AN EXPERIMENTAL STUDY ON THE BEHAVIOUR OF CONCRETE BY ADDITION OF FLY ASH AND ITS SPLIT TENSILE STRENGTH

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ABSTRACT

Extensive data are presented on the properties, in the fresh and hardened state, of fly ash concrete containing normal weight and light-weight aggregates suitable for structural applications. The mixes are proportioned to have one-day strength compatible with concrete without fly ash, possessing adequate cohesiveness and workability to enable them to be compacted into place easily in structural members with bar reinforcement. It is shown that the curing regime has a significant influence on strength development. Tests on reinforced concrete beams and slabs are reported to show that fly ash concrete can exhibit structural performance similar to that of conventional concrete with adequate safety factors and predicted by existing codes. The data presented show that with fly ash of controlled quality, structural concrete construction can be designed to incorporate fly ash up to 30percent by weight of cement.

Key words fly ash, bamboo fibres, split tensile and compressive strength

INTRODUCTION

Fly ash, the fine particulate waste material produced by pulverized coal-based thermal power station, is an environmental pollutant, it has a potential to be a resource material. It is nowadays used in cement, concrete and other cement based applications in India. As per IS 3812: 2003, the generic name of the waste product due to burning of coal or lignite in the boiler of a thermal power plant is pulverized fuel ash. Pulverized fuel ash can be fly ash, bottom ash, pond ash or mound ash. Fly ash is the pulverized fuel ash extracted from the fuel

gases by any suitable process like cyclone separation or electrostatic precipitation. Pulverized fly ash collected from the bottom of boilers by any suitable process is termed as Bottom Ash. The terminology Pond Ash is used when fly ash or bottom ash or both mixed in any proportion is conveyed in the form of water slurry is deposited in pond or lagoon. When fly ash or bottom ash or mixture of these in any proportion is conveyed or carried in dry form and deposited dry, it is known as Mound Ash.

KEYWORDS: flyash , compressive strength and split tensile strength

REVIEW OF LITERATURE

Syed Afzal Basha P.Pavithra Kottam Karunakara Reddy B.Sudharshan Reddy Fly Ash collection and storage in the Thermal Power Plant: The fly ash is collected in most of the old power plants in India through wet system, since it is cheaper than any other mode of transport. In the wet system, fly ash is mixed with water and sluiced to the settling ponds or dumping areas near the plant. However, due to limited disposal area many of the TPPs are in the process of converting to dry collection system (through ESP's) particularly the NTPC Power Plants. ESP's are most popular equipment and widely used for emission control today which enables the collection of dry fly ash. In the dry collection system, after arresting the fly ash in the ESP, it is taken to the silos for storage by pressurized or vacuum pneumatic system. When required, this can be obtained in a container for further transportation directly from the silos or conveyed further to the delivery point by pneumatic pressurized system. All new plants commissioned recently/being commissioned has provision for dry fly ash collection system.

Gulshan Kumar, Deepankar Kr. Ashish. Et.al Properties of Bamboo A lot of researches have been conducted till date to examine the properties of raw

bamboo. Different researches had shown that properties of bamboo depend largely on the type of bamboo, physical composition of bamboo.

Humberto C. Lima It has studied the durability aspect of bamboo to be used as reinforcement in cement concrete mixtures and analysed that while working as reinforcement in concrete, bamboo splints have larger dimensions than any other type of fibres, which implies that majority of bamboo fibres are completely enclosed in the parenchyma and they are not in direct contact with the alkalinity of the cement matrix, therefore, the higher number of the fibre end points are less vulnerable to deterioration. Moreover, penetration of products produced due to hydration of cement becomes difficult due to bamboo-splint dimensions.

METHODOLOGY

1. RESOURCE COLLECTION

- Collection of raw materials:Fly ash,cement,fine aggregate

2. STUDY ON MATERIALS:

- Sieve analysis on coarse and fine aggregates
- Specific gravity tests on coarse and fine aggregates

3. CASTING

- Casting of cubes and cylinders with normal mix and design mix

4. COMPRESSION TEST

- Initial test after 7 days of curing
- Test after 14 days of curing
- Test after 28 days of curing

5. SPLIT TENSILE TEST

- Test on cylinders for split tensile strength

6. COMPARISION

- Tabulation of results
- Comparing the results of normal mix with design mix

7. CONCLUSION

- Concluding the above results and verifying the usage of bamboo as FIBER in concrete design

8. REPORT

- Providing the theoretical report of the project with the tabulation of the results

SIEVE ANALYSIS FOR 20mm AGGREGATE

AS PER IS 460:1962

WEIGHT OF SAMPLE TAKEN = 4500gms

IS SIEVE SIZE (mm)	WEIGHT RETAINED (gm)	PERSENTAGE OF WEIGHT RETAINED (%)	PERSENTAGE OF CUMMULATIVE WT. RETAINED (%)	PERSENTAGE OF CUMMULATIVE WT. PASSING (%)	SPECIFICATION LIMIT AS PER IS 460:1962
40	0	0	0	0	100
20	240	5.33	5.33	94.67	85-100
10	4220	93.77	99.10	0.9	0-20
4.75	30	0.66	99.76	0.24	0-5
PAN	10	0.22	100	0	0

SIEVE ANALYSIS FOR FINE AGGREGATE

AS PER IS 460 : 1962

WEIGHT OF SAMPLE TAKEN 2000gms

IS SIEVE SIZE (mm)	WEIGHT OF RETAINED (gms)	PERSENTAGE OF RETAINED (gms)	PERSENTAGE OF CUMMULATIVE RETAINED (%)	PERSENTAGE OF CUMMULATIVE PASSING (%)	SPECIFICATION LIMIT
10	0	0	0	100	100
4.75	28	1.40	1.40	98.60	92-100
2.36	230	11.50	12.90	87.10	75-100
1.18	320	16.00	28.90	71.10	55-90
0.60	405	20.25	49.15	50.85	35-39
0.30	510	25.50	74.65	25.35	8-30
0.15	476	23.80	98.45	1.55	0-10
PAN	31	0	0	0	0

SPECIFIC GRAVITY TEST ON 20mm AGGREGATE

S.NO	DESCRIPTION	TEST SAMPLE (1)	TEST SAMPLE (2)
1	Weight of empty pycnometer (w1)	652	652
2	Weight of pycnometer and dry aggregate (w2)	1772	1761.5
3	Weight of pycnometer, dry aggregate and water (w3)	2245	2235.5
4	Weight of pycnometer and water (w4)	1533	1533
	Specific gravity	2.74	2.61

AVERAGE SPECIFIC GRAVITY =2.67

SPECIFIC GRAVITY TEST ON FINE AGGREGATE

S.NO	DESCRIPTION	TEST SAMPLE (1)	TEST SAMPLE (2)
1	Weight of Empty pycnometer (w1)	**652**	**652**
2	Weight Of Pycnometer and Dry aggregate(w2)	**1336**	**1333**
3	Weight of Pycometer, Dry aggregate and Water(W3)	**1953**	**1957**
4	Weight of Pycnometer and Water (w4)	**1533**	**1533**
	SPESIFIC GRAVITY	**2.59**	**2.65**

AVERAGE SPECIFIC GRAVITY = 2.62

FORMULA FOR SPECIFIC GRAVITY

$$S = (W2-W1)/(W4-W1)-(W3-W2)$$

Where,

S – specific gravity of a material

W1 – Weight Of Empty Pycnometer (in gms)

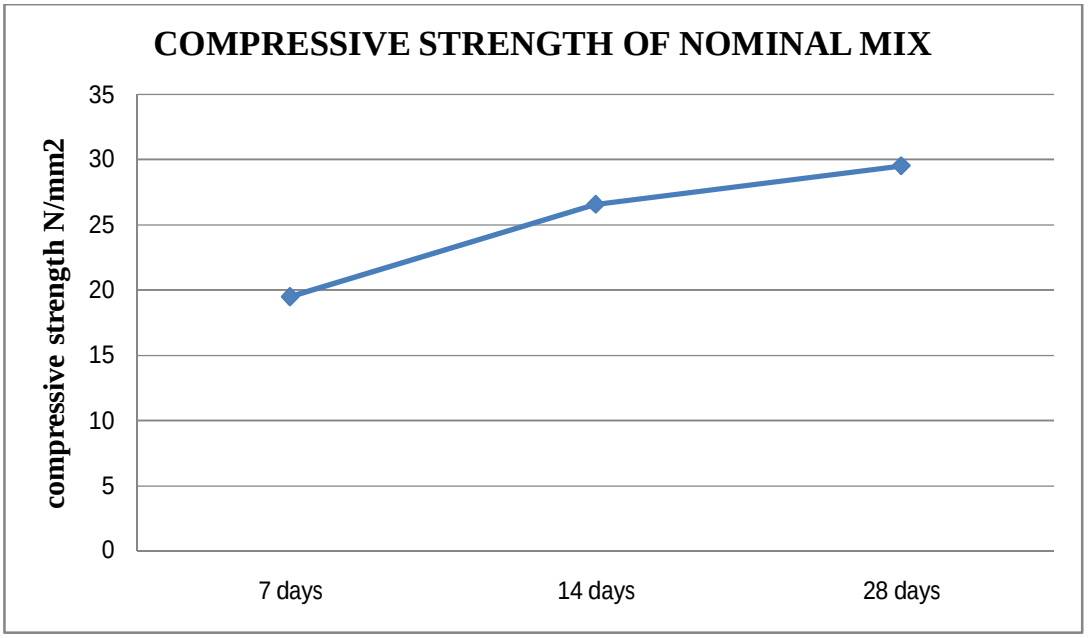
W2 – Weight Of Pycnometer And Dry Aggregate (in gms)

W3 – Weight Of Pycnometer, Dry Aggregate And Water (in gms)

W4 – Weight Of Pycnometer And Water (in gms)

COMPRESSION TEST RESULTS ON NOMINAL MIX CUBES

S.NO	MARK	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	0	7	440	19.49	25.203
2	0	14	598	26.58	
3	0	28	664	29.54	

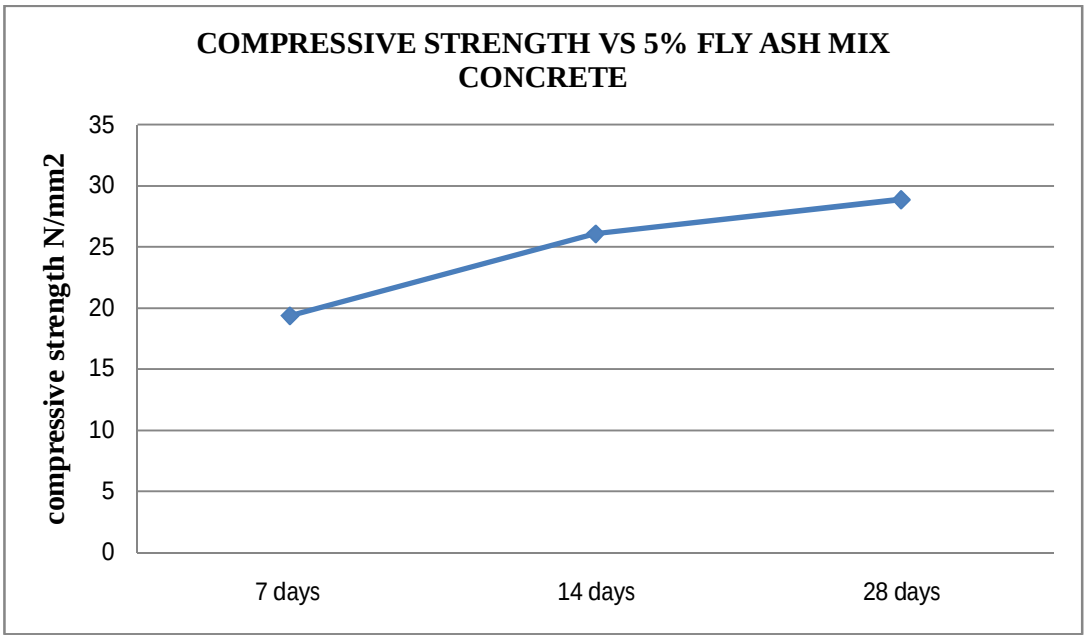


DISCUSSIONS:

- Compressive strength of nominal mix at 28 days is 29.54 N/SQ.MM

COMPRESSION TEST RESULTS ON 5% FLY ASH MIXED CONCRETE

S.NO	MARK	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	5%	7	436	19.39	24.79
2	5%	14	587	26.1	
3	5%	28	650	28.9	

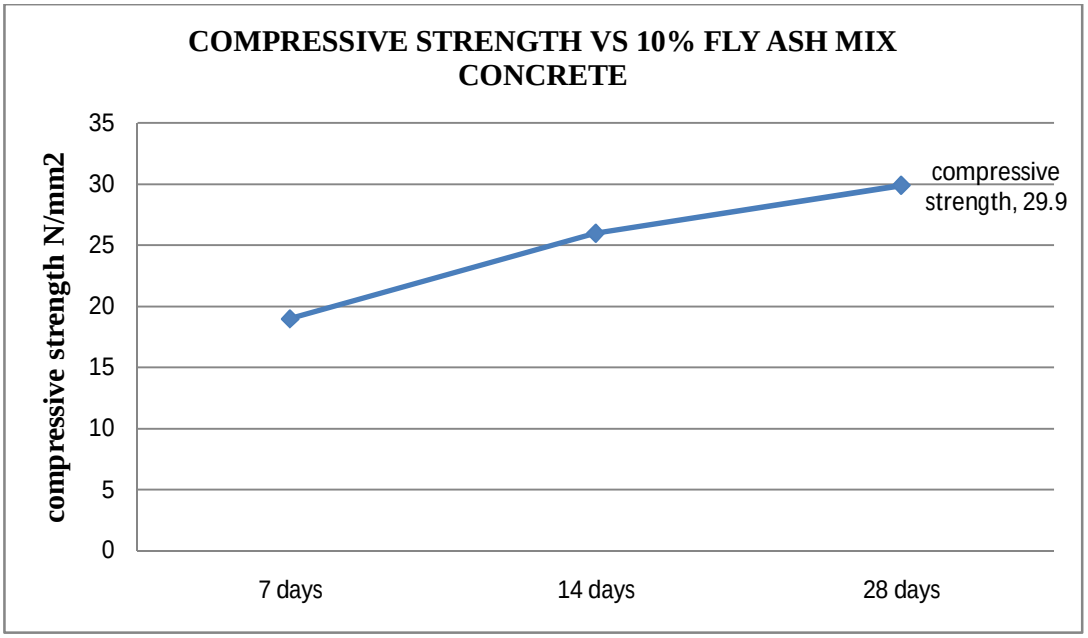


DISCUSSIONS:

The compressive strength has decreased when 5% of flyash is added to the mix i.e,28.9 N/Sq.mm

COMRESSION TEST RESULTS ON 10% FLY ASH MIXED CONCRETE

S.NO	MARK	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	10%	7	438	19.00	25.3
2	10%	14	597	26.00	
3	10%	28	672	29.9	



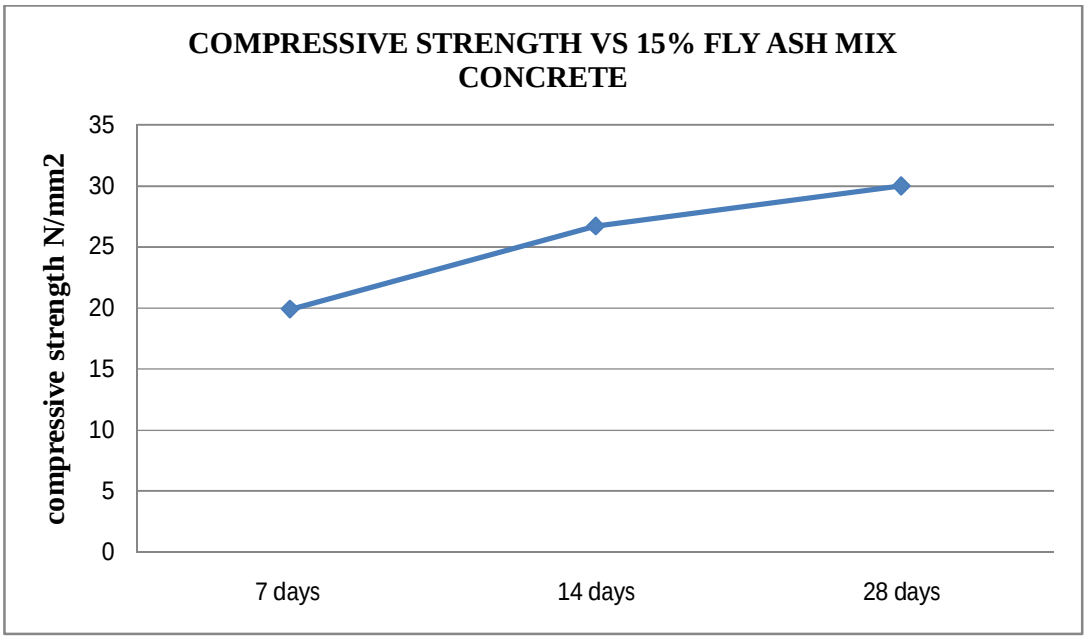
DISCUSSIONS:

The compressive strength has decreased when 10% of flyash is added to the mix i.e,29.9 N/Sq.mm

but its compressive strength has increased when compared to 5% flyash

COMRESSION TEST RESULTS ON 15% FLY ASH MIXED CONCRETE

S.NO	MARK	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	15%	7	448	19.9	25.53
2	15%	14	600	26.7	
3	15%	28	675	30.0	

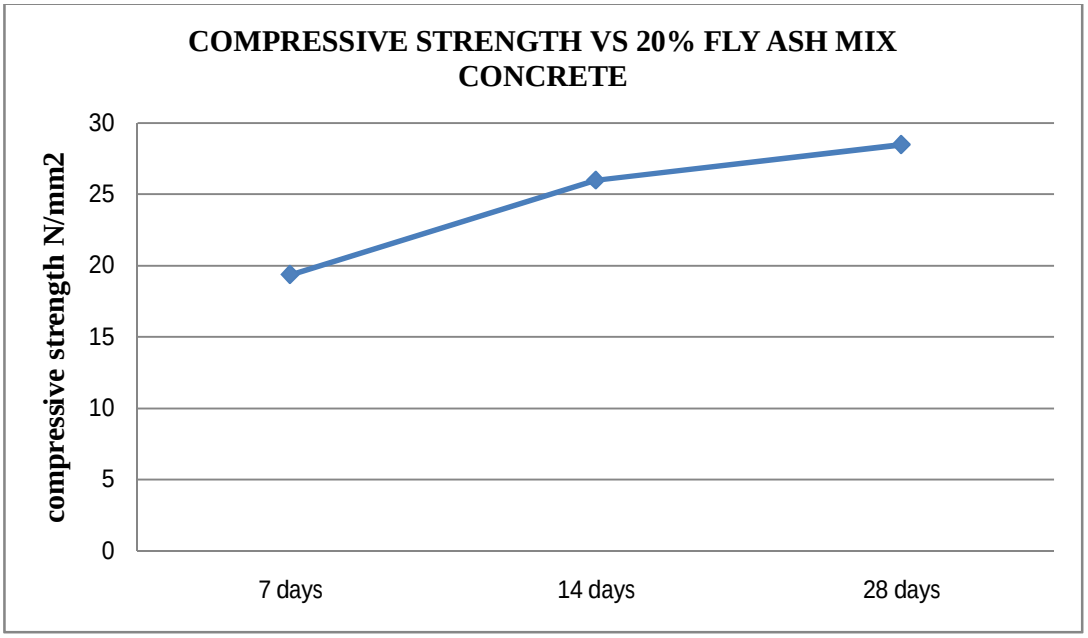


DISCUSSIONS:

The compressive strength has increased when 15% of flyash is added to the mix i.e,30.0 N/Sq.mm

COMPRESSION TEST RESULTS ON 20% FLY ASH MIXED CONCRETE

S.NO	MARK	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	20-F	7	436	19.38	24.6
2	20-F	14	585	26	
3	20-F	28	641	28.5	



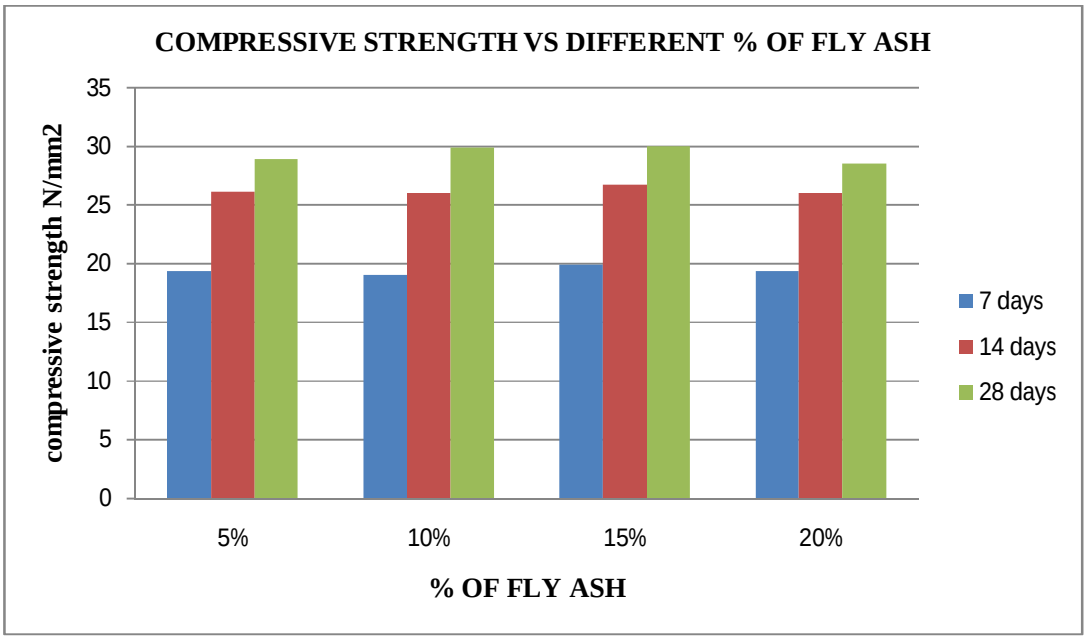
DISCUSSIONS:

The compressive strength has decresed when 20% of flyash is added to the mix i.e,28.5 N/Sq.mm

Finally ,maximum compressive strength is in the case when 15% flyash is added to the mix i.e, 30.00 N/Sq.mm when compared to nominal mix of concrete

COMPRESSION TEST RESULTS WITH DIFFERENT FLY ASH MIXES IN CONCRETE

% OF FLY ASH	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
5%	7	436	19.39	24.79
5%	14	587	26.1	
5%	28	650	28.9	
10%	7	438	19.00	25.31
10%	14	597	26.00	
10%	28	672	29.9	
15%	7	448	19.9	25.53
15%	14	600	26.7	
15%	28	675	30.00	
20%	7	436	19.38	24.6
20%	14	585	26.00	
20%	28	641	28.5	



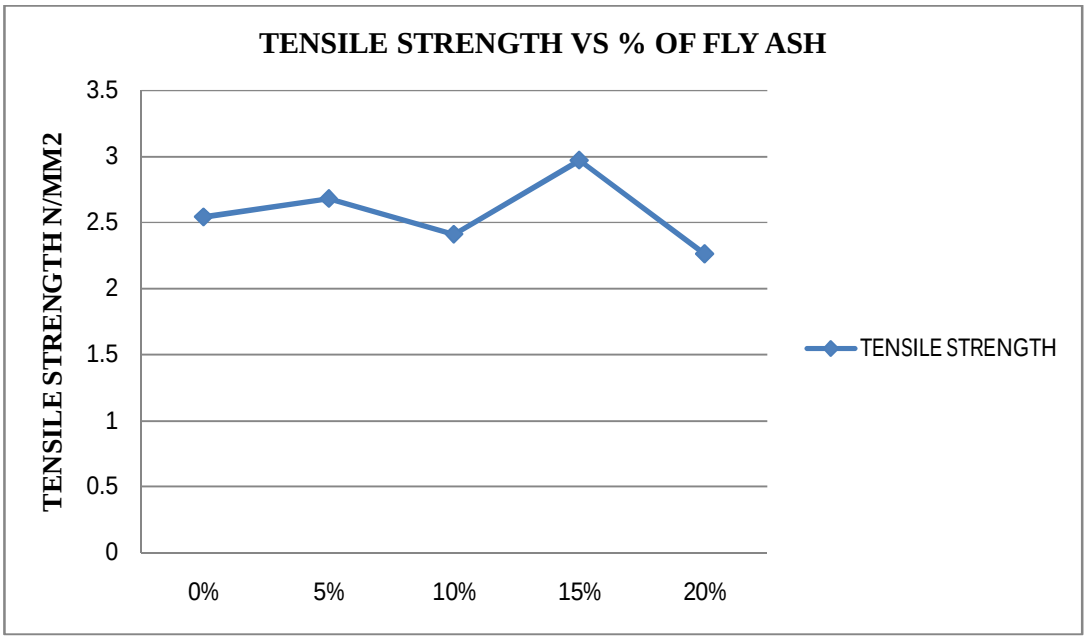
DISCUSSIONS:

Finally ,maximum compressive strength is in the case when 15% flyash is added to the mix i.e, 30.00 N/Sq.mm when compared to nominal mix of concrete

Average compressive strength has been also increased when compared to other different fly ash mixes i.e, 25.53 N/Sq.mm.

SPLIT TENSILE TEST FOR DIFFERENT % OF FLY ASH

SL.NO	CYLINDER MARK	% OF FLY ASH	LOAD AT FAILURE	TENSILE STRENGTH N/mm2
1	FS0	0	180	2.54
2	FS5	5	190	2.68
3	FS10	10	170	2.41
4	FS15	15	210	2.97
5	FS20	20	160	2.26



DISCUSSIONS

The split tensile strength has increased to 2.97 N/Sq.mm when 15% flyash is added to the mix

As from the above graph it is observed that ,the split tensile strength has shown decreased value when 0%, 5%,10% and 20% of fly ash is added to the mix

CONCLUSIONS

Based on the experimental study done on the behaviour of concrete by addition of Fly Ash and bamboo as FIBRE, the following conclusion was drawn

- The cube compressive strength as increased when 15% of fly ash is added to the mix and its compressive strength has decreased when it exceeds 15%.
- The split tensile strength has increased to 2.97 N/Sq.mm when 15% flyash is added to the mix
- It is observed that ,the split tensile strength has shown a decreased value when 0%, 5%,10% and 20% of fly ash is added to the mix
- It is also an environmental friendly method since the availability of fly ash is in abundance and can be put to a greater use.
- Hence it has paved a path for an exclusive study of fly ash as fiber in the concrete technology

REFERENCES

1 IS3812-2003, Pulverized Fuel Ash specification, part for use as pozzolana in cement, cement mortar and concrete.

2 IS456-2000 Plain & Reinforced Concrete Code of Practice.

3 IS:269-1989-OrdinaryPortlandCement-33Grade(Reaffirmed2004)

4 IS:8112-1989-43GradeOrdinaryPortlandCement(Reaffirmed2005)

5 IS:12269-1987-53GradeOrdinaryPortlandCement(Reaffirmed2004)

6 IS: 1489 part-1 1991 - Portland Pozzolana Cement fly ash based (Reaffirmed2005)

7 IS: 1489 part-2 1991 – Portland Pozzolana Cement calcined clay based (Reaffirmed2005)

8 IS: 455-1989-PortlandSlagCement(Reaffirmed2005)

9 ASTM International C: 618-03 Standard specification for coal Fly ash and Rawor Calcined Natural Pozzolana for use in Concrete.

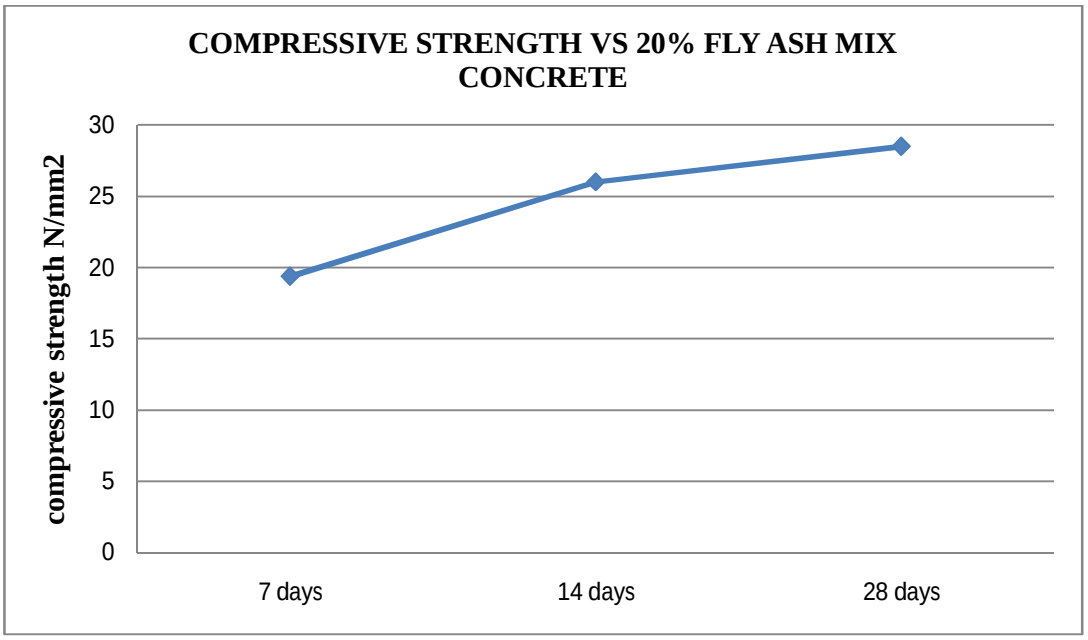
10 V.M.MalhotraandAARamezanianpourMarch1994, Fly Ash In Concrete

11 Fly ash in concrete (Properties and Performance) - Report of Technical Committee67-FAB (RILEM)

12 Souvenir & Seminar Document May 1996 Maharashtra India Chapter of ACI, Use of Fly ash in concrete.

13 Dr.AK Chatterjee, Concrete for the 21 Century Meeting the challenges The Indian Scenario Cement substitute Materials for concrete making The Indian Scenario.

14 MDAThomas, KBCripwell and PlOwens Fly Ash in concrete: An Overview of more than 30years of Experiences in the United Kingdom.


COMPRESSIVE STRENGTH VS 20% FLY ASH MIX CONCRETE
compressive strength N/mm2
30
25
20
15
10
5
0
7 days
14 days
28 days