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# TO STUDY THE EFFECT OF PARTIALLY REPLACEMENT OF CEMENT IN M-30 CONCRETE FROM FLY ASH, SILICA FUME AND POLYPROPYLENE FIBRE.

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**ABSTRACT :-***A research project is being carried out on structural grade concrete containing low cement and high volumes of admixtures and fibers. This report is primarily concerned with the literature information on high-volume admixtures and fibers concrete. An extensive literature search was completed about technologies involving high volume uses admixtures and fibers in concrete for structural applications.*

***KEYWORD:-****Silica fume, Fly Ash and Polypropylene fibre, Admixtures.*

## I. INTRODUCTION

In many countries around the world, silica fume and fly ash are used for producing active admixtures. These admixtures are used for reducing the Portland cement content in mortar and concrete production. The positive effects exerted by such admixtures on properties of portland cement mortar and concrete have been emphasized in many studies with strength there is also an addition in surface resistance of Portland cement mortar and concrete. The benefits of using silica fume and fly ash in partial replacement of Portland cement are well established for high performance concrete. Where silica fume enhance strength properties of concrete but it can increase water demand placing difficulties and plastic shrinkage problems in concrete and present handling difficulties in the raw state if not properly used. Fly ash are depending on the nature of fly ash being considered. Most of the intensive research works are concentrated and focused on the compressive strength though the literature regarding research on silica fume and fly ash and polypropylene fibre seems to be rich.

## II. LITERATURE REVIEW

i. By Dr. S. L. Patil, J. N. Kale, S. Suman International journal of Advance engineering research and studies. “Fly ash concrete a technical analysis for compressive Strength.”
ii. International journal of civil engineering and technology vol.7 issue 4, july-august 2016 “EFFECT OF SILICA FUME ON VARIOUS PROPERTIES OF FIBRE REINFORCED CONCRETE.”
iii. International journal of scientific and engineering research Mr.Amol P.Titarmare Pro.shri R.S.Deotale “Experimental study reports on use of fly ash, silica fume, polypropylene in higher grade ready mix concrete.”
iv. International journal structural and engineering research H.S.Jadhav and R.R.Chavarekar “Role of fly ash and silica fume on compressive strength characteristics of high performance concrete.”

## III. OBJECTIVE

The overall goals of this research is the study of admixtures (Fly ash, Silica fume) and polypropylene fibre on properties of concrete and comparing the result of concrete regard compressive strength.
To reduce the Percent of cement in concrete with increase the strength

i. To learn the developments in materials, production method and mechanical properties and their uses.
ii. To compare the results between plain concrete, fiber concrete and mineral admixture mixed concrete.
iii. To study the functions of admixtures.
iv. To achieve a concrete mix of greater strength than conventional mix strength Conclusions will be formulated based on these results.

 

# IV. MATERIAL USED

## i. Concrete

The word concrete comes from the Latin word "concretus" (meaning compact or condensed), the perfect passive participle of "concrescere", from "con-" (together) and "crescere" (to grow).

Concrete is a composite material composed of coarse aggregate bonded together with a fluid cement which hardens over time.

## ii. Cement

Cement was first invented by Egyptians. The manufacturing of cement was started in England around 1825.

The first cement factory was installed in Tamilnadu. Our country is the 2nd largest production of cement in the world Cement is a binding material used in construction. It has property of setting and hardening when mixed with water to attain strength.

The properties of cement are depending upon chemical composition, the processes of manufacture and the degree of fineness of cement grains.

## iii. Fly Ash

A by-product of coal-fired electric generating plants, it is used to partially replace Portland cement (by up to 60% by mass).

The properties of fly ash depend on the type of coal burnt. In general, siliceous fly ash is pozzolanic, while calcareous fly ash has latent hydraulic properties.

## iv. Silica fume

A byproduct of the production of silicon and ferrosilicon alloys. Silica fume is similar to fly ash, but has a particle size 100 times smaller.

This results in a higher surface-to-volume ratio and a much faster pozzolanic reaction. Silica fume is used to increase strength and durability of concrete, but generally requires the use of super plasticizers for workability.

Pic-Silica fume

## v. Polypropylene fiber

Polypropylene fiber was first use to reinforce concrete in the 1960.Polypropylene is a synthetic hydrocarbon polymer the fiber of which is made using extrusion processes by hot-drawing the material through a die.

 

### vi. Fine Aggregate

Aggregate of maximum Size 4.75 mm are used as a fine aggregate the Experimental program was locally procured And conformed to grading zone 3 as per IS: 383-1970.

| Properties | Observed value |
|---|---|
| Specific gravity | 2.5 |
| Fineness modulus | 2.48 |
| Bulk density | 1585 kg/m3 |
| Loose density | 1461 kg/m3 |
| Percentage of bulking | 32 % |
| Percentage of lumps | 0.65 % |
| Water absorption | 1.20 % |

### vii. Coarse aggregate

The coarse aggregates are locally available was used having maximum size of 20 mm.

| Properties | Observed value |
|---|---|
| Specific gravity | 2.73 |
| Fineness modulus | 6.86 |
| Bulk density | 1532 kg/m3 |
| Loose density | 14579kg/m3 |
| Aggregate crushing value | 30.21 |
| Aggregate impact value | 34.15 |
| Maximum size of aggregate | 12.5 |
| Flakiness index | 23.22 % |
| Elongation index | 30.43 % |
| Water absorption | 0.69 % |

### viii. MOULDS

Here we used 2 types of moulds for checking strength at various proportions of replacement.
**Cubical**: - The size of each mould is 150*150*150 mm was used for preparing the concrete specimens for determination of compressive strength of concrete.
**Cylindrical**: - cylinder size 300 mm in Height and 150 mm in Diameter was used to prepare the Concrete specimens for determination of Splitting Tensile Strength of concrete.

## V. METHODOLOGY

**i.** Conduct the test on aggregate:

- Sieve analysis test (IS 2720 Part IV - 1985)
- Aggregate crushing strength (IS 2386 Part IV - 1963).
- Impact value test (IS 2386 Part IV - 1963).
- Abrasion value test (IS 2386 Part IV - 1963).
- Flakiness index test (IS 2386 Part I - 1963).
- Elongation index test (IS 2386 Part I - 1963).

 

**ii.** Conduct the test on water:

- PH value of water

**iii.** Conduct the test on cement

- Consistency of cement.
- Setting time test.
- Then design of concrete mix in which the strength of concrete will increase and it also reduce the required quantity of cement concrete becomes economical than conventional concrete.

**iv.** Method Used

- Trial method
- Error method

**v.** Important Criteria:

- High strength is achieved if the particle packing is dense with minimum voids. For this high paste volume is essential.
- Mineral and chemical admixtures are used.
- Two batches of concrete were prepared: one without super plasticizer one with super plasticizer.
- In this experimental work for each mix of composite, a total 33 specimen of following Type were prepared.
- For compressive strength test, 3 cube of each proportion having size 15X15X15 cm.
- All above specimens were prepared with various fibers with replacement of cement by the 10 % - 30% of its weight.

| TEST | REMARK |
|---|---|
| Agg crushing value | 10.37% |
| Agg impact value | 7.55% |
| Agg abrasion value | 8.19% |
| Flakiness index | 9.88% |
| Elongation index | 11.21% |
| PH value of water | 7.4 |
| Fineness of cement | 3.51% |
| Consistency of cement | 34mm |
| Initial setting time | 38min |
| Final setting time | 592min |

## VI.MIX DESIGN

The design of concrete mix is not a simple task on account of the widely varying properties of the constituent materials , the conditions that prevail at the site work, in particular the exposure condition that are demanded for a particular work for which the mix is designed . Design of concrete mix requires complete knowledge of various properties of these constituent material, the implications in case of change on these condition at site the impact of properties of plastic concrete. The

concrete mix design was prepared according to IS code 10262-2009 to control concrete. The grade M-30 and w/C ratio is 0.55 which is constant for all mix design.

## VII. RESULTS

i. **Determination of compressive strength**

Compression is the most common test conducted on hardened concrete partly because it is an easy test to perform.

The cube specimen is of size (15x15x15) cm. the largest size of aggregate does not exceed 20mm, 10cm size cubes may also be used alternative the compressive strength test specimen.determine following formula:
Compressive Strength (MPa) = Load carried in N /Bearing area in $mm^2$

ii. Compression Testing Machine (CTM)

Operation of the machines is by hydraulic transmission of load from test specimen to separately housed load indicator. the hydraulic system is ideal since replaces transmission of load through levers and knife edges.

iii. Result Table


**iv. Result Analysis**

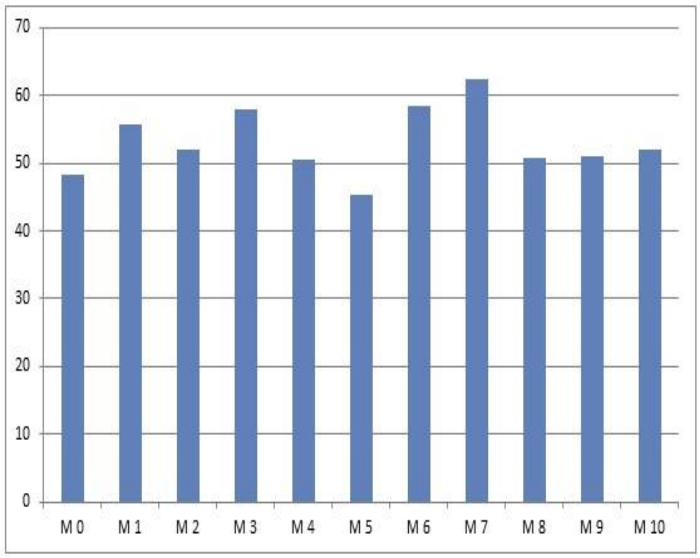


fig.Bar chart of test result

 

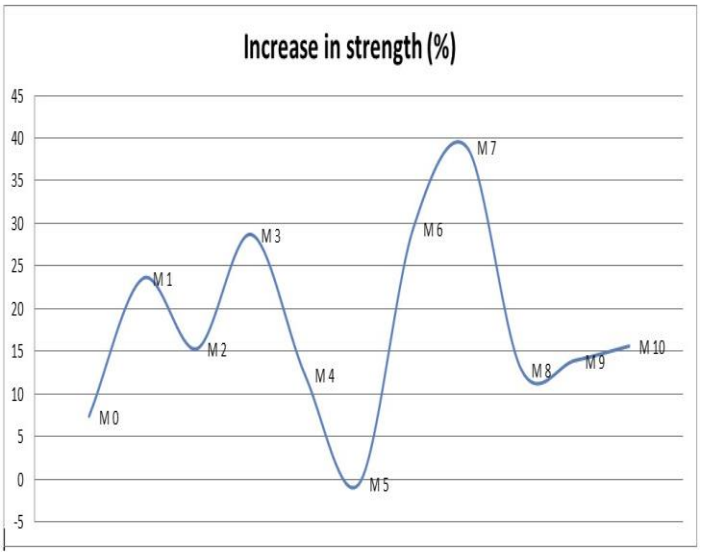


Fig.Strength analysis

| Name of proportion | Mix proportion | Compressive Strength (After 28 days) KN/m | Increase in strength(%) |
|---|---|---|---|
| $M_0$ | ORDANARY MIX | 48.33 | 7.4 |
| $M_1$ | 10:20:0 | 55.61 | 23.57 |
| $M_2$ | 10:20:0.5 | 51.99 | 15.33 |
| $M_3$ | 10:20:1 | 57.92 | 28.71 |
| $M_4$ | 10:20:1.5 | 50.51 | 12.24 |
| $M_5$ | 10:20:2 | 44.80 | -0.5 |
| $M_6$ | 15:15:0 | 58.36 | 29.68 |
| $M_7$ | 15:15:0.5 | 62.51 | 38.91 |
| $M_8$ | 15:15:1 | 50.81 | 12.91 |
| $M_9$ | 15:15:1.5 | 51.10 | 13.55 |
| $M_{10}$ | 15:15:2 | 52.04 | 15.64 |

 

## VIII. CONCLUSION

- Great Increase in strength
- Polypropylene gives greater bonding with concrete. Use of polypropylene fiber didn't leads to sudden failure.
- Failure goes by minor cracks in block Polypropylene fiber increase tensile strength of concrete.
- Use of silica fume in proper proportion gives the high compressive strength..
- Use of fly ash in concrete up to 30% it did not affect on compressive strength of concrete, it is better replacement for cement in concrete because of its low cost.
- The addition of polypropylene 0.5-1% gives best result otherwise it fail to given better result.
- Polypropylene fibre have greater strength to weight ratio,anti-corrosiveness hence it will be a best alternative to conventional steel fibre.
- By using certain admixture we achieve concrete of high strength.
- The design can be use high strength concrete 45 MPA its strong
- Fly ash and silica fume is good replacement of concrete.
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## IX. FUTURE SCOPE IN INDIA

- Low cost high performance fibre offers the potential to solve the largest problem in the cement and concrete industry i.e. cracking and structural failure of concrete.
- Because of the higher performance and lower potential cost predicted for polypropylene fibres they have the potential to cost effectively replace fiberglass steel fibre polyethylene fibre polyester fibre aramid and carbon fibres.
- The raw material is abundantly available in india for manufacturing polypropylene fibre plant to be install.
- High strength concrete is used for structures are supposed to carry load.
    - **a.** Railway bridges upto 58MPA
    - **b.** Diaphragm walls up to 50-55 MPA
    - **c.** Abrasion-Resistant concrete 40-60 MPA
    - **d.** High rise buildings 40-60MPA

## X. REFRENCES

1. J. Perform. Constr. Facil., 2005, JOURNAL PERFORMANCE OF CONSTRUCTED FACILITIES © ASCE / NOVEMBER 2005 /263-266
2. J. Perform. Constr. Facil., 2006, JOURNAL OF PERFORMANCE OF CONSTRUCTED FACILITIES © ASCE / FEBRUARY 2006, 20(1): 2-5
3. J. Mater. Civ. Eng., 1994, "Admixture Applications in Large concrete pours".
4. By Marc Jolin,t Denis Beaupre/ Michel Pigeon/ and Ann Lamontagne 1997 J. Mater. Civ. Eng., 1997, 9(4): 180-184
5. Krishi Sanskriti Publications 2014 Journal of Civil Engineering and Environmental Technology
6. By Dr. S. L. Patil, J.N. Kale International journal of Advance engineering research and studies.

 