EXPERIMENTAL INVESTIGATION ON LIME CONCRETE USING BAMBOO FIBER

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Abstract: This project presents the experimental study to determine the simultaneous effects of bamboo fiber on the Lime Concrete. Mixes with different levels of fly ash (0.0, 10, 20 and 30%) as a replacement by weight of white cement were prepared. Concrete offers many advantages regarding mechanical characteristics. Reinforcement with randomly distributed short fibers presents an effective approach to the stabilization of the crack and improving the ductility and tensile strength of concrete. Bamboo fiber reinforcement is considered to be an effective method for improving the shrinkage cracking characteristics, toughness, and impact resistance of concrete materials. Also a variety of materials are added to concrete so as to improve its mechanical behavior. The mechanical properties were conducted by comprising the compressive, splitting tensile & flexural strengths at 14 days , 21 days and 28 days.. The Lime Concrete mixes have a slump flow in the range of 230mm for 30sec. However applying these fibers at their maximum percentage volume fraction determined through this study, increased the tensile strength

***Key words* – Bamboo fiber,flyash,white cement.**

I. INTRODUCTION

Lime mortar is not as strong in compression as Portland lime based mortar, but both are sufficiently strong for construction of non-high-rise domestic properties. Lime mortar does not adhere as strongly to masonry as Portland lime. This is an advantage with softer types of masonry, where use of lime in many cases eventually results in lime pulling away some masonry material when it reaches the end of its life. The mortar is a sacrificial element which should be weaker than the bricks so it will crack before the bricks. It is less expensive to replace cracked mortar than cracked bricks.Under cracking conditions, Portland lime breaks, whereas lime often produces numerous microcracks if the amount of movement is small. These microcracks recrystallise through the action of 'free lime' effectively self-healing the affected area. Historic buildings are frequently constructed with relatively soft masonry units (e.g. soft brick and many types of stone), and minor movement in such buildings is quite common due to the nature of the foundations. This movement breaks the weakest part of the wall, and with Portland lime mortar this is usually the masonry. When lime mortar is used, the lime is the weaker element, and the mortar cracks in preference to the masonry. This results in much less damage, and is relatively simple to repair.Lime mortar today is primarily used in the conservation of buildings originally built using lime mortar, but may be used as an alternative to ordinary portland lime. It is made principally of lime (hydraulic, or non hydraulic), water and an aggregate such as sand. Portland lime has proven to be incompatible with lime mortar because it is harder, less flexible, and impermeable. These qualities lead to premature deterioration of soft, historic bricks so the traditionally, low temperature fired, lime mortars are recommended for use with existing mortar of a similar type or reconstruction of buildings using historically correct methods.

II. HYDRAULIC LIME AND NON HYDRAULIC LIME

Hydraulic lime sets by hydration so it can set under water. Non-hydraulic lime sets by carbonatation and so needs exposure to carbon dioxide in the air and cannot set under water or inside a thick wall. For natural hydraulic lime (NHL) mortars, the lime is obtained from limestone naturally containing a sufficient percentage of silica and/or alumina. Artificial hydraulic lime is produced by introducing specific types and quantities of additives to the source of lime during the burning process, or adding a pozzolan to non-hydraulic lime. Non-hydraulic lime is produced from a high purity source of calcium carbonate such as chalk, limestone or oyster shells.

III. NON HYDRAULIC LIME

Non-hydraulic lime is primarily composed of (generally greater than 95%) calcium hydroxide, $Ca(OH)_2$. Non-hydraulic lime is produced by first heating sufficiently pure calcium carbonate to between 954° and 1066 °C, driving off carbon dioxide to produce quicklime (calcium oxide). This is done in a lime kiln. The quicklime is then *slaked*: hydrated by being thoroughly mixed with enough water to form a slurry (lime putty), or with less water to produce dry powder. This hydrated lime (calcium hydroxide) naturally turns back into calcium carbonate by reacting with carbon dioxide in the air, the entire process being called the lime cycle.

IV. OBJECTIVE AND SCOPE

- To produce Environmentaly friendly Concrete.
- To Test the Strength and Durability of the Concrete.
- To used for the sack of economy in Foundation work, Under Floors, Over Roof.
- To produce Flexibility of Concrete.
- To obtain Ductility in Concrete by using Bamboo Fiber.

3.1Flow Test

Flow test was conducted on fresh concrete to know the workability of concrete. It is possible to produce and design mixes incorporating fly ash content up to 30% The produced have a slump flow in the range of 295 mm,for 30sec

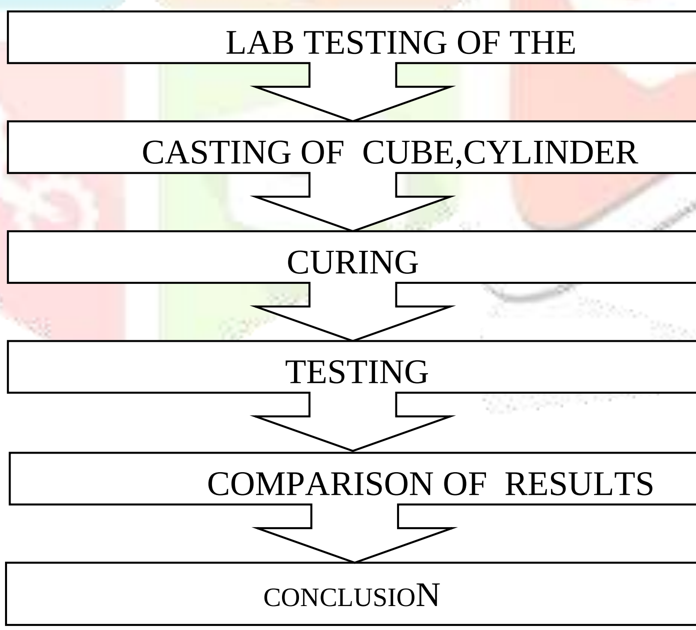
3.2 Slump Test

Slump test was conducted on fresh concrete as per IS119-1959 to know the workability of concrete.Slump test is the most commonly used method for measuring work ability, which can be employed either in laboratory or at site of work. It is used conveniently as a control test and gives an indication of the uniformity of concrete from batch to batch.The slump cone mould is placed on a smooth, horizontal, rigid and non-absorbent surface in which concrete is poured in three layers and tamped 25 times by tamping rod taking care to distribute the strokes evenly over the cross section. The mould is removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allows the concrete to subside. This subsidence is referred as Slump of concrete.The difference in level between the height of the mould and that of the highest point of the subsided concrete is measured. This difference in height in mm is taken as Slump of concrete. From the observed the slump test result, the degree of workability of concrete was medium where the slump values lies between 25-50mm.

3.3 Hardened Concrete Test

The hardened properties of concrete like compressive strength and the micro structural properties like saturated water absorption. Sorptivity for the concrete mixes were conducted as per IS 516-1959,IS5816-1999 and ASTM standards respectively.

I. RESEARCH METHODOLOGY



3.1Compressive Test

The Compressive Strength of concrete with bamboo fiber was conducted on the Cubes of size 150mm, and Cylinder were tested as per IS 516 -1959 specifications and the experimental set up as shown in fig 3.1. The unit weight of the specimens was also determined at the same time. The Cubes and Cylinder were tested for compressive strength at the age of 14 days, 21 days and 28 days after curing.

Fig no 3.1. Compression test

3.2 Tensile Test

The splitting tensile strength was determined at ages of 14 days, 21 days, 28 days on cylinders measuring 150-mm diameter and 300 mm height and cured in water until the date of test according the ASTM C496.

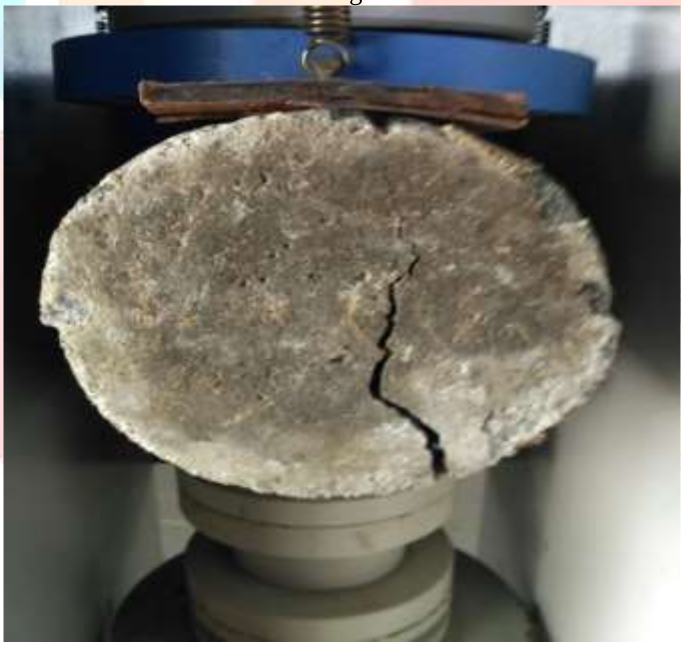


Fig no 3.2 Tensile test

3.3 Materials Used

1.White Lime:

White Portland lime differs physically from gray lime only in terms of its color. Its setting behavior and strength development are essentially the same as that expected in gray lime, and it meets standard specifications such as ASTM C 150 and EN 197. In practice, because much white lime is used in pre-cast concrete products, it is commonly made to a high-early strength specification such as ASTM C 150 Type III.

Fig-1.1 White Lime

2. Fine Aggregates:

They are aggregate most of which passes 4.75mm IS Sieve. M Sand is used as the fine aggregate. Sieve analysis is carried out and as per sieve analysis it comes under Zone-II. The limits for each zone as per IS: 383 – 1970.

3. Coarse Aggregates:

Aggregate most of which is retained on 4.75mm IS Sieve and containing only so much finer material as is permitted for the various types described in this standard. As per IS: 10262 – 1982 clause 3.6 explaining the combination of different coarse aggregate fractions two different sizes, 20mm and 12.5mm size coarse aggregates were used which results in an overall grading conforming to Table 2 of IS: 383 - 1970.

4. Fly ash:

FA as fine powder form was used with surface area of 22,000 cm2/gm and at different levels namely: 0.0, 10, 20 and 30% as a partial replalime by weight of lime content.

5. Water:

Clean tap water, with water-binder ratio (w/b) equal to 0.45 was kept fixed in all mixes in this study.

IV. RESULTS AND DISCUSSION

4.1 Results of Compressive Test

Table 4.1 Test Result of 28 Days Compressive Strength in MPa

M20 Mix	0%	10%	20%	30%
	23	24	25	27

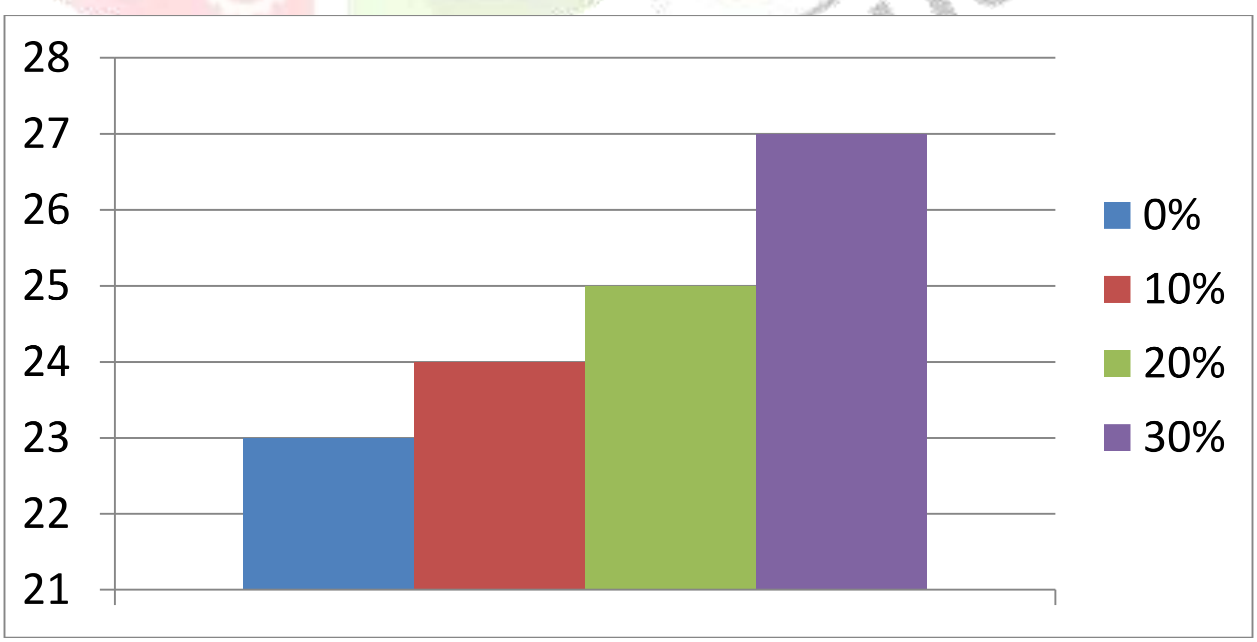


Fig 4.1 Test Result of 28 Days Compressive Strength in MPa

4.2 Result of Tensile Test

Table 4.2 Test Result of 28 Days Tensile Strength in MPa

M20 Mix	0%	10%	20%	30%
	1.68	1.72	1.73	1.77

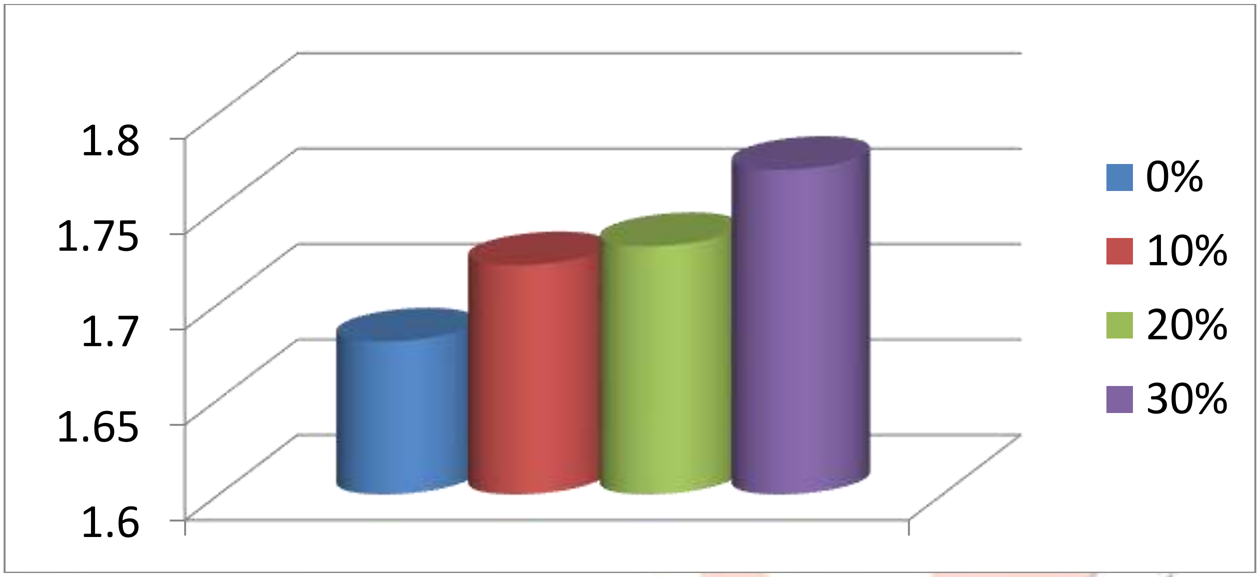


Fig 4.2 Test Result of 28 Days Tensile Strength in MPa

4.3 Conclusion

- Hydrated lime could be considered as a sustainable binder due to lower production energy needs, lower CO2 emission during production and CO2 absorption by carbonation.
- Hydrated lime has greater workability and plasticity.
- Hydrated lime- water paste sets and hardens due to the chemical reaction of the carbon dioxide in air with lime.
- Hydrated lime usually gains strength in time greater than the time in which lime concrete gains same value of strength.
- Lime concrete takes a long time to cure, and while the ancient world had lots of time,today time is money.
- Lime concrete does not harden in water but stays soft. So there are situations where itcannot be used.
- The density of lime concrete is lower than that for lime concrete.

V. ACKNOWLEDGMENT

We would like to express our sincere thanks to our Principal, **Dr.RAMESH P.L.N, B.Tech., M.Tech., Ph.D.,** Prathyusha Engineering College, Thiruvallur for providing the permission and College facilities for the successful completion of this Project. We feel grateful to **Mr.K.MUTHUKUMAR M.E.,** Assistant Professor, Department of Civil Engineering, Prathyusha Engineering College, Thiruvallur, for his guidance, encouragement and support.

REFERENCES

[1] Aideen Dowling, Jean O'Dwyer, Catherine C. Adley "lime in the limelight" Journal of Cleaner production. Vol. 92, 1 April 2015, Pages 13-22.

[2] Mehta, P. k. and Monterio, J.m., (2006),"Concrete – Microstructure, Properties and Materials" Third Edition, New Jersey, pp.1-684,.

[3] Grist, E.R, Paine, K.A, Heath, A., Norman, J. and Pinder, H., (2015), "The environmental credentials of hydraulic Lime - pozzolan Concrete", Journal of Cleaner production, pp.26.37.