ABSTRACT:
This paper aims to study about the strength of concrete using aluminum powder. In this research, an attempt has been made to develop light weight concrete by the partial replacement of cement with aluminum powder in addition of ivory white banana fiber. The fine powder of aluminum reacts with the calcium hydroxide in the cement matrix produces hydrogen gas. This hydrogen gas in the mix gives the cellular structure and makes the concrete lighter than the conventional concrete thereby reducing the dead weight of concrete. Replacement of aluminum powder (0 to 1.5%) by weight of cement is used to produce aerated (gas) concrete.The availability of banana fibers is large in amount. They are economical with no chemicals.Banana fibers significantly improved many of the engineering properties of the concrete notably compressive strength and tensile strength. The ability to resist cracking and spelling were also enhanced. Thus it acts as a natural admixture giving required properties to the ordinary cement concrete. In this project M25 grade of concrete, Ordinary Portland cement of grade 43 is used in the addition of three different percentages of banana fibers (0.5%) and aluminum powder(0.5%,1%,1.5%) to obtain required compressive strength and split tensile strength for concrete.
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Keywords: aluminum powder, banana fiber, compressive strength, durability, flexural.

1.INTRODUCTION

Aluminum powder is usually used to obtain autoclaved aerated concrete by a chemical reaction generating a gas in fresh mortar, so that when it sets it contains a large number of gas bubbles. Aluminum is used as a foaming agent in AAC production worldwide and it is widely proven as the best solution for its purpose.The main specialties of lightweight concrete are its low density and low thermal conductivity light weight concrete is made by introducing air or gas into slurry composed of Portland cement and sand, so that when the mix sets and hardens uniform cellular structure is formed. Fiber reinforcing has added versatility into concrete so as to overcome its brittleness. Fiber is a small piece of reinforcing Material possessing certain characteristics properties. Fibers can be in form of coconut fiber, banana fiber, steel fiber, glass fiber, natural fiber, synthetic fiber, etc. But in our project we have to use banana fiber.

The fibers are used to reduce shrinkage cracking. Main role of fibers is to bridge the cracks that develop in concrete and increase the ductility of concrete elements, improvement on post cracking behavior of concrete. It increase more resistance to Impact load, controls plastic shrinkage cracking and drying shrinkage cracking and lowers the permeability of concrete matrix and thus reduce the bleed.

2.LITERATURE REVIEW

Mukesh D[1]. Ghadge[2] (1) presented a paper on"Floating Concrete by using Light Weight Aggregates and Air Entraining Agent**"** This Project deals with the development of Floating type of concrete by using lightweight aggregate (Pumice stone) and Aluminum powder as an air entraining agent. There are many types of lightweight concrete which can be produced either by using lightweight aggregate or by using an air entraining agent. In this study we have worked on combination of above mentioned types. This concrete is a non-structural concrete. In this study, comparison has be made between plain cement concrete and lightweight concrete having different proportion of Aggregate size and fix quantity of Aluminum content (i.e. 2%) by the weight of cement has been taken into account. It helps to increase volume of concrete and hence reduce the weight.

Marwan Mostafa[1], Nasim Uddin[2] (2) presented a paper on "Experimental analysis of compressed earth block (CEB) with banana fibers resisting

flexural and compression forces."This study summarizes the average compressive and flexural strength results in seven mixes. The fiber reinforced blocks with fiber length of 6mm and 7mm recorded for the highest in both compressive strength and flexural strength compared to all fiber reinforced

Blocks with fiber length ranges from 5mm to 10mm.And the experimental work is concluded that the blocks constructed by adding banana fibers throughout the mix performed better than the block with no fibers in both compressive and flexural strength.

GauravUttamShinde[1], Dr S.S Valunjkar[2] (3) presented a paper on "An experimental study on compressive strength, void ratio and infiltration rate of pervious concrete". The paper represents the experimental methodology and experimental results related to compressive strength, void content and infiltration rate. Various mix designs of pervious concrete was tested, results were determined and analyzed. Cube size of 150mm x 150mm x 150mm was prepared to investigate compressive strength, void ratio and infiltration rate. Different concrete mix proportion such as 1:4, 1:5 and 1:6 with different size of gravels such as 9mm to 12mm was used to check these properties of pervious concrete. It was observed that when void ratio increases, infiltration rate also increases and compressive strength decreases and vice versa.

Anush K Chandrappa[1], Krishna Prapoorna Bilgiri[2] (4) presented a paper on "pervious concrete as a sustainablepavement material-Research findings and future prospects:A state of art review". This research studies recommenddifferent mix designs and proportioning systems forpervious concrete based on various principles. The mostcommon principle of mix design is to provide enoughcement coating to the aggregate. The cement to aggregateratio adopted in the range of 1:4 to 1:12.The water cementratio used in the range of 0.28 to 0.36.The water cementratio used in 1:4 mix is 0.36.This study also indicated thatthe use of fibers can optimize the strength and drainageProperties of pervious concrete.

Mr. Solomon Ikechukwu Anowai[1] (5) presented a paper on "Durability properties of banana fiber reinforced fly ash concrete"This study investigates the durability properties of banana fiber reinforced fly ash concrete. Grade 25 concrete incorporating 0, 10, 20, 30 and 40% fly ash were designed and reinforced with 0.5% volume fraction banana fibers of 30mm long. The specimens were cast, cured in water up to 90 days and the compressive strength determined. After curing in water for 90 days, some of the samples were immersed in 5% sulphuric acid, magnesium sulphate and sodium chloride solutions for 28 days. The residual mass and compressive strengths after exposure to these media were determined and compared with the compressive strength obtained after curing in water for 90 days. Some samples were also exposed to temperatures of 200, 400 and 600oC and their residual compressive strengths determined. The results showed that partial replacement of cement with fly ash improved the acid resistance of banana fiber reinforced concrete by reducing the losses in mass and compressive strength. Partial replacement of cement with fly ash improved the resistance of banana fiber reinforced concrete to sulphate attack with the specimens containing 20% replacement of cement with fly ash recording the lowest loss in compressive strength compared to its 90 days compressive strength. The results also showed that partially replacing cement with 10 and 20% fly ash improved the resistance of banana fiber reinforced concrete to chloride attack. Fire resistance of banana fiber reinforced concrete was also improved by partial replacement of cement with fly ash. This implies that a 20% fly ash blended concrete reinforced with 0.5% volume fraction of 30mm long banana fibers can be used for construction purposes in a chemically aggressive environment.

3. OBJECTIVE

The objective of the research is to find the strength parameters of aluminum powder with reinforced banana fiber concrete cubes and beams by the following three,

A) Compressive strength test
B) Flexural strength test
C) Durability test

- To utilization the natural fiber
- To reduce the cracks of concrete specimens.

4. MATERIALS AND MATERIAL PROPERTIES

A) Cement:

Ordinary Portland cement of 43 grade conforming to IS 12269 is used throught the experimental program. The specific gravity of cement is 3.052

B)Coarse Aggregate:

Crushed hard granite stone of maximum size 20mm is used for concrete. The specific gravity of coarse aggregate is found 2.77.

C)Fine Aggregate

Fine aggregate used for this entire investigation for concrete is river sand. The specific gravity of fine aggregate is 2.69.

D)Aluminum Powder

Aluminum powder with grain size less than 100µm and particularly with fractions less than 50µm, can easily form highly flammable aero suspensions. The aluminum powder confirming to IS:438-2006 is used in this investigation. Fine, uniform, smooth metallic powder of specific surface area 9000cm2/gm is used. Density - 0.12 gm/cc.

Fig.1 Aluminum powder

E)Banana Fiber

Length and diameter of Banana fibers is 80 mm,0.05mm and it was measured by a vernier scale and micrometer. Specific gravity of banana is 1.12 using a pycnometer.waterabsorption of the Banana fiberis 98% were calculated after 24hrs of immersion in water.

Fig.2 Banana fiber

5. CASTING OF SPECIMENS

Concrete is prepared in the mixture and put in a tray. In these tray required quantity of aluminum powder and banana fiber are added and mixed properly. Fresh properties of concrete are determined. The specimens are cast. In the next day, specimens were demoulded and put in a curing tank.

Fig.3 Casted specimens

6. TESTING

The testing of materials is a carried out to find the properties of the materials used in this project. The tests carried out on cement are specific gravity. The tests carried out on fine aggregate are specific gravity , sieve analysis, water absorption and bulk density. The tests carried out on coarse aggregate are specific gravity, sieve analysis, bulk density and water absorption test.

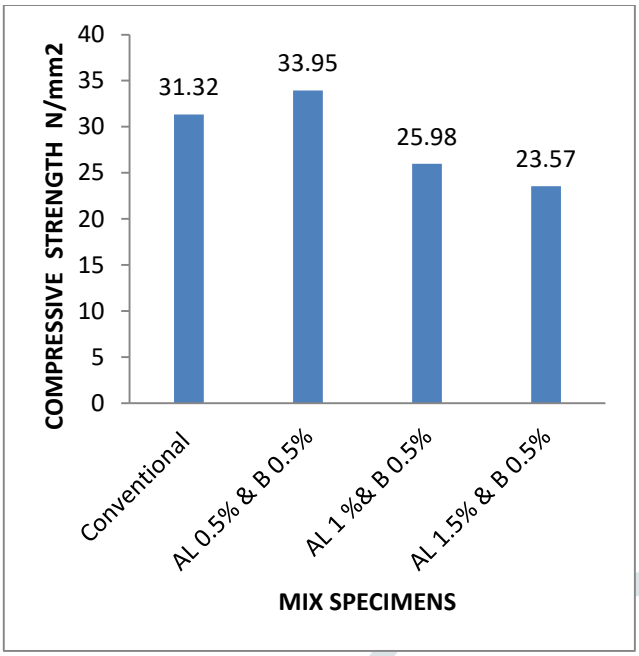
Fig.4 Testing of specimens

6.1 COMPRESSIVE STRENGTH:

Compression test is the most common test conducted on hardened concrete, partly because it is an easy to perform, and partly because most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength. The compression test is carried out on specimen's cubical specimens.Cubes 150 mm × 150 mm × 150 mm in size were used. The cube moulds were cleaned thoroughly and properly oiled along their faces. The mould was then filled with concrete in three layers and compacted using a tamping rod. Further, the moulds were placed on the vibrating table for 60 seconds to achieve proper compaction and subsequently maintained on a plane and level surface in the laboratory for 24 hours. The cubes were demoulded and set aside for curing.

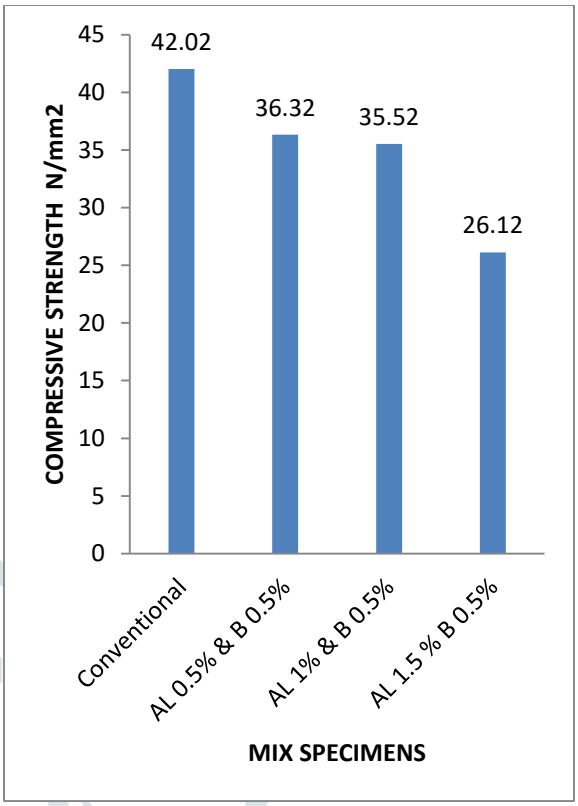
Compressive strength of concrete cubes for 7 days

SI NO		SPECIMEN		COMPRESSIVE STRENGTH (N/mm^2)	AVERAGE (N/mm^2)
		Banana fiber	Aluminum powder		
1	Mix 1	Conventional		33.12	31.32
				29.82	
				31.02	
2	Mix 2	0.5 %	0.5%	35.32	33.95
				30.02	
				36.53	
3	Mix 3		1%	28.02	25.98
				27.62	
				22.32	
4	Mix 4		1.5%	26.17	23.57
				25.22	
				19.32	



Compressive srength of concrete cubes for 7 days

SI NO		SPECIMEN		COMPRESSE STRENGTH (N/mm^2)	AVERAGE (N/mm^2)
		Banana fiber	Aluminum powder		
1	MIX 1	Conventional		44.02	42.02
				40.62	
				41.42	
2	MIX 2	0.5%	0.5%	50.34	36.32
				54.43	
				48.21	
3	MIX 3		1%	37.02	35.52
				35.11	
				34.44	
4	MIX 4		1.5%	29.12	26.12
				26.62	
				22.64	



6.2 FLEXTURAL STRENGTH:

Flexural strength test is carried by using beam specimen. Beam had 1600mm length, 150mm wide and depth 220mm. The beam moulds were cleaned thoroughly and properly oiled along their faces. The steel rods with stirrups placed in the mould before concrete placed in mould.

The mould was then filled with concrete in three layers and compacted using a tamping rod. The cured specimens were tested under load frame instrument.

The beam specimens were tested for midpoint loading and their deflection were observed with LVDT attached to the specimen. The readings were recorded in data logger attached to the loading frame instrument. Gradual loading has

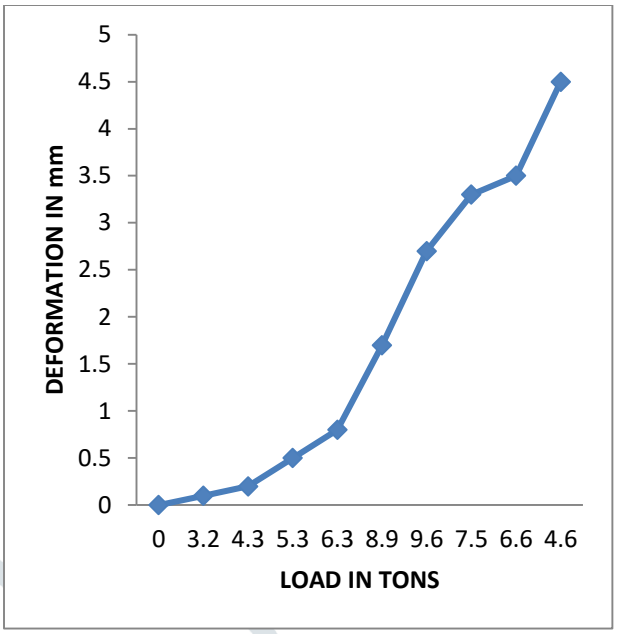
been imposed on the specimen through a load cell 100tons capacity until failure.

Beam is tested and the ultimate load carrying capacity of beam is finding out by using test results. The variation between load and deformation is plotted as a graph.

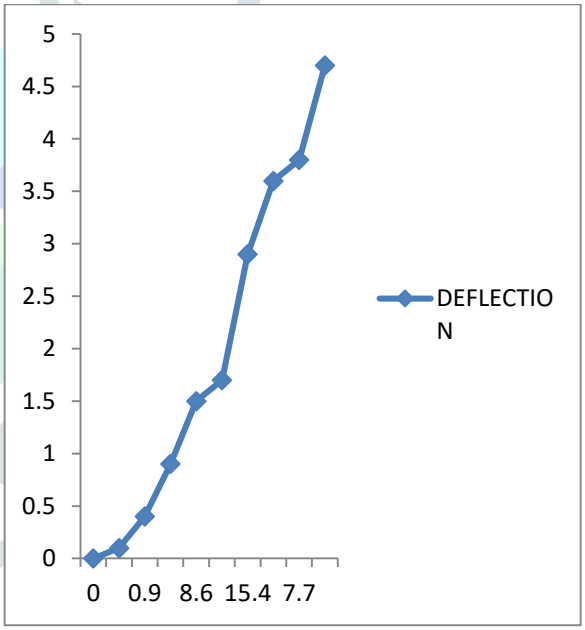
CC		AL 0.5% & BA 0.5%		AL 1% & BA 0.5%		AL 1.5% & BA 0.5%	
load (tons)	deflection (mm)	load (tons)	deflection (mm)	load (tons)	deflection (mm)	load (tons)	deflection (mm
0	0	0	0	0	0	0	0
3.2	0.1	3.6	0.1	2	0.4	1.1	0.5
4.3	0.2	4.6	0.4	2.5	0.7	1.6	0.9
5.3	0.5	6.2	0.9	4.7	1.5	2.2	1.2
6.5	0.8	8.6	1.5	9.3	2.2	5.32	2.4
8.9	1.7	10	1.7	11.5	2.6	7.02	3.1
9.9	2.7	15.4	2.9	17	3.4	12.35	3.8
7.5	3.3	9.6	3.6	10.2	3.9	6.91	4.4
6.6	3.5	7.7	3.8	7.8	4.2	4.45	4.9
4.6	4.5	6.9	4.7	5.4	5.1	2.01	5.4

Fig.5 CC-28days load vs deformation curve

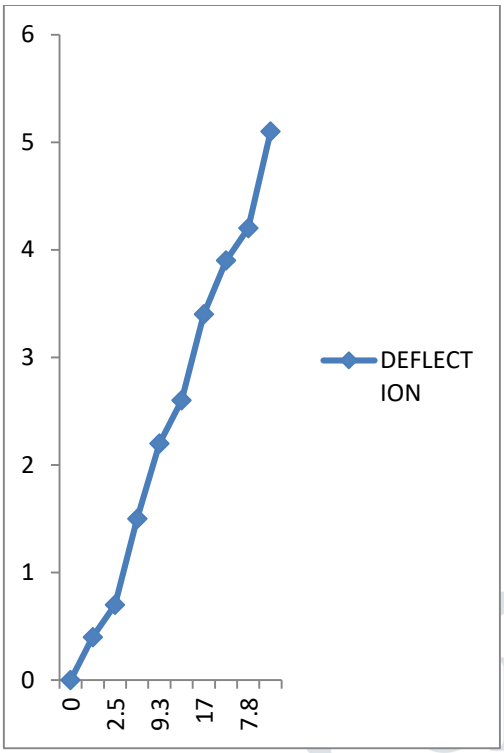
Flexural strength of beam



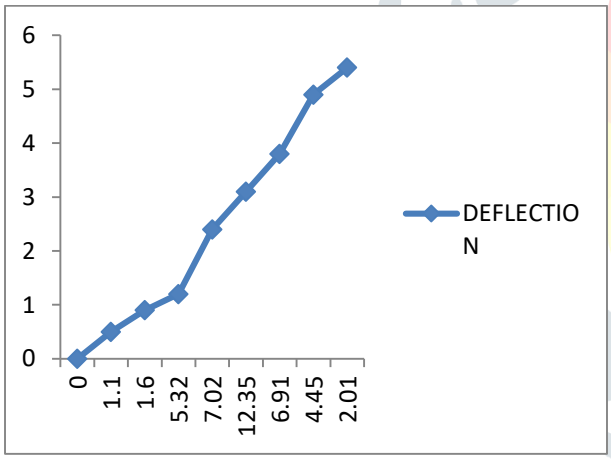
CC-28days load vs deformation curve



AL 0.5% & BA 0.5% -28days load vs deformation curve



AL 0.5% & BA 0.5% -28days load vs deformation curve



AL 0.5% & BA 0.5% -28days load vs deformation curve

6.3DURABILITY TESTS

The following are the various durability test carried out in this experimental study.

1. Acid Resistance Test

Acid attack Test

Cubes of size 150mm x 150mm x 150mm are cast for each mix. After 28 days of curing, all specimens were kept in atmosphere for 1day for constant weight. The weight of cubes were taken and then the cubes were immersed in 5% concentrated H_2SO_4. The acid solution was replaced whenever the pH value exceeds 9.5. After the completion of age of immersing in acid solution, the specimens were taken out and were washed in running water and kept in atmosphere for 1day for constant weight. Subsequently the specimens are weighed and loss in weight and hence the percentage loss of weight was calculated. The degree of acid attack was evaluated by compressive strength were conducted at 28 days.

Acid Attack (H_2SO_4) in concrete

Replacement of cement Using Aluminum powder (%)	Addition Of banana fiber (%)	H_2SO_4			Loss in Compressive strength N/mm^2
		Initial Weight	Final Weight	Weight Loss (%)	
0	0	3.508	3.417	4.7	20.67
1	0.5	2.514	2.428	3.54	21.02
1.5		2.523	2.44	3.4	18.74

7.CONCLUSION

It has been concluded that based on the test results, which showed that the utilization of aluminum powder and ivory white banana fiber has considerably increased the strength of M25 grade concrete with the combination of aluminum powder and banana fiber.

The specimens were casted for various proportions of aluminum powder (0 to 1.5%), banana fiber (0.5%) and the test results indicated

aluminum powder 0.5 % addition gives improved result when compared to other combinations. Then, aluminum powder added 0% to 1.5% by weight of cement with optimum banana fiber and the test results compared with conventional concrete and banana fiber optimum percentage added concrete.

Since aluminum powder is a waste material it can be utilized effectively by reducing the quantity of cement which not only reduces the cost of concrete but also keep the environment safe and avoid dumping of waste aluminum powder in land.

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