HIGH VOLUME FLY ASH CONCRETE

FLY ASH

- Fly Ash –

  finely divided residue resulting from the combustion of the powdered coal and transported by the flue gases and collected by the electrostatic precipitator.

- Exhibits Pozzolanic behaviour

WHAT IS HIGH VOLUME FLY ASH CONCRETE?

- High volume fly ash concrete is a concrete where a replacementof 50 to 60 percentage of cement is made with the usage of fly ash.

- But IS: 456 – 2000(Code of Practice for Plain and Reinforced Concrete) allows replacement of OPC by Fly ash up to 35% as binding material.

Ways To Use Fly ash In Concrete

- Mixing fly ash with cement clinker at the factory to produce Portland Pozzolana Cement (PPC).

- Using fly ash as an admixture at the time of making concrete at work site

Benefits of Using Fly Ash

- Low heat of hydration and thermal shrinkage
- Improved resistance to attack by sulfate soils and sea water

Ash Production And Its Availability

- Fly ash obtained from Electrostatic Precipitators (ESP) is stored in silos.
- Electrostatic Precipitators (ESP)

➢ 6 to 8 rows

➢ field(row) at the boiler end is called as first field & counted subsequently 2, 3 onwards

➢ field at chimney end is called as last field

➢ coarse particles of fly ash are collected in first fields of ESP

➢ fineness of fly ash particles increases in subsequent fields of ESP.

Characteristics Affecting Performance of Fly Ash Concrete

- Fineness - Finer the fly ash, the more the surface area available to react with lime and thus more will be the pozzolanic activity of fly ash.

- Calcium (CaO) content – Higher the CaO content, the greater will be the pozzolanic activity and greater the contribution to the strength in concrete.

ASTM Classification

- Class F Fly ash : less than 5% CaO.
- Class C Fly ash : more than 15 % CaO.

Properties of Fresh Concrete

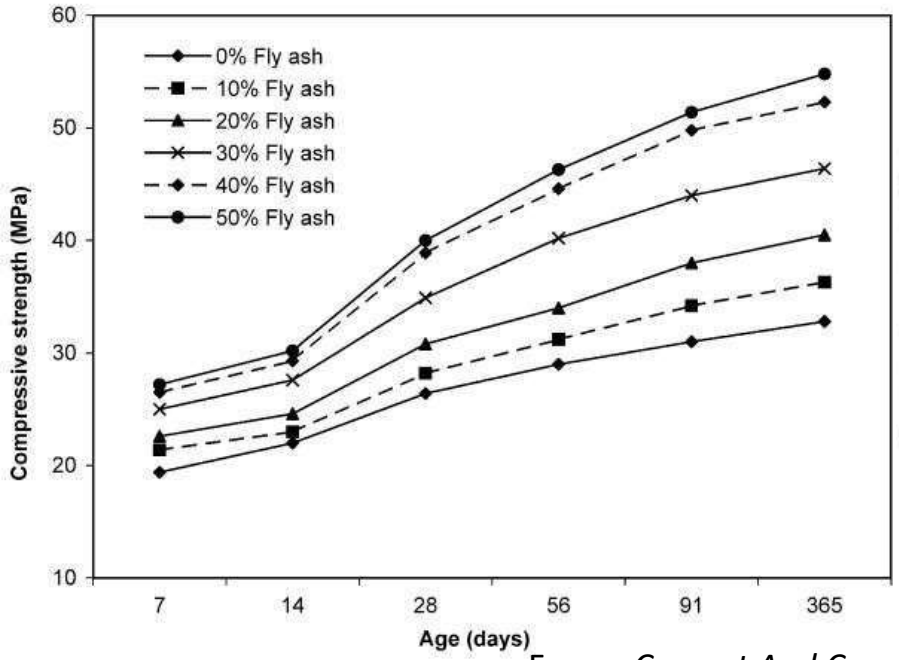
Table 1.Properties of Fresh Concrete

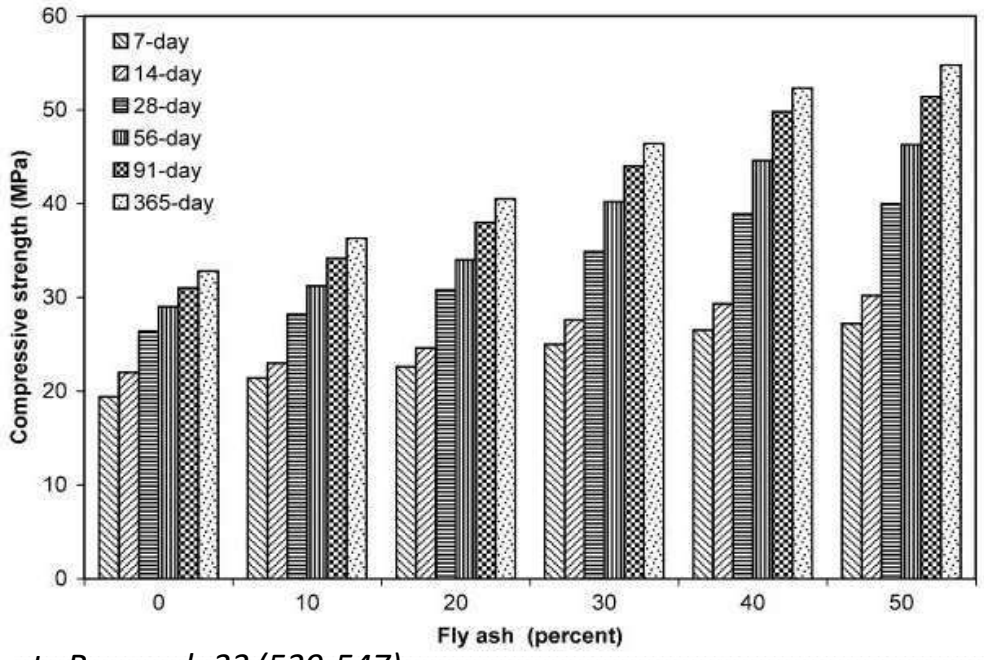
Mixture No.	M1	M2	M3	M4	M5	M6
Cement (kg/m^3)	390	390	390	390	390	390
Fly ash (%)	0	10	20	30	40	50
Fly ash (kg/m^3)	0	50	110	170	220	280
W/C	0.47	0.48	0.49	0.49	0.49	0.5
Coarse Aggregate(kg/m^3)	1170	1170	1170	1170	1170	1170
Sand(kg/m^3)	560	510	450	390	340	280
Super plasticizer (l/m^3)	2.6	3.5	3.6	3.7	3.7	3.9
Slump(mm)	100	90	65	40	30	20
Air Content (%)	5.2	4.8	4.4	4.0	3.8	3.2
Air Temperature (^oC)	27	26	27	26	25	26
Concrete Temperature (^oC)	28	26	28	27	26	27
Fresh Concrete Density (kg/m^3)	2308	2310	2314	2314	2316	2319

From *: Cement And Concrete Research 33 (539-547)*

Properties of Hardened Concrete

Compressive Strength





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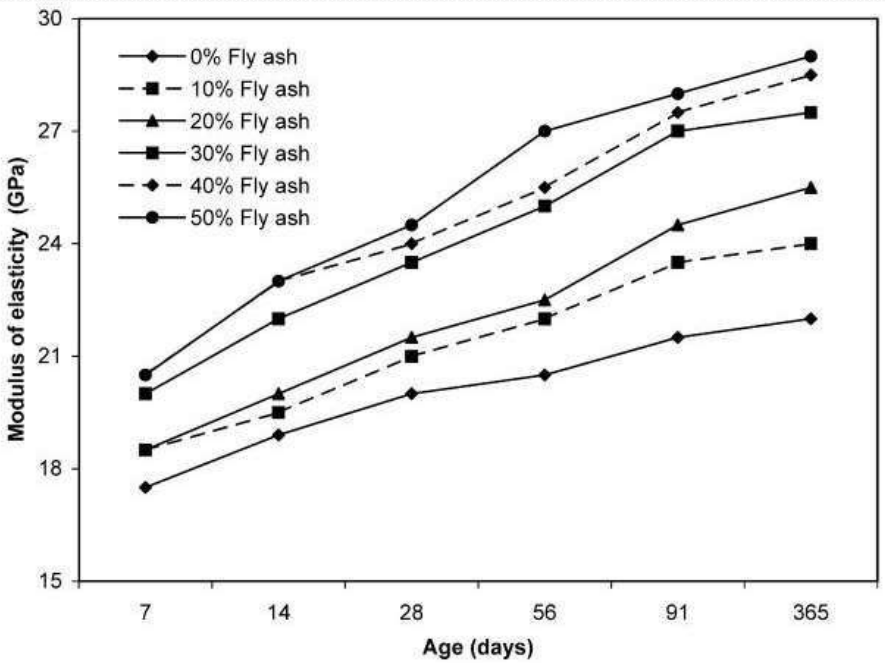
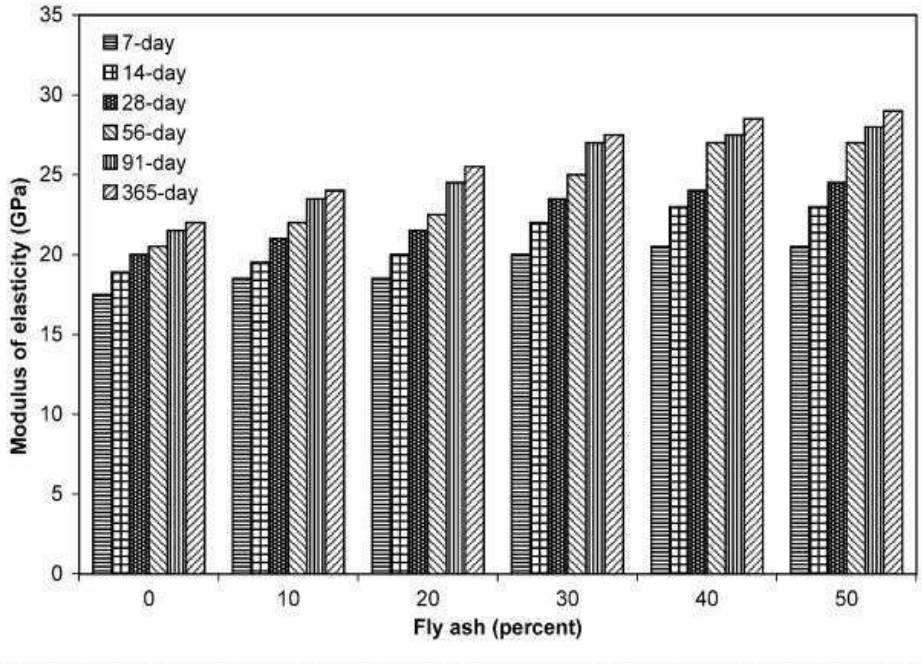
Modulus of elasticity





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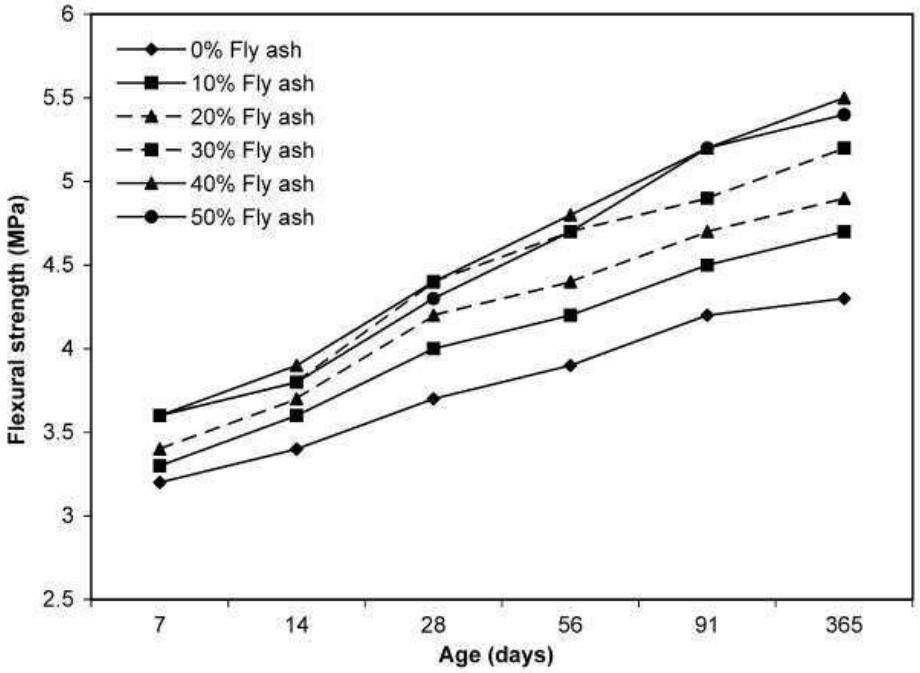
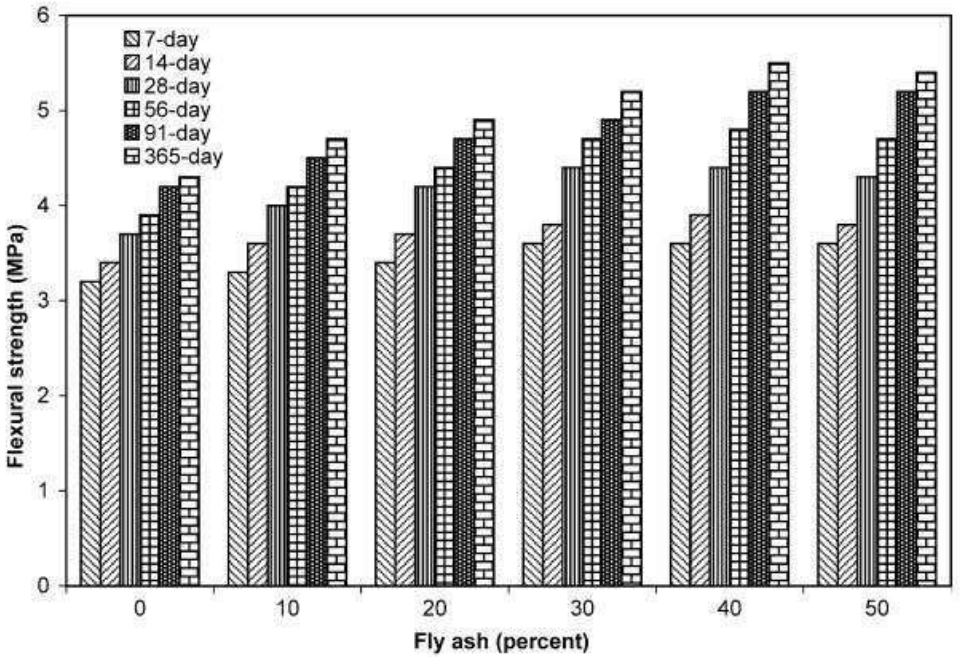
Flexural Strength





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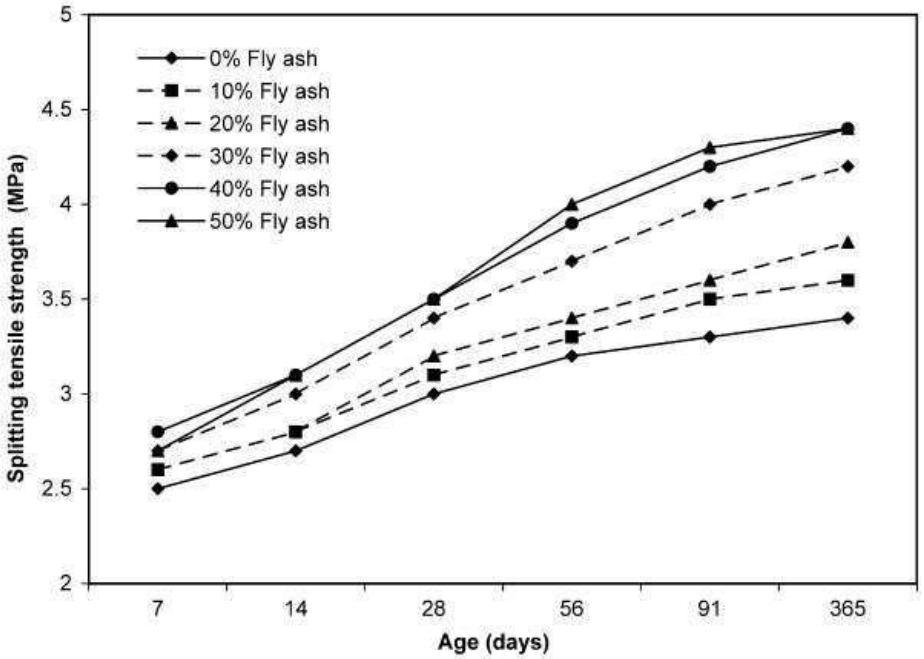
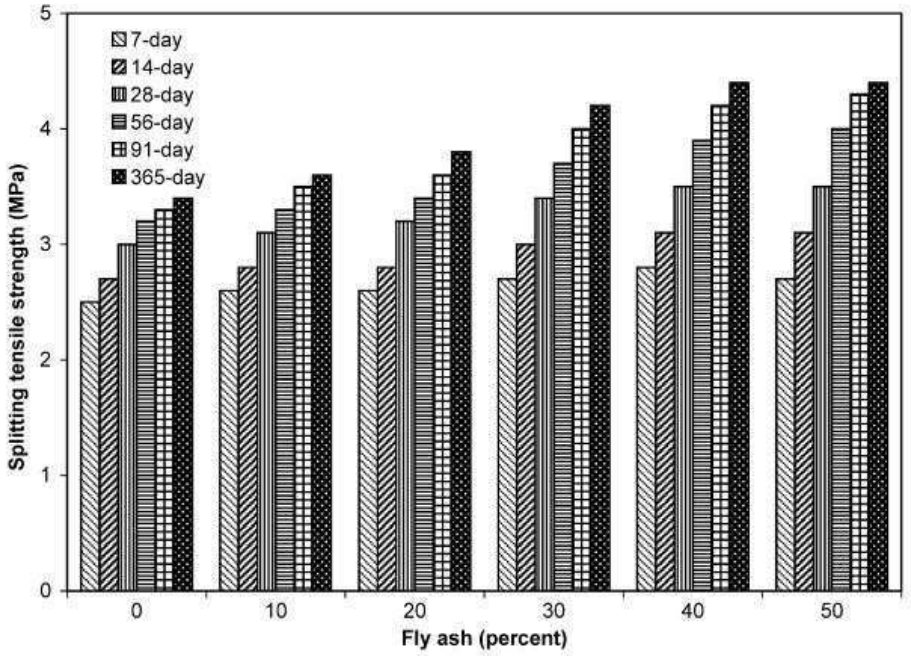
Split Tensile Strength





From *: Cement And Concrete Research 33 (539-547)*

WATER-TIGHTNESS AND DURABILITY

Water Tightness ensures

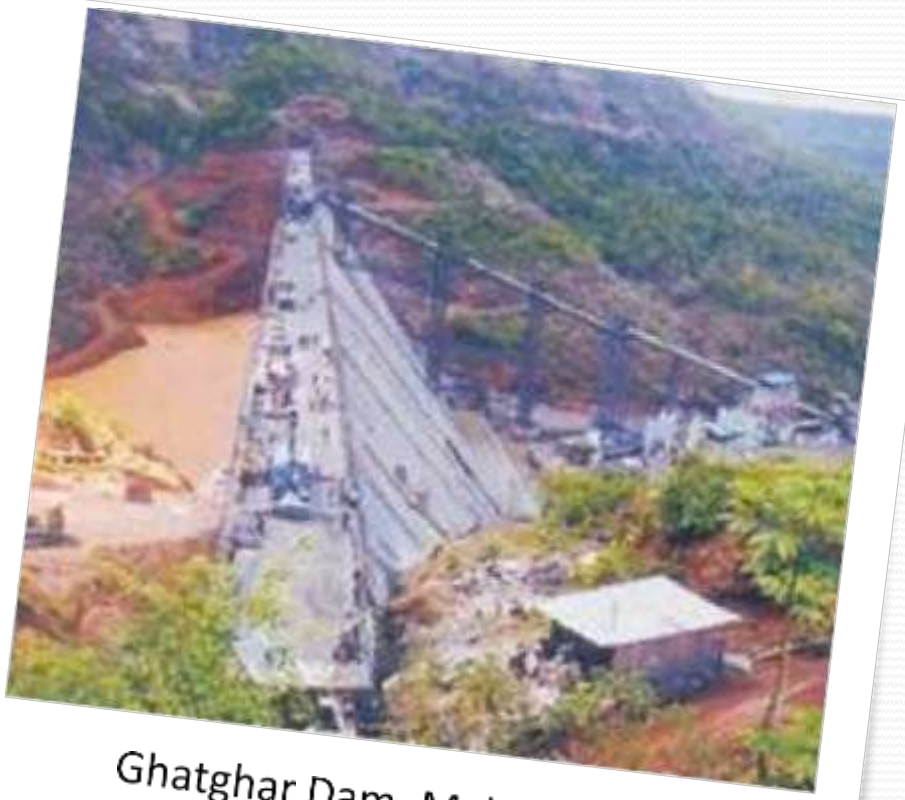
- Resistance to corrosion
- Resistance to alkali aggregatereaction
- Resistance to sulfateattack
- Durability

Construction Practices And Curing

- HVFAC takes longer time to set. Accelerating admixtures used based on compatibility
- HVFAC concrete mixtures do not suffer excessive slump loss in a short period
- With slabs, concrete surfaces must be membrane cured or by covering the surface with a heavy plastic sheet
- Minimum of 7 days of moist-curing mandatory

APPLICATIONS OF HVFAC

Dam Construction



Ghatghar Dam, Maharashtra

Pavement Constuction

CONCLUSIONS

- HVFAC provides a good option for recycling of fly ash
- Characteristics such as resistance to corrosion, resistance to alkali aggregate reaction, resistance to sulfate attack, durability get incorporated
- Longer time required for proper curing
- Properties like compressive strength, flexural strength, modulus of elasticity and split tensile strength are improved.

REFERENCES

- **Rafat Siddique**(2003), "Effect of fine aggregate replacement with Class F fly ash on the mechanical properties of concrete", *Cement and Concrete Research Vol.33, pp.539 – 547.*