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# An Advanced Progessive Performance of Cement Concrete with Preferencial Substitutions with Glass Fiber and Class - F- Flyash

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**ABSTRACT**
Fly ash has been used as partial replacement of Cement in Concrete and Glass fiber has been used as additive. Fly ash and Glass fiber is provides several advantages like strength, workability etc. And they will provide environmental benefits related to disposal of worst materials and to reduced $CO_2$. The component of work is to study fly ash as replacement and Glass fiber as additive in Concrete. Fly ash as partial replacement of cement and glass fiber is additional reinforcement in the cement concrete. Which is satisfies the several properties of concrete like as compressive, split tensile stress and flexural strength. In this study we conducted different strengths tests, normal Consistency, Specific gravity and fineness test to the cement and Fly ash. As well as specific gravity, water absorption and fineness modulus tests conducted to coarse aggregate and Fine aggregates. In strength regarding we did M30 grade of Concrete for this study. We prepared /casted nominal cubes and mix M2 (5% FA), M2 (10% FA) and M2 (2%GF) and mix M3 (5% FA+ 2% GF), M3 (10% FA+ 2% GF) in this all mixes we concluded, one mix which is give maximum strength for 7 days & 28 days.

***Keywords*** **-** Fly ash, Glass fiber, Compressive strength, workability, split tensile strength, Flexural strength and M30 grade of concrete.

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## I. INTRODUCTION

The Now a day's concrete is becoming a major part in construction by using partially replacement of fly ash will reduce the cement quantity in concrete. This kind of material replacing which can more popular for next generation, that can be binding material in concrete it Portland cement. Due to this OPC are gradually decreases, due to this huge amount of $CO_2$ will reduced to affect the Environment, climate change and Global warming.

This is main reason for partial replacement of Cement, So utilization of industrial and agricultural wastage products for partial replacement of Cement, It will be suitable for development for present days are future days. This will shows the recycling and reuse of waste materials instead a part of Cement. They will protect Environment from hazardous gas and $CO_2$ emissions.

The other reason for utilization of this component in cement can significantly improve the properties of Concrete. One of the most important suitable resources of mineral additive among the industrial wastage is glass fiber as it is available in huge quantities. Glass fiber mixture is a new material in reinforcement Concrete. Several types of fibers are available in market mainly glass fiber, tal fiber and organic polymers etc, we used class-F glass fiber to our resources & that given excellent results to us.

When the fibers are use in the Concrete will reduce the cracks and improve the strength of Concrete (Tensile and flexural).

## II. Literature reviews on Fly ash

**Shaikuthali, et al :**

The experiment conduct on the workability and compressive strength properties of normal weight concrete using high dosage of fly ash to cement replacement. Based on the results and the

experimental investigation we noticed that the slump loss and non destructive strength properties of using fly ash percentage fixed. The strength measured using non-destructive strength test is low when compare to compressive strength. It shows about 40% of differences between the strengths measured using NDT and compressive strengths test

**Pitroda J, et al:**

The cement has been replaced by fly ash accordingly in the range of 0%, 10%, 20%, 30% and 40% by weight of Cement for $M_{25}$ and $M_{40}$ mix. Result was indicated that FA can be used as Cement substitute at 10% replacement at 28 days. curing age, compressive strength reduces when Cement replaced fly ash. As fly ash percentage increase Compressive strength and split strength decrease.

## III. Literatures on Glass fiber

**Srinivasa R, et al:**

Glass fiber was added to the concrete at 0.03% by Concrete volume. Comparison study was carried out to show the effectiveness of with and without glass fibers. the increase in compressive strengths for all the grades of Concrete mixes was varied from 20 to 25%. when compared 28 days strengths.

**Literature Summary**

In this experimental work the cement has been replaced by fly ash accordingly in the different ranges such as 10%, 20%, 30% and 40% by weight of Cement for different mixes. Test results were shows that compressive strength increases with the increases of fly ash 10% replacement at age of 28 days up to optimum value, beyond which strength values started decreasing. The compressive strengths properties and workability as compared to the normal weight of Concrete using dosage of fly ash Cement replacement.

The glass fiber was added to the Concrete at 0.031% Concrete volume. This proper reports, the results of an experimental investigation carried out to the behavior of glass fibres on fly-ash based concrete. M30 grade mix proportion was taken and the Cement is replaced with fly ash and glass fibers were adding by Concrete volume. In 10% of fly ash replacing by cement and 0.03% of glass fiber gives maximum Compressive strength.

## IV. Objectives:

The main objectives of this experimental investigation are as follows.

1. To study the various properties of fly ash used for partial cement replacement and glass fibre is used as additional reinforcement.
2. Various mechanical properties of concrete such as compressive strength, durability and workability properties of this project.
3. Use of industrial waste in use full manner to reduce the disposal problem in present and future days and significantly reduce the $CO_2$ emission and also avoid adverse effect environment, provide economic construction material to the construction industry

## V. MATERIALS USED

**Cement**

In this study ordinary Portland Cement (OPC) 53 grade was used. The specific gravity of Cement is 3.15, finess of Cement is 8%.

**Fine aggregate**

Normal River sand Conforming to grading zone-IV as per 383-1970 was used as fine aggregates. Average Specific gravity is 2.37. Fineness modulus of sand is 2.6

**Coarse aggregate**

In this study natural available 20mm size coarse aggregate was used. The specific gravity of C.A is 2.8. Fineness modulus of C.A is 2.6.

**Glass fiber**

In this present study Glass fibers of 12mm length and with diameter 0.014 mm. The density of glass fiber is 26kN/m³. It was collected from Buddha building technology

**Fly ash**

In this study class-F fly ash was used and it was collected from NTPC Vishakhapatnam. The specific gravity is 2.5. The Finess of the fly ash is 2.28%.

## VI. Methodology:

In this study the main objective is strength improvement. We study the effects of fly ash as mineral by product for partial replacement of Cement and Glass fiber is additional reinforcement by the weight of Concrete. In these investigations in this study better strength and other properties of concrete by mixing of Concrete we mixing manually. We used partial replacement of Cement by the fly ash at 0%, 5%, 10% and added an additive 2% Glass fiber

For every mix we texted as slump and we measure workability for each proportion 9 cubes of size 150 x 150 x 150 mm.These are for Compressive strength. 3cylinder of 100mm dia and 200mm height for split tensile strength.3beams of size 100 x 100 x 500 mm for flexural strength. We conducted 7 days, 14days and 28 days carried in curing tanks

We tested Cubes, cylinders, beams for Compressive, split and flexural strength tests.

## VII. Concrete mix design

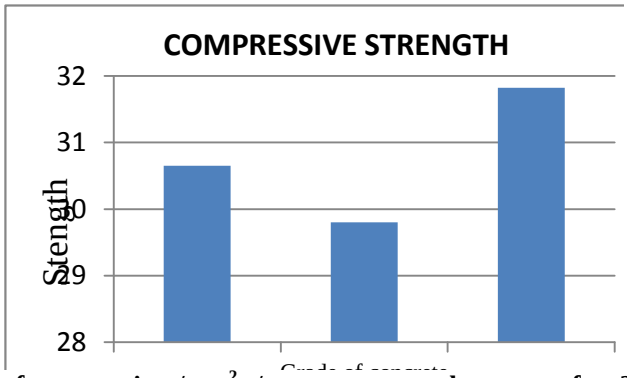
| Mix | % of mix | Glass fiber (kg) | Fly ash (kg) | Cement (kg) | Fine aggregate (kg) | Coarse aggregate (kg) | Water content (liters) |
|---|---|---|---|---|---|---|---|
| $M_1$ | 0%(normal concrete cube) | - | - | 5.630 | 7.285 | 17.459 | 2.815 |
| $M_2$ | 5%(fly ash) | - | 0.270 | 5.139 | 7.285 | 17.459 | 2.815 |
| $M_3$ | 10%(fly ash) | - | 0.541 | 4.869 | 7.285 | 17.459 | 2.815 |
| $M_4$ | 2% (glass fiber) | 0.972 | - | 5.630 | 7.285 | 17.459 | 2.815 |
| $M_5$ | 5% (fly ash)+2% (glass fiber) | 0.972 | 0.270 | 5.139 | 7.285 | 17.459 | 2.815 |
| $M_6$ | 10% (fly ash)+2% (glass fiber) | 0.972 | 0.541 | 4.869 | 7.285 | 17.459 | 2.815 |

## VIII. Results and discussions

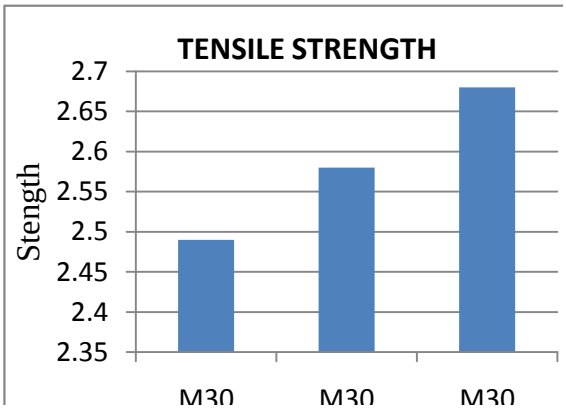
| Mix code | No | Peak load (KN) | Peak stress | Average compressive strength | Spilt tensile strength ($N/mm^2$) | |
|---|---|---|---|---|---|---|
| M30 | 1 | 687.8 | 30.53 | 30.55 | 2.49 | 2.58 |
| | 2 | 675.5 | 30.02 | | 2.58 | |
| | 3 | 699.8 | 31.10 | | 2.68 | |
| 5% F | 1 | 590 | 26.26 | 35.56 | 2.78 | 2.73 |
| | 2 | 920 | 40.88 | | 2.85 | |
| | 3 | 890 | 39.55 | | 2.56 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10% F | 1 | 590 | 26.22 | 29.32 | 2.45 | 2.21 |
| | 2 | 510 | 22.66 | | 2.56 | |
| | 3 | 590 | 27.25 | | 2.89 | |
| 0% F +2% GF | 1 | 717.52 | 31.98 | 31.89 | 2.70 | 2.70 |
| | 2 | 740 | 32.89 | | 2.69 | |
| | 3 | 692.55 | 30.78 | | 2.72 | |
| 5% F+2% GF | 1 | 822.37 | 36.55 | 35.77 | 2.88 | 2.75 |
| | 2 | 782.55 | 34.78 | | 2.67 | |
| | 3 | 809.55 | 35.98 | | 2.70 | |
| 10% F+2% GF | 1 | 883.25 | 39.25 | 39.33 | 2.88 | 2.44 |
| | 2 | 868.95 | 38.62 | | 2.67 | |
| | 3 | 902.27 | 40.12 | | 2.70 | |

**8.1 Normal Concrete Cube Results:**

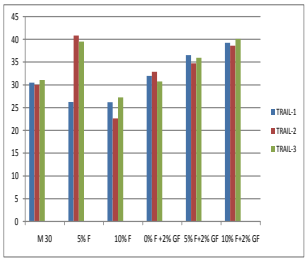



**8.1 Compressive strength of concrete in n/mm$^2$ v/s percentage replacement after 28 days of curing**




***8.2 Split tensile strength results of M 30 grade concrete cube after 28 days***

## IX. REPLACEMENT RESULTS FOR 28 DAYS




## X. Conclusion

In the present study, the effect of addition of Glass Fiber on the conventional concrete and fly ash based cement concrete were studied. In the fly ash based cement concrete, proportion of the element of the binding material was 15% fly ash and 85% cement. The various proportions of fly ash based concrete along with the addition of Glass Fiber such 0% fly ash+2% GF, 5%FA+2%GF and 10%FA+2%GF. The Compressive strength of Conventional concrete are observed to attained the optimum strength at 7 days at 5% of fly ash addition when compared to conventional concrete. Mechanical properties of Compressive strength results increased with increasing of age of concrete. These results were increased with increasing of fly ash content up to 5% then decreasing gradually above 10%.

## XI. Gallery

**Picture: 11.1**

**Picture:11.2**


**Picture 11.3** **Picture 11.4**

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