# Experimental Analysis of Autoclaved Aerated Concrete Blocks using Polypropylene fiber

**Prof. Shinde S.B.[1], Chavan Rohan[2], Kamble Abhishek[3], Sonawane Ashwin[4], Shinde Pravin[5]**

[1]Assitant Professor,

[2,3,4,5] UG Student, Department of Civil Engineering, APCOER, Pune, India

**Abstract**: - As lightweight concrete is successful in construction work due to its properties such as workability, less dead load and durability, resulting in rapidly increased use of light weight concrete. The paper presents the results of investigation on their effect of using polypropylene fiber in AAC block and conducting various tests such as compressive strength test, flexural strength test, water absorption test. AAC block produced by using cement, fly ash, water and expansion agent i.e, aluminium powder.

***Keyword—Polypropylene fiber, Aluminium powder, Fly ash, Compressive strength, Flexural strength.***

## 1.INTRODUCTION

AAC (autoclaved aerated concrete) block is lightweight concrete block made from cement, fly ash, water and aluminium powder. The size of AAC blocks can be reduce to increase floor area, minimizing the use of raw materials and achieving economy. To reduce the size of blocks without compromising the strength, therefore by adding polypropylene fiber in AAC block to increase various properties like strength, durability and toughness of block.

## 2. MATERIALS

**a) Cement**: Cement is used as a binding material in aerated concrete using polypropylene fibre Block of (Ordinary Portland Cement Ultratech) of

53 grade is used in the production process. Cement of this grade is available in local market.

| Sr. No. | Physical ty | proper |
|---|---|---|
| 1 | Specific gravity Values | 3.11 |
| 2 | Initial setting | time 45 min |
| 3 | Final setting time | 290 min |
| 4 | Fineness | 2.5% |

**b) Lime:** The lime obtained from calcinations process of lime stone used. It is also known as burnt lime or quick lime.

| Sr.No. | Physical property | Values |
|---|---|---|
| 1 | Specific gravity | 2.71 |
| 2 | Lime shaking test | 30-40 C |
| 3 | Sieve test | Min 80% |

**c) Gypsum:** Gypsum is a rock material usually found in earth`s crust. It acts as a hardening retarder in Portland cement.

| Sr.No. | Physical property | Values |
|---|---|---|
| 1 | Specific gravity | 2.25 |
| 2 | Sieve test | Min 80% |

**d) Fly ash:** Ash produced from combustion of coal. It is also known as pulverized fuel ash, composed of particulates that are driven out of coal-fired boiler together with fuel gases.

| Sr.No. | Physical property | Values |
|---|---|---|
| 1 | Specific gravity | 2.5 |

**e) Aluminium powder:** It is finely divided aluminium. It is used as a foaming agent, added to create hydrogen bubbles in the mix which increase the volume of the block.

**f) Polypropylene fiber:** Polypropylene fibers based on 100% virgin high tenacity polypropylene straight fibers and fibrillated mesh fiber in graded lengths, with chemical surface treatment for uniform dispersion in wet concrete.

**g) Water:** Water is an important ingredient that helps in chemical reaction. Potable water is used in this process.

## 2.1 MIX DESIGN

**3.** Almost 95% of the raw materials can be made suitable for AAC line through proper mix design. Also we can have many different mix designs for the same density same strength of Blocks.

**4.** We will help you to get the Best quality blocks at optimal cost by means of designing proper Mix as per your input raw materials.

**5.** The following are basic guidelines (certainly not the final call) on the suitability of basic raw materials for

| 1. Fly Ash (55-70%) | | | |
|---|---|---|---|
| **Index Item** | | **Grade (%)** | |
| | | Gr I | Gr - II |
| Degree of finenes s | (0.045 square hole sieve left amount) ≤ | 30 | 45 |
| | (0.080 square hole sieve left amount) ≤ | 15 | 25 |
| Ignition loss ≤ | | 5.0 | 10.0 |
| SiO2 ≥ | | 45-55 | 40 |
| SO3 ≤ | | 1 | 2 |

| 2. Cement (6-15%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SiO2 | Al2O3 | FeO3 | CaO | MgO | C3S | C2S | C3A | C4AF |
| 21-23 | 5-7 | 3-5 | 48-64 | 4-5 | 44-59 | 18-30 | 5-12 | 10-18 |

AAC.

| 3. Lime (8-25%) | | | | |
|---|---|---|---|---|
| **Item** | **Grade** | | | |
| | **Super Gr.** | | **1st Gr.** | **2nd Gr.** |
| A(CaO+MgO) Quality Fraction % | ≥ | 90 | 75 | 65 |
| MgO Quality Fraction % | ≤ | 2 | 5 | 8 |
| SiO2 Quality Fraction % | ≤ | 2 | 5 | 8 |
| CO2 Quality Fraction % | ≤ | 2 | 5 | 7 |
| Digestion speed ,min | ≤ | 5-15 | | |
| Digestion temperature , ℃ | ≥ | 60-90 | | |
| Undigested residue quality fraction,% | ≤ | 5 | 10 | 15 |
| Fineness (0.008 square hole sieve left amount) % | ≤ | 10 | 15 | 20 |

| 4. Gypsum/Plaster (3-5%) | | |
|---|---|---|
| CaSO4 | > | 70 |
| MgO | < | 2 |
| Chloride | < | 0.05 |
| Preferably ground residue 90μm | < | 10-15 |

| 5. Aluminum Powder (about 0.08%) | | | |
|---|---|---|---|
| Type and recommendation for supply depend on raw materials and mix formula | | | |
| Metal Content | Approx. | >=65% | Powder |

Therefore final mix proportion is,

| Ingredients | Unit |
|---|---|
| Fly ash | 520 kg |
| Cement | 104 kg |
| Lime | 45kg |
| Aluminium powder | 325 gm |
| Soluble oil | 1 lit |
| Gypsum | 6 kg |
| Polypropylene fiber | 0.02% |
| Water | 0.50 |

## 3 Testing on specimen:

### 3.1 Compressive strength test:

Compressive strength of concrete cube test provides an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. Concrete compressive strength for general construction varies from 15 mpa (2200 psi) to 30 mpa (4400 psi) and higher in commercial and industrial structures.

Reference: IS : 516 - 1959, IS: 1199-1959, SP : 23-1982, IS : 10086-1982.

**Result :**

| Fiber % | Point load (KN) | | | Compressive strength (Mpa) | | |
|---|---|---|---|---|---|---|
| 0% | 70.85 | 72.25 | 75.42 | 3.14 | 3.21 | 3.35 |
| 0.02% | 69.73 | 73.12 | 73.18 | 3.09 | 3.24 | 3.25 |
| 0.04% | 78.83 | 80.12 | 72.45 | 3.50 | 3.56 | 3.22 |
| 0.06% | 70.35 | 72.25 | 75.12 | 3.12 | 3.21 | 3.33 |

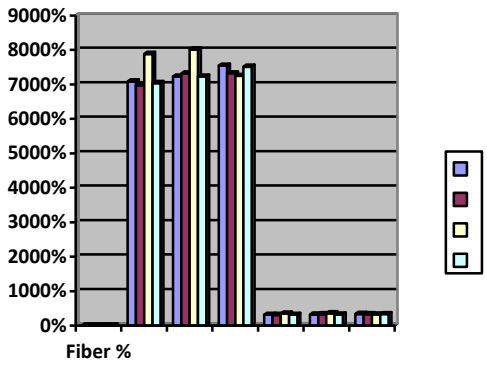


**Fig: - Compressive strength of block**

### 3.2 Flexural Strength test:

Objective: This clause deals with the procedure for determining the flexural strength of moulded concrete flexure test specimens

Reference: IS : 516 - 1959, IS: 1199-1959, SP : 23-1982, IS : 10086-1982

Result :

| Fiber % | Point load (KN) | | | Flexural strength (Mpa) | | |
|---|---|---|---|---|---|---|
| 0% | 22.07 | 25.87 | 27.85 | 0.49 | 0.57 | 0.61 |
| 0.02% | 24.82 | 26.38 | 27.54 | 0.55 | 0.58 | 0.61 |
| 0.04% | 28.15 | 26.36 | 29.89 | 0.62 | 0.58 | 0.66 |
| 0.06% | 25.20 | 28.29 | 26.50 | 0.56 | 0.62 | 0.58 |

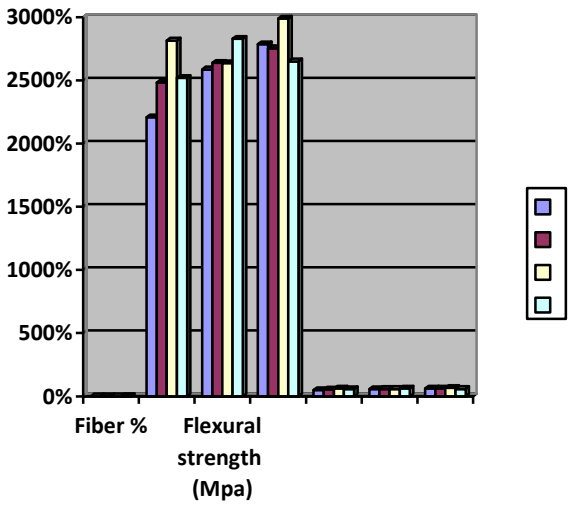


**Fig:- Flexural strength of block**

After getting the testings an autoclave aerated concrete block bar charts are plotted for compressive strength and flexural strength.

## 4. Conclusion

**1**. Use of polypropylene fibre in aerated autoclaved concrete blocks neither increases the strength nor decreases the strength.

**2.** As outcome of this analysis is not as expected result.

**3.** The objective of reducing the size of aerated autoclaved concrete cannot be achieved as the

strength of block by addition of fibre is not increased.

**4.** Hence, the experimental analysis on autoclaved aerated concrete block by using fibre is found that the compressive strength and flexural strength of the block does not increase with addition of fibre.

## 6. Reference

1.Amit Sahu, Prof. Archana Tiwari, "Aerated Concrete Blocks Using Polypropylene Fiber", International Journal for Research in Applied Science & Engineering Technology (IJRASET),ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887,Volume 5,Issue XII December 2017.

2.Anthony Nkem Ede1 (PhD) and Abimbola Oluwabambi Ige1,"Optimal Polypropylene Fiber Content for Improved Compressive and Flexural Strength of Concrete",IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 11, Issue 3 Ver. IV (May- Jun. 2014).

3. . E.Ikponmwosa, F. Falade, C. Fapohunda "A review and investigation of some properties of foamed aerated concrete", Nigerian Journal Technology (NIJOTECH) Vol.33. No.1, January 2014.

4. Kollie Ramujee "Strength properties of polypropylene fiber reinforced concrete", International journal of innovative research in science, engineering and technology. Vol 2, Issue 8, August 2013.

5. Milind V. Mohod1 "Performance of Polypropylene Fibre Reinforced Concrete" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 1 Ver. I (Jan- Feb. 2014).

6. Peng Zhang, Qing-fu Li "Effect of polypropylene fiber on durability of concrete composite containing fly ash and silica fume" (2012).

7. Praveen kaur, Mohit talwar "Different types of fibers used in FRC" International journal of advanced research in computer science, Vol8, No 4, may 2017.

8. Sunil j, Dr.M. S. Ravikumar, "Effect of fibers on the compressive strength of hollow concrete blocks", International journal of civil engineering and technology (IJCIET) Vol :9 Issue:2 February-2018.

9. S.Kotteeswaran , "Study on Properties of Foam Concrete Using Fibers", International Journal of Research and Review E-ISSN: 2349-9788; P-ISSN: 2454-2237.