AN EXPERIMENTAL STUDY ON AUTOCLAVED AERATED CONCRETE BY REPLACING FINE AGGREGATE WITH DOLOMITE

Selvan David A. and SuntarRaajan V.C.

***Abstract* --- Autoclaved Aerated Concrete (AAC) is a kind lightweight concrete that is manufacture by aerating the cement-sand mortar. It is a mixture of cement, lime and dolomite with a trace amount of aluminium powder to bind the materials. AAC is mainly used for non load bearing structures. Dolomite due to its light weight property used as fine aggregate. The increased lime content improves the formation of microscopic air bubbles in aerated concrete. To enhance the strength, polypropylene fiber was added at various percentages. AAC with 0.75% of polypropylene fiber and 45% of lime along with cement and dolomite was found to perform well in accordance with conventional AAC.**

***Index Terms*— Autoclaved, AAC, Concrete, Aerated Concrete**

I. INTRODUCTION

Autoclaved Aerated Concrete (AAC), though relatively unknown in the United States, is currently one of the many building products being touted as "green" or "environmentally friendly". Aerated concrete can be placed easily, by pumping if necessary and does not require compaction, vibrating or leveling [1-3]. It has excellent resistance to water and frost and provides a high level of both sound and thermal insulation. It is very versatile; since it can be tailored for optimum performance and minimum cost by choice of a suitable mix design especially the density of aerated concrete [4]. This is because different density might give different use and performance of aerated concrete. The fact that aerated concrete can be made using different mix designs meant that it was not a single product [5].

A. Properties

The low density is achieved by the formation of air voids to produce a cellular structure. These voids are typically 1mm – 5mm across and give the material its characteristic appearance. AAC have compressive strength ranging from 3-12 Nmm^{-2}. Densities range from about 300 to 1800 kgm^{-3}. Mainly it is used for partition wall. AAC blocks are excellent thermal insulators and are typically used to form the inner leaf of a cavity wall. It is possible to construct virtually an entire house from AAC, including walls; floors using reinforced aerated concrete are easily cut to any required shape. AAC also has good acoustic properties and it is durable, with goof resistance to sulphate attack and to damage by fire and frost. The properties of aerated concrete depend on its composition, grain size of aggregate, amount of expansion agent used and time period of autoclave curing. The compressive strength, drying shrinkage, absorption properties directly depends on the method of duration of curing. The strength development is rather slow for non-autoclaved aerated concrete (NAAC).

B. Scope of the Project

The Dolomite is being extensively used as fine aggregates for both mortar and concrete applications as an alternative to silica sand. It is necessary to search for alternative sand and dolomite has been identified as one of the best preferred options. So that we decide to study the behavior of aerated concrete by using fully dolomite. Then the Polypropylene Fiber is added by 0.50%, 0.75% and 1.00% of weight.

II. METHODOLOGY

The percentage addition of Polypropylene fiber is chosen as 0.5% to 1% at 0.25% interval after the review of literature. The preliminary tests such as specific gravity are carried out for the materials such as cement, lime and dolomite. As there is no specific mix design procedure for Autoclave Aerated Concrete, various trials are done by changing the ratios of the components used in it. Specimens were casted for the trial mixes and various parameters like change in height and volume, expansion ratio, dry weight and dry density are studied. Depending upon the results optimum values are fixed and a mix is computed. To the mix Polypropylene fiber is added and compressive strength were determined.

III. MATERIALS USED

A. Cement

The OPC53 grade conforming IS 12269 - 2013 was used in this work. The preliminary test for cement conducted is of specific gravity of 3.13, fineness modulus is 2% and consistency is 31%.

B. Lime

Calcium Oxide (Unslaked Lime) is an inorganic material. Lime is one of the main components used in Autoclaved Aerated Concrete. The preliminary test for lime conducted is of specific gravity of 3.3

C. Dolomite

The word dolomite is also used to describe the sedimentary carbonate rock, which is composed predominantly of the mineral dolomite.

D. Aluminium Powder

Aluminium is converted into flakes by mechanical means using stamp mill and then powdered by ball milling. The preliminary test for lime conducted is of specific gravity of 2.85.The powdered aluminium reacts with $Ca(OH)_2$ and liberates hydrogen gas

$2Al+3Ca(OH)_2+6H_2O=3CaO.Al_2O_3 .6H_2O + 3H_2$

E. Polypropylene Fibre

Polypropylene is one of the most successful commodity fibers, reaching a world production capacity of four million tons a year. Due to its low density (0.9 gm/cc), high crystalline, high stiffness and excellent chemical/bacterial resistance, is tactic polypropylene fibre is widely used in many industrial applications such as nonwovens, industrial ropes, packaging materials, furnishing products, etc. Polypropylene fiber has potential, high-volume applications in the carpet, textile, apparel and industrial textile markets.

IV. MIX PROPORTION

For autoclaved aerated concrete there is no mix design procedure. So trial and error method is conducted. From the results the optimum value of the materials are fixed.

Mix Ratio:

The mix ratio finally obtained is **1:1:0.9** (cement: sand: water). Optimum values obtained from the trial mixes are

1. Optimum Water/Cement ratio- 0.9
2. Optimum Aluminium content- 1.25% of weight
3. Optimum Lime content-45% of weight

V. RESULTS AND DISCUSSION

From the trial mixes the mix ratio is obtained. Initially the conventional mix is casted from the obtained mix ratio. And then Polypropylene fiber is added from 0-1% and cubes are casted. Compressive strength and bulk density are determined.

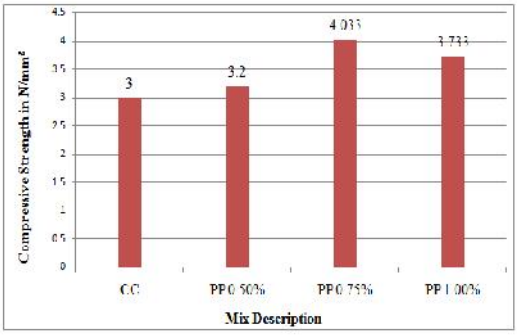

Fig.1 *Comparison of Compressive Strength*

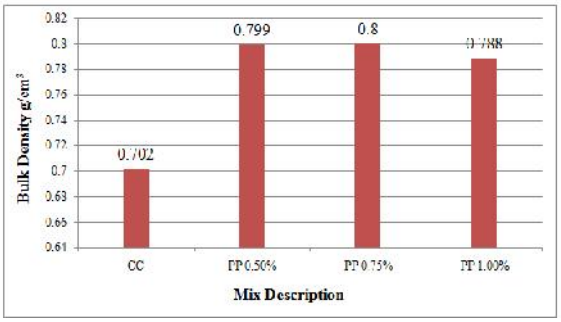

Fig.2. *Comparison of Bulk Density*

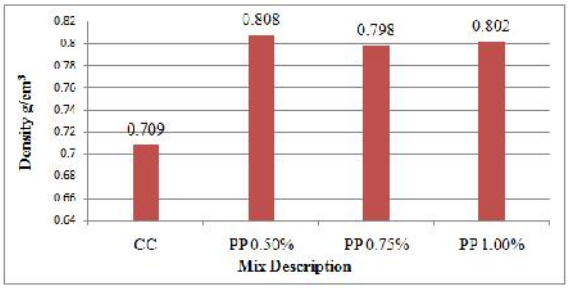

Fig.3. *Comparison of Density*

VI. CONCLUSION

- With the addition of Polypropylene Fiber up to 0.75% the compressive strength, density and bulk density increases and the maximum value is obtained at 0.75%.
- The percentage increase in compressive strength of AAC with 0.75% addition of Polypropylene Fiber is 28.66%.
- In the same way addition of Polypropylene Fiber decreases the expansion ratio of AAC.

The compressive strength value decreases when the addition level of Polypropylene Fiber should be increased above 0.75% so that the optimum value of the addition of PP is 0.75%.

Selvan David A., (*PG Scholar; Structural Engineering, davidselvan7@gmail.com)*

SuntarRaajan V.C. (PG Scholar , Dr.SivanthiAditanar College of Engineering , suntar.civil@gmail.com)

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