# STRENGTH ANALYSIS OF CLASS OF FLY ASH BASED COCONUT FIBRE COMPOSIT CONCRETE FOR PAVING

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***ABSTRACT: Concrete is now the most widely used construction material as it can be cast to any form and shape at site very easily. Cement concrete has established itself as the most preferred material. Fly ash is the fine powder produced as a product from the combustion of pulverized coal. The disposal is one of the main reason of fly ash. As dumping of fly ash as a waste material may cause severe environmental problems. This research presents the strength of coconut fibers and its applications in different branches of engineering, particularly in civil engineering as a construction material. Coconut fiber is one of the natural fibers available in India, and is extracted from the husk of coconut fruit. Coconut fibers reinforced composites have been used as cheap and durable non-structural elements. The aim of this review is to spread awareness of coconut fibers as a construction material in civil engineering. In this context a composite with class F fly ash concrete and treated coconut fibers available in plenty in rural areas of India can be a good proposition and with this background, experimental investigation to study the effects of replacement of cement (by weight) with different percentages of fly ash and the effects of addition of processed natural coconut fiber on flexural strength, compressive strength, splitting tensile strength will taken up. Plain cement concrete has high compressive strength but low in flexural strength and negligible in tensile strength. If we are use coconut fiber then, tensile strength and flexural strength is increased also increase compressive strength.***

***Key words: Concrete, coconut fibers, fly ash, Workability, Mechanical properties***

## I. LITERATURE REVIEW

The number of significant results has been reported on the use of fly ash in concrete & coconut fibers in concrete.

Saravana Raja Mohan, and co-workers carried out experiment investigation to evaluate the properties of fly ash based coconut fiber composite cement was replaced with five percentages (10%, 15%, 20%, 25%, & 30%) of class c fly ash. Four percentages of coconut fibers (0.15, 0.3, 0.45 & 0.60%) having 40mm length were used. The fly ash based coconut fiber reinforced concrete shows a better performance than ordinary concrete.

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

Experimental View

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 for each case is as follows.

1. Workability of concrete test like slump cone test and compaction factor test.
2. Mechanical properties like Compressive strength, Split Tensile strength, Flexural strength test and Modulus of Elasticity

Table No. 01: Casting and Curing of M20 Grade of Concrete with 0% Fly Ash 0% Coconut Fiber

| Sl. No. | Particular | Mix Design | Code | No. of Specimen | Curing period in days | Remark |
|---|---|---|---|---|---|---|
| 1 | Cube | M20 | S1 | 9 no's | 7, 14,28 | Cube size 150x150x150mm |
| 2 | Cylinder | M20 | S1 | 3 no's | 28 | Cylinder size 300x150mm |
| 3 | Prism | M20 | S1 | 3 no's | 28 | Prism size 700x150x150mm |

Table No. 17: Casting and curing of M20 grade of concrete with 10% cement replaced by fly ash and 0.5% of coconut fiber of 40mm.

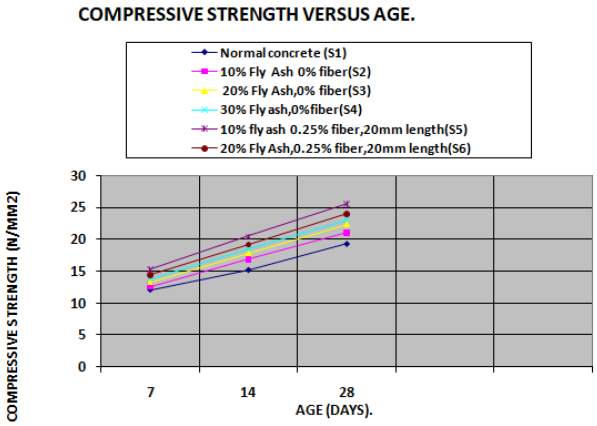
| Sl. No. | Particular | Mix Design | Code | No. of Specimen | Curing period in Days | Remark |
|---|---|---|---|---|---|---|

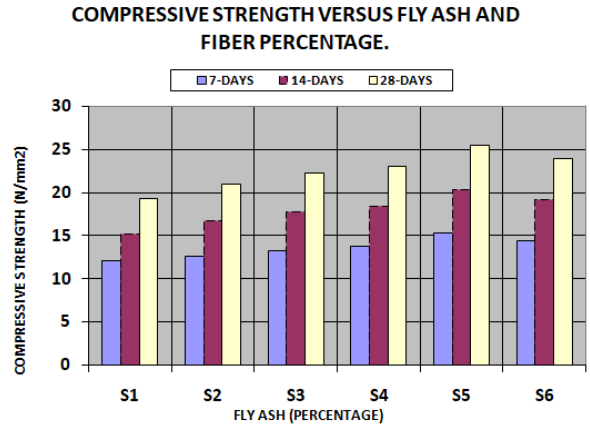
  

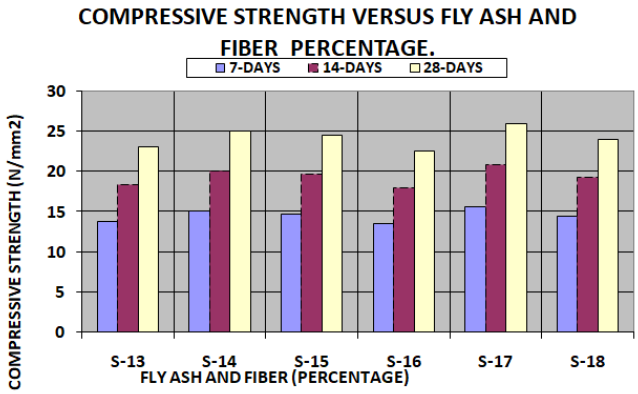
| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Cube | M20 | S19 | 9 no's | 7, 14,28 | Cube size 150X150X 150mm |
| 2 | Cylinder | M20 | S19 | 3 no's | 28 | Cylinder size 300x150mm |
| 3 | Prism | M20 | S19 | 3 no's | 28 | Prism size 700x150x150mm |

Testing of Materials:
Ordinary Portland Cement of 53 Grade confirming to IS: 8112-1989 was used in the investigation.Cement in general can be defined as a material which possesses very good adhesive and cohesive properties which makes it possible to bond with other materials to form compact mass.

| SERIAL NO | PROPERTIES | CHART RESULTS | REQUIREMENTS AS PER IS:8112-1989 |
|---|---|---|---|
| 1. | Specific gravity | 3.15 | - |
| 2. | Finness (specific gravity) | 301$m_2$/kg | Should not be less Than 225$m_2$/kg |
| 3. | Normal consistency | 30% | - |
| 4. | Setting time in min.<br>Initial setting time<br>Final setting time | 130<br>197 | Should not be less than 30min<br>Should not be exceed 600min. |
| 5. | Soundness Test:<br>By 1. Le Chatelier<br>2. Auto clave method. | 0.5mm<br>0.0935% | Should not exceed 10mm<br>Should not exceed 0.8% |
| 6. | Compressive strength<br>3 – days<br>7 – days<br>28 -days | 34.5N/mm²<br>45.50N/mm²<br>65.00N/mm² | Should not less than 27N/mm²<br>Should not be less than 37N/mm²<br>Should not be less than 53N/mm² |
| 7. | Temperature during testing | 27 ˚c | Min 25 ˚c and Max 29˚c |




Results and Discussion of Compressive Strength:
Compressive strength of concrete mixes made with and without fly ash and coconut fiber with different percentage and variation 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 with 30 % of fly ash reduced the compressive strength of concrete. And for a particular percentage of fly ash there was a decrease in compressive strength of fly ash concrete, as the percentage of fiber increased from 0.25% to 0.5%. However, this reduction in strength with addition of fibers continued to decrease with an increase in the percentage of fly ash content. Generally, presence of fibers induces porosity and reduces compressive strength depending upon fly ash content.

## II. CONCLUSIONS

The following conclusions can be drawn from the present Compressive strength, Splitting Tensile strength, Flexural Strength and Modulus of Elasticity 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%.

## SCOPE FOR FURTHER STUDY

- In this investigation the work can be carried out by using higher grades of concrete.
- In this investigation, to increase the strength of concrete the number of days of curing can be extended up to 91 days.
- In this investigation 20mm down size aggregate have been used. Further work can be carried out by using 10mm aggregate size.
- In this investigation fly ash of about 30% of the total powder content have been used. Further work can be carried out by using fly ash upto 50%.

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