Investigation of compressive Strength of fly ash based fiber reinforced concrete.

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ABSTRACT

The compressive strength of concrete is one of the most important Properties of concrete in most structural application concrete is implied primarily to resist compressive stress. In the investigation, conventional concrete and fly ash based coconut fibre composite, concrete cubes of 150mm x 150mm x 150mm sizes were used for testing the compressive strength. The cubes are tested in a compression-testing machine of capacity 2000kn. The load has been applied at a rate of 315kn/mm. The load applied in such a way that the two opposite sides of the cubes are compressed. The load at which the control specimen ultimately fails is noted. Compressive strength of concrete mixes made with and without fly ash and coconut fibre with different percentage and variation in length of fibre were determined at 7, 14, and 28 days of curing. The test results are given in table and shown in figure. The maximum compressive strength was obtained for a mix having a fibre length of 40 mm, 10% fly ash and fibre content of 0.25% by weight and increase in strength over plain concrete and fly ash concrete without fibre content.

Keywords— *Compressive Strength, Flexural Strength ;*

INTRODUCTION

Concrete in general has a higher brittleness with increase in strength. This is a major drawback since brittleness can cause sudden & catastrophic failure, especially in structures which are subjected to earthquake, blast or suddenly applied loads i.e., impact. This serious disadvantage of concretecan at least partially be overcome by the incorporation of fibers. The incorporation of fiber can cause a change in the failure mode under compressive deformation from brittle, thereby imparting a degree of toughness to concrete.

The utilization of fly ash instead of dumping it as a waste material can be both on economic and environmental grounds and also because of its beneficial effects of lower water demand for similar workability reduced bleeding and lower evolution of heat. The proportion of fly ash used as a cementitious component in concrete depends on several factors. The design strength and workability of concrete, water demand and relative cost of fly ash compared with cement are particularly important in mixture proportioning of concrete.

To bring into focus the use of coconut fibers in concrete and experimental programme was planned to study the material characteristics. The primary objective of this investigation is to study experimentally the properties of fibers. The properties of concrete namely, compressive strength, were studied.
cost functions, are approximated using quadratic or piecewise quadratic functions, assuming that the incremental cost curves of generators are monotonically increasing [1]. However, in practice, this assumption is not valid because the cost functions exhibit higher order non-linearities and discontinuities due to valve point loading effects in units fired by fossil fuels [2]. The cost function needs to be more realistically expressed as a piecewise non-linear function rather than a single quadratic function. The ELD problem with valve point effects is denoted as a non smooth optimization problem having complex and non convex characteristics which make the challenge of obtaining the global minima, very difficult. Therefore, conventional gradient based optimization methods fail in such cases and result in inaccurate dispatches. A classical approach to solve the ELD problem with valve point loading is dynamic programming. [3] In which all possible solutions are enumerated while choosing for an optimal dispatch. This method suffers from the problem of dimensionality and excessive evaluation at each stage.

countries which are very useful for realization.

OBJECTIVES

The salient objectives of the present study have been identified as follows:

1. The main objective of the present work is to develop structural concrete.
2. The determination of the possibilities of directly using the flyash replacing a high % of cement
3. The scope of the present work is limited

NEED FOR THE PROPOSED WORK

Necessity and importance of the study on bulk utilization of high calcium flyash in structural concrete.

i) Strength and durability characteristics
ii) Analysis and discussion on the investigation.
iii) Decrease the cost of making concrete.
iv) The qualitative and quantitative conclusion.

LITERATURE REVIEW

A.Zuraida, S. Norshahida and co-workers. Carried out experimental investigation on effect of fiber length variation on mechanical and physical properties of coir fiber reinforced cement albumen composite, Albumen protein was added as a binder and the coir fiber with the length of (2.5, 5, 10 and 20mm) was used as partial replacement of the cement mixture. Flexural strength and compressive strength, Bulk density moisture content and water absorption were investigated the test results showed that increase in fiber length increase the flexural strength. Incorporation of long fiber into cement paste however decreased the workability and thus introduced voids which resulted in low density. In fact, the water absorption & moisture content were also increased.

Alida Abdullah, and co-workers Carried out experimental investigation on the effect of natural fiber content on the physical & mechanical properties of composite cement reinforce with coconut fiber. The mix design was based on 1:1 for cement sand ratio and 0.55 was fixed for amount of water per cement ratio. Coconut fiber was added as reinforcement and replacing the composition of sand. Composites wete developed base on 3% wt, 6%wt, 9% wt, 12% wt & 15%wt of coconut fiber by mixing & curing process. Composite were cured in water for 7, 14 & 28 days the test results showed that the composite reinforced with 9% wt of coconut fiber demonstrated the highest strength of modulus of rapture and compressive strength.

Wilson O Tablan carried out the experimental investigation on effect of coconut fiber as reinforcement to concrete on its flexural strength and cracking behavior. 25% coconut fiber was added as reinforcement. The ratio of 1:2:4 mixture of concrete was used in making the specimen & curing the period of 28 days. The result showed that the concrete reinforced with coconut fibers yielded a higher flexural strength compared to concrete without coconut fiber reinforcement. More ever the concrete with coconut fiber indicated transformation from abrupt to gradual failure of the specimens and splitting when ultimate load was applied hence the added coconut fibers enhanced the flexural strength of the concrete.

Tan Eng slang carried out experimental investigation on effect of coconut fiber & egg albumen to properties of the concrete such as the compressive strength & flexural strength. The three types of concrete mixture were concrete containing 0.1% coconut fiber & 1% egg albumen, concrete containing 0.5% coconut fiber & 0.5% egg albumen and concrete control sample from analysis showed that the both the additives of coconut fiber & egg albumen with concrete in different percentage show improvement in the development of the strength. By compairing concrete containing 0.1% coconut fiber & 0.1% egg albumen with concrete containing 0.5% coconut fiber & 0.5% egg albumen, the strength of lower percentage additive was higher than the higher percentage of additive.

Baruah and Talukdar carried out experimental investigation the properties of plain concrete and coconut fiber reinforced concrete with different fiber volume fractions ranging from 0.5 to 2% The misc design for plain concrete was 1:1:67:3.64 with W/C of 0.535 The coconut fiber having length of 4cm and with volume fraction of 0.5, 1, 1.5 and 2% were added to prepare CFRC. The test result showed that coconut fiber reinforced concrete with 2% fibers showed better results among all volume fractions. The compressive strength splitting tensile strength modulus of rupture and shear strength of coconut fiber reinforced concrete with 2% fibers by volume fraction were increased up to 13.7, 22.9, 28 & 32.7% respectively as compared to those of plain concrete.

Reis investigated the mechanical characterization flexural strength, fracture toughness & fracture energy of concrete reinforced with natural coconut fiber. The test results showed that fracture toughness & fracture energy of coconut fiber reinforced concrete were higher than that of other fibers reinforced concrete, flexural strength was increased up to 25% with coconut fiber only.

Siddique carried out experimental investigation to evaluate the mechanical properties of concrete mixes in which cement was partially replaced with class F fly ash, cement was replaced with 10%, 20%, 30%, 40%, 50% of class F fly ash by weight the test results showed that the compressive strength, splitting tensile strength & flexural strength of fly ash concrete mixes with 10% to 50% cement replacement with fly ash showed improvement in the results as compared to concrete.

Methodology and Experimentation

The aim of this experimental investigation is to study the variation in strength characteristics of concrete structural elements, for the proportion of M20 grade. In each mixes containing different percentages of fly ash is replaced by means of cement starting from 0% as normal concrete, i.e. controlled concrete 10%, 20%, and 30%, and two percentages of natural coconut fibers 0.25% and 0.5% with different lengths of 20mm 40mm 60mm were used. The number of specimens casted

The degree of compaction, called the compaction factor, is measured by the density ratio i.e. the ratio of the density actually achieved in the test to the density of the same concrete fully compacted. The test, known as the compacting factor test, is described in BS 1881: Part 103: 1993 and in ACI 211.3-75 (Revised 1987) (reproved 1992), and appropriate for concrete with a maximum size of aggregate up to 40mm. The apparatus consists essentially of two hoppers, 2 each in the shape of a frustum of cone, and one cylinder, the three being above one another. The hoppers have hinged doors at the bottom, as shown in figure. All inside surfaces are polished to reduce friction.

The upper hopper is filled with concrete, this being placed gently so that at this stage no work is done on the concrete to produce compaction. The bottom door of the hopper is then released and the concrete falls into the lower hopper. This is smaller than the upper one and is, therefore, filled to overflowing, and thus always contains approximately the same amount of concrete in a standard state; this reduces the influence of the personal factor in filling the top hopper. The bottom door of the lower hopper is then released and the concrete falls into the cylinder. Excess concrete is cut by two floats slid across the top of the mould.

Serial No.	Mix Design Code	Compaction Factor
1	M1	0.81
2	M2	0.82
3	M3	0.84
4	M4	0.85
5	M13	0.87
6	M22	0.90

Workability of various concrete mix design for compaction factor test

Mix Design Methodology:

Mix design is defined as a quantity of material (cement, fine aggregate, coarse aggregate) required per cubic meter of concrete. Indian Standard method of mix design (as per IS: 456-2000, IS: 10262-2009) the mix design of plain concrete is carried out as follows.

1. Grade designation (Characteristic Compressive strength)
2. Type of grade of cement
3. Type of Aggregate
4. Maximum nominal size of aggregates
5. Minimum water/cement ratio, cement content
6. Workability by durability required
7. Quality control achieved.

As per Indian Standard method of mix design (as per IS: 456-2000, IS: 10262-2009) the mix design of plain concrete is carried Out as: -

1. Target Mean Strength of concrete mix design
   Fck = fck + t x s.
   Fck = Target average compressive strength at 28 days
   fck = Characteristics compressive strength at 28 days
   S = Standard deviation and (Table 1 IS 10262-2009)
   t = A static, depending upon the accepted proportion of low results and the number of tests, for large number of test the value of "t".

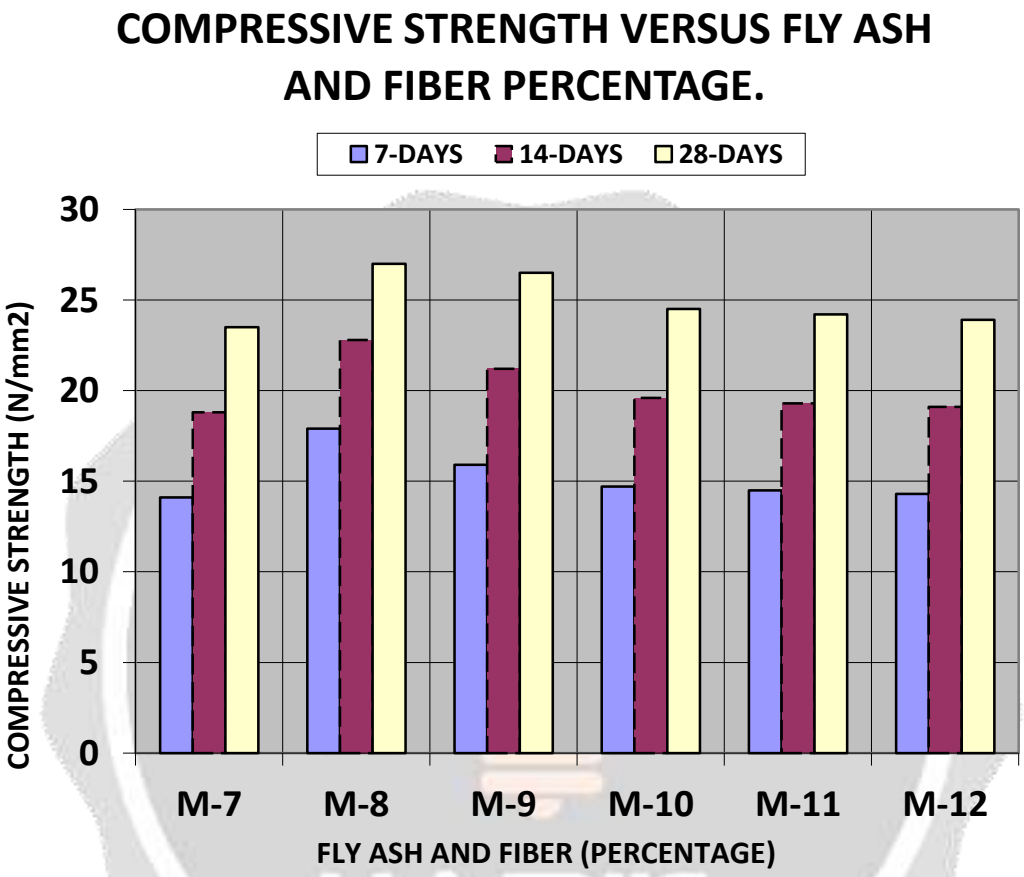
Details of Specimens Used:

1. 150mm x 150mm x 150mm cube specimens for
   Compressive strength.

   Modulus of Elasticity.
2. 100mm diameter x 200mm length specimens are used for Split Tensile Strength test.
3. 100mm x 100mm x 500mm prisms specimens are used for Flexural Strength test.

RESULTS

Experimental Results



Discussion of Compressive Strength:

Compressive strength of concrete mixes made with and without fly ash and coconut fiber with different percentage and varation in length of fiber were determined at 7, 14, and 28 days of curing. The test results are given in table and shown in figure. The maximum compressive strength was obtained for a mix having a fiber length of 40 mm,10% fly ash and fiber content of 0.25% by weight and increase in strength over plain concrete and fly ash concrete without fiber content. The 7 day compressive strength of fly ash based coconut fiber concrete was found to be high as 17.9 Mpa. Which is more than ordinary concrete and fly ash concrete. Similarly 28 day compressive strength was found to be about 27 Mpa which is more than that of ordinary concrete and fly ash concrete. The effect of replacement of cement with three percentages of fly ash and addition of coconut fibers on the compressive strength of concrete is shown figure. It is clear that the replacement of cement

CONCLUSIONS

Compressive strength, of fly ash based coconut fiber reinforced concrete specimens were higher than the plain concrete (Control Mix) and fly ash concrete specimens at all the ages. The strength differential between the plain concrete specimens and fly ash based fiber reinforced concrete specimens became more distinct after at 28 days.

The maximum 28 day cube compressive strength obtained was 27 mpa, for a mix with fiber length of 40mm, 10% fly ash and fiber content of 0.25% by weight and increase in strength over plain cement concrete is found to be 39.89% and increase in strength over fly ash concrete is 17.39%.

REFERENCES

1. Saravana raja mohan, P.Jayabalan, A Rajaraman on properties of fly ash based coconut fiber composite, American Journal of Engg and Applied Science 5(1):29-34,2012
2. A.Zutaida, S.Norshahida, I.Sopian and H.Zahurin (malaysia) on effect of fiber length variation on mechanical and physical properties of coir fiber reinforced cement albumen composite. IIUM Engg Journal Vol.12 No 1, 2011.
3. Alida Abdullah, Shamsu lBaharinJamaludin, MazleeMohd Noor, Kamarudin Hussinon Composite Cement Reinforced Coconut Fiber: Physical and Mechanical Properties Australian Journal of Basic and Applied Sciences, 5(7): 1228-1240, 2011
4. Wilson o. table an Flexural Strength of Concrete Beams Containing Twinned Coconut Fibers Vol 5 No.1 December 2007 ISSN: 2094-1064
5. Majid Ali Coconut fibre: A versatile material and its applications in engineering Journal of Civil Engineering and Construction Technology Vol. 2(9), pp. 189-197, 2 September, 2011Available online at http://www.academicjournals.org/jcect ISSN 2141-2634 ©2011 Academic Journals.
6. Tan eng slang effect of coconut fibre and egg albumen in concrete for greener environment.
7. Ben Davis on Natural Fibre Reinforced Concrete.
8. Baruah and Talukdar properties of plain concrete and coconut fiber reinforced concrete Journal of Civil Engineering and Construction Technology Vol. 2(9), pp. 189-197, 2 September, 2011 Available online at http://www.academicjournals.org/jcectISSN 2141-2634 ©2011 Academic Journals
9. IS: 8112-1989 Specifications for 43-Grade Portland cement, Bureau of Indian Standards, and New Delhi, India.
10. IS: 383-1970, Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi, India.
11. IS: 10262-1982, Recommended Guidelines for Concrete Mix Design. Bureau of Indian Standards, New Delhi, India.
12. IS: 1199-1959, Indian Standards Methods of Sampling and Analysis of Concrete, Bureau of Indian Standards, New Delhi, India.
13. IS: 516-1959, Indian Standard Code of Practice-Methods of Test of Strength of Concrete, Bureau of Indian Standards, New Delhi, India.
14. IS: 456-2000 “Plain and Reinforced concrete code of practice”.