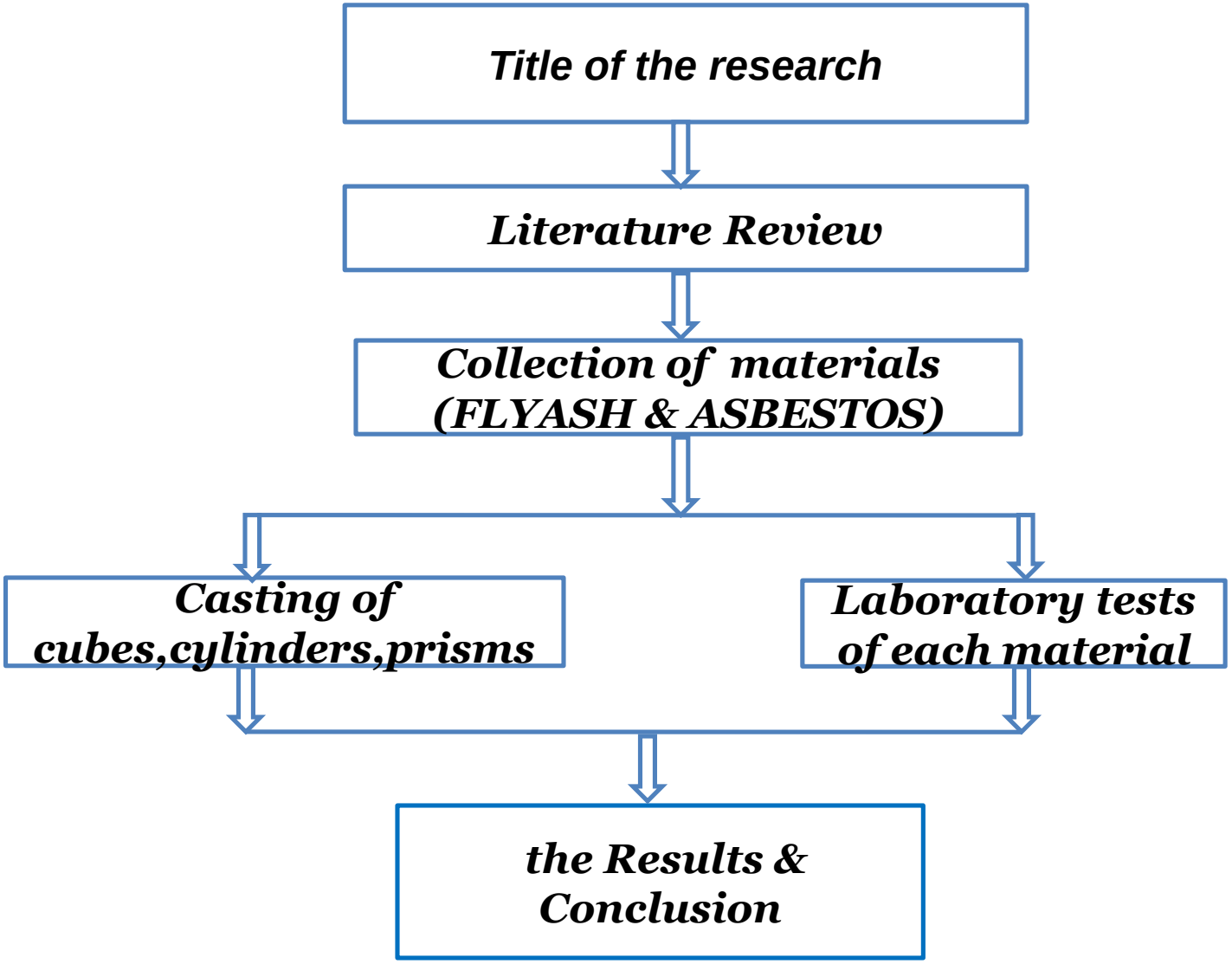
# OBJECTIVES

TO DETERMINE THE PHYSICAL PROPERTIES AND ENGINEERING PROPERTIES OF FLY ASH AND ASBESTOS.

TO DETERMINE INDEX AND STRENGTH PROPERTIES OF VARIOUS COMPOSITION OF CEMENT-FLY ASH AND ABESTOS.

TO ACHIEVE THE GOOD TEST RESULT OF FLY ASH AND COIR ASBESTOS COMBINED CONCRETE.

# METHODOLOGY

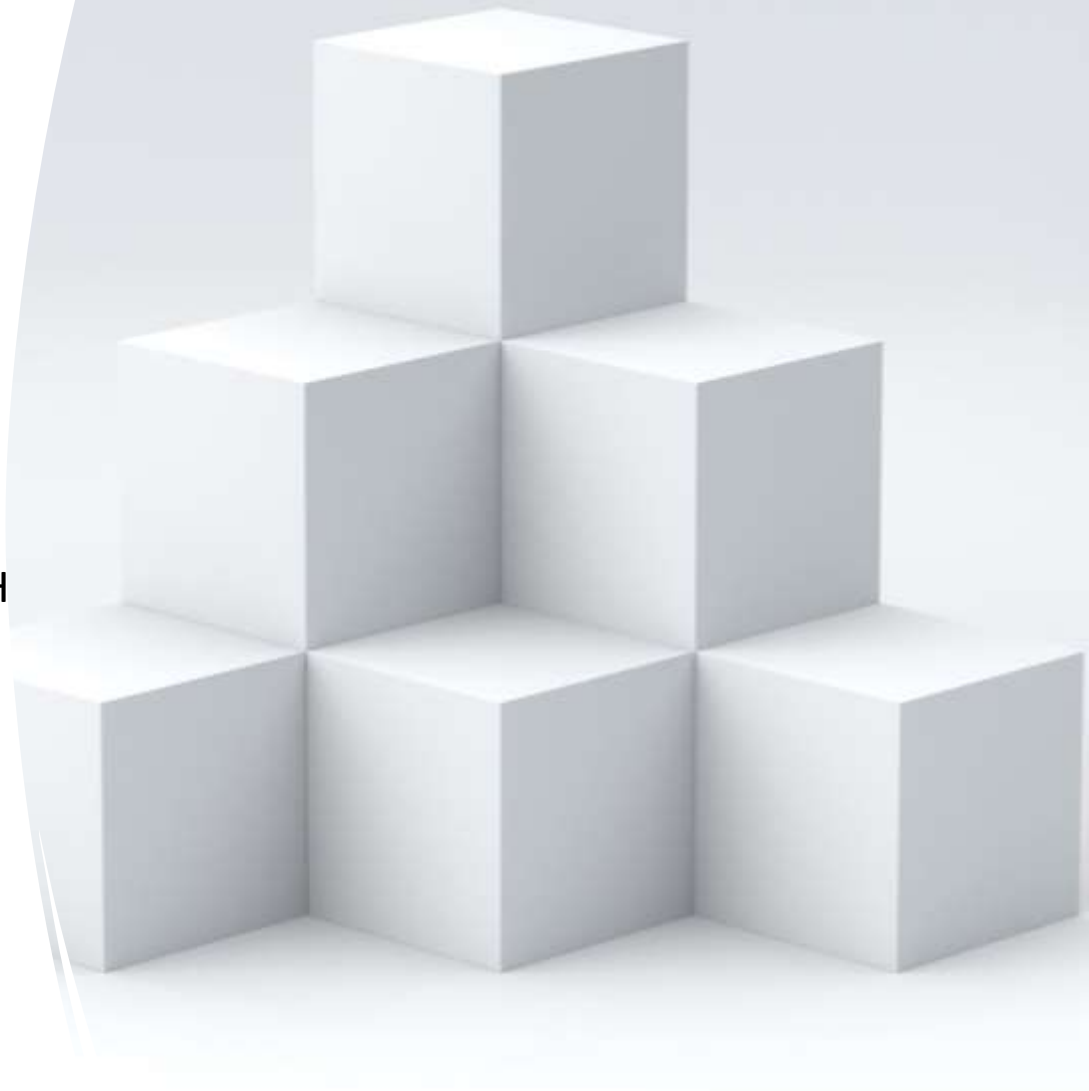


# Methodology

**CUBES**-COMPRESSIVE STRENGTH
150mm*150mm* 150mm

**CYLINDERS**-SPLIT TENSILE STRENGTH
150mm*300mm

**PRISMS**-FLEXURAL STRENGTH



# Experimental work

**Tests on Cement::-**

- Fineness Test.
- Consistency Test.
- Setting Time Test.
- Strength Test.
- Soundness Test.
- Tensile Strength Test.

# Tests on Fine &Coarse Aggregate

**Tests on FINE AGGREGATE:-**

1. Sieve Analysis.
2. Specific Gravity.
3. Water Absorption & Moisture Content.
4. Bulk Density & Voids.

**Tests on COARSE AGGREGATE:-**

1.Sampling of Aggregate Tests

2.Aggregate Crushing Value

3.Impact Value of Coarse Aggregate

4.Sieve Analysis Test of Coarse Aggregates

5.Flakiness Index of Aggregate

6.Elongation Index of Aggregate

# Aggregate Classification : S

- **Fine Aggregate**
  - Sand and/or crushed stone.
  - < 4.75 mm.
  - F.A. content usually 35% to 45% by mass or volume o aggregate.

- **Coarse Aggregate**
  - Gravel and crushed stone.
  - >4.75 mm.
  - Typically between 9.5 and 37.5 mm.

# REFERENCES


1. Mehta, P.K., 2004, May. High-performance, high-volume fly ash concrete for sustainable development. In *Proceedings of the international workshop on sustainable development and concrete technology* (pp. 3-14). Ames, IA, USA: Iowa State University.
2. Crouch, L.K., Hewitt, R. and Byard, B., 2007. High volume fly ash concrete. *World of Coal Ash (WOCA)*, pp.1-14.
3. Inaba, T., Nagano, M. and Endo, M., 1999. Investigation of plasma treatment for hazardous wastes such as fly ash and asbestos. *Electrical Engineering in Japan*, *126*(3), pp.73-82.
4. The Indian concrete journal, November; 2004,
5. The Indian concrete journal, June; 2005,
6. The Indian concrete journal, March; 2006,

# THANK YOU