

# **USE OF FLY ASH IN PRECAST COMPONENTS**

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## **ABSTRACT:-**

Fly ash is finely divided residue resulting from the combustion of pulverised bituminous coal in thermal power plant & other industries. Research scholars have found that fly-ash is possessing Pozzolonic properties. Due to pozzolonic properties of flyash its addition in OPC conc. durability can be enhanced. Flyash concrete mix would give equivalent strength at later stage i.e. 56 days & beyond but show lower strength in the initial period.

In precast component the strength of conc at the time of removal of form work to be atleast twice the stresses.(Due to prevailing load)at transfer at that age. Also 7 days & 2 days strength is prime requirement. To achieve this flyash is chemically activated & tried out.

In manufacturing Precast components, the skilled & experienced of persons involved may be advantageously used.

The most common reason for use of flyash is saving in cost of material & labour & improves quality of conc.

## **✦ KEY WORDS:**

OPC, Fly ash, Precast, Prestress.

## **✦ INTRODUCTION:-**

When we burn pulverised coal in boiler to generate electricity in thermal power station or industries, Flyash is produced as a waste product.

It is difficult & also costlier for safe disposal of flyash. Use of it for sustainable development is the right answer.

Research Scholars & Civil Engineers have found that flyash has pozzolonic properties.

Use of Flyash in OPC conc will result in strong durable & economical conc.

## **✦ NEED FOR CHEMICAL ACTIVATION:-**

Flyash conc mix would give equivalent strength at later stage i.e. 56 days & beyond but show lower strength in the initial period.

In precast component the strength of conc at the time of removal of form work to be at least twice the stresses.(Due to prevailing load)at transfer ie. Approx 3-5 MPA. Also 7 days & 28 days strength is prime requirement as per IS 456-2000.

In manufacturing precast conc component each mould or form requires a capital investment for this reason manufacturer generally achieve their competitive position in the market by using limited no of forms. For this reason there is always a temptation for earlier demoulding.

## **✦ MASONRY UNITS: -**

Bricks, blocks, paver blocks, roofing tiles etc. can be manufactured using high volume flyash.

General Composition: -

Flyash: 60 – 75%

Gypsum: 5 – 10%

Sand/Querry dust: 15 – 20%

Lime: 5 – 10%

Instead of lime: 4 – 6% cement can be used.

Resultant products have low water absorption 4 – 5%  
 Comp Strength: 80 – 100 kg/cm<sup>2</sup>. [1]

➤ **COMPARISION OF COMPRESSIVE STRENGTH FOR M40 CONC.**

**Table 1:-**

% age replacement of cement	Ave comp strength 7 days in MPa	Ave comp strength 28 days in MPa
0	42.96	57.78
5	43.19	56.74
10	53.48	57.78
15	54.52	60.44
20	57.04	67.19
25	53.63	61.17
30	50.07	58.74
35	43.70	55.33
40	43.11	53.36
45	40.74	50.81
50	26.93	34.22

**Table 2:- COMPARISION OF COMPRESSIVE STRENGTH**

Type of conc.	28 days comp. strength N/mm <sup>2</sup>		
	Ref conc.	Fly ash conc.	
	0%	25%	35%
M20	22.00	31.09	20.09
M30	33.66	35.25	39.09

Chemically activated Flyash, for 33% replacement of cement, is tried out successfully for fencing poles, doors & window frames in the actual field. [4]

➤ **CONCRETE PIPE:-**

Flyash may provide significant benefits in the manufacture of concrete pipes. Pipe containing flyash is more resistant to weak acids & sulphates.

Many concrete pipe manufacturers use cement content higher than needed for strength to obtain the required workability. The cement content can be reduced by replacing some of the cement with flyash.

Use of flyash increase the cohesiveness of no slump mix freshly placed concrete facilitating early form stripping. Flyash can reduce the amount of hair line cracks on the inside surface of stored pipe sections.

Chemically activated Flyash for 33% replacement of cement is tried out successfully for spun pipe in the actual field

➤ **PRESTRESSED CONCRETE:-**

In Prestressed concrete products, each form used in the production concrete products requires a large capital investment. For this reason, prestressed conc. products generally achieve their competitive position in the market place by using a limited no of forms. For this production compressive strength of 22 to 25 MPa is required at the time of form removal or stripping to transfer the prestress from the form or prestressing bed to conc. i.e. 3 days strength. [5] [6]

To achieve this in Flyash cement conc. replacement of sand by quarry dust is tried out. The results are as shown in table

**Table no 3. Strength of Quarry dust Flyash Concrete**

Average Compressive strength in MPa			
% age replacement of cement	3 days	7 days	28 days
0%	22.5	42.96	57.78
20%	17.5	57.04	67.19
20% + 10% quarry dust	24.0	-----	-----

M45 Grade conc. (used for electricity pole) was selected for the experiment.

➤ **Conclusion:-**

Upto 33% replacement of OPC 53 grade is possible without affecting the strength criteria.

Use of Cemsave(Activated flyash) in precast components improves workability resulting in sharp distinctive corners & edges. Better surface appearance can be obtained due to improved flowability.

The most common reason for use of flyash is ‘to manufacture world class conc., at competitive price.’

**Table 4:-** Extract of Table 5 IS-456-2000 [3]

Sr No.	Exposure	Plain concrete			Reinforced concrete		
		Min <sup>m</sup> cement content Kg/m <sup>3</sup>	Max <sup>m</sup> free water cement ratio	Min <sup>m</sup> grade of conc.	Min <sup>m</sup> cement content Kg/m <sup>3</sup>	Max <sup>m</sup> free water cement ratio	Min <sup>m</sup> grade of conc.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	---	300	0.55	M20
ii)	Moderate	240	0.60	M15	300	0.50	M25
iii)	Severe	250	0.50	M20	320	0.45	M30
iv)	Very Severe	260	0.45	M20	340	0.45	M35
v)	Extreme	280	0.40	M25	360	0.40	M40

Notes:- (1) Cement content described in this table is irrespective of the grades of the cement & it is inclusive of additions mentioned in 5.2 according to IS-456 2000. The additions such as Flyash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content & water cement ratio if the suitability is established & as long as the maxm amount taken into account do not exceed the limit of pozzolona & slag specified in IS-1489(Part 1) & IS-455 respectively.

(2) Minm grade for plain concrete under mild exposure condition is not specified.

*“In the real world of modern concrete, flyash is as essential an ingredient of the mixture as Portland cement, aggregates, water & Chemical admixture. In most concretes I use it in larger amounts (By volume) than Portland cement, & therefore it not an admixture, i.e. an addition to the mixture. Concrete without flyash & chemical admixtures should only be found in museum showcases.” [7]*

-E.A. Abdun-Nur, 1984.

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