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# STUDY ON INFLUENCE OF VARIOUS ADMIXTURES ON STRENGTH AND WORKABILITY PROPERTIES OF LIGHT WEIGHT CONCRETE

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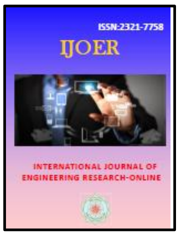


**ABSTRACT**

Light weight concrete is used in recent years because of its certain advantages over the conventional concrete. By adding chemical admixtures such as Aluminum powder, Zinc powder and Used engine oil to mix for the production of light weight concrete and the mineral admixtures such as Flyash GGBS Silica Fume are added to compensate the adverse effect of chemical admixtures on the compressive and tensile strength of concrete. These chemical admixtures like aluminium powder and zinc powder when added to mix release hydrogen gas in the form of bubbles which expand the concrete thus making the mix lighter than normal concrete while used engine oil forms thin layer called lamella at air & oil interface like this is causes air entrainment. The main functional usage of chemical admixtures is to minimize cement content. This is the reason why light weight mix is economical and lighter than the conventional mix. But according to literature we came to know that air entraining agents will impose adverse effect on compressive and tensile strength of concrete so mineral admixtures such as Flyash GGBS Silica Fume are added to compensate the adverse effect of chemical admixtures. Therefore an experimental study has been conducted on concrete with addition of mineral admixtures with different percentages like 10% and 20% by weight of cement. For each percentages of mineral admixture mix chemical admixtures i.e. aluminum & zinc at percentages of 0.2 5%, 0.5%, 0.75% and 1% and used engine oil with percentages of 0.05%, 0.1%, 0.12% and 0.15% was added. In addition to this another trails were done by the addition of only mineral admixtures dosage of 10% and 20% to the conventional concrete mix. A comparison between conventional concrete, conventional mineral admixture concrete and light weight concrete mixes is done regarding to the properties such as workability (slump), compressive strength and split tensile strength is done.

## 1. INTRODUCTION

**1.1 LIGHT WEIGHT CONCRETE** Light weight concrete is not new material, it was first used in 1920s and its application of foamed in construction works was not recognized until 1970s it was Swedish person who first started using a mix for construction which contains cement, lime, sand, water and this mix was expanded by addition of aluminium powder in it for the formation of hydrogen gas in slurry.

Lightweight concrete is developed by following methods,

1.) using lightweight aggregates,
2.) using Air Entraining agents,
3.) Omit sand fraction from aggregate.

In this project we are using air entraining agents such as Aluminium powder, zinc powder and used engine oil for the production of light weight concrete and on other hand we are also using mineral admixtures such as fly ash ggbs silica fume to compensate due the adverse effect of chemical admixtures on strength of concrete

**1.2 CEMENT:** Cement is a material with adhesive and cohesive properties. Cement when mixed with mineral fragments and water, binds the particles into a whole compact. Cement is the most important and costliest ingredient of concrete. For the purpose of construction works, the cement is used to bind stones, sand, bricks etc.,

**1.3 SAND:** Sand is composed of finely divided rock and mineral particles. Sand is finer than gravel. Sand is available in various places those are in hilly areas and in rivers and in canals, in some special places. As per the Indian standards the zone obtained is zone-II by conducting dry sieve analysis.

**Table 1: Fineness modulus of sand**

| I.S. Sieve designation | % of passing as per IS (zone II) | % of passing (obtained) |
|---|---|---|
| 10mm | 100 | 100 |
| 4.75mm | 90-100 | 97.37 |
| 2.36mm | 75-100 | 93.89 |
| 1.18mm | 55-90 | 84.67 |
| 600 micron | 35-59 | 65.75 |
| 300 micron | 8-30 | 22.99 |
| 150 micron | 0-10 | 4.55 |

**1.4 FLYASH:**Fly ash is by product of the combustion of pulverized coal in thermal power plants. One of the most important uses of fly ash is in making cement and concrete. As fly ash is available at free of cost, there is considerable savings in making concrete by addition of fly ash

**CLASSIFICATIONS OF FLY ASH:**Fly ash broadly classifies into two classes

**Class F:** Fly ash normally produced by burning anthracite bituminous coal, usually has less than 5%cao. Class F fly ash has pozzolanic properties only.

**Class C:** Fly ash is normally produced by burning the lignite sub bituminous coal, some class C fly ash may have Cao content in excess of 10% in addition to pozzolanic properties class C fly ash also possesses cementitious properties.

**Table 2: Physical Analysis of Fly Ash**

| Physical characteristics | Typical characteristics of fly ash SEPL |
|---|---|
| Specific gravity | 1.830 |

**1.5 GGBS:** Ground Granulated Blast Furnace Slag (GGBS) is a byproduct of the steel industry. Blast furnace slag is defined as "the non-metallic product consisting essentially of calcium silicates and other bases that is developed in a molten condition simultaneously with iron in a blast furnace."

**Table 3: Physical Analysis of GGBS**

| Physical characteristics | Typical characteristics of ggbs from Vendor ASTRA Chemicals |
|---|---|
| Specific gravity | 2.910 |

**1.6 SILICA FUME:** Silica fume, also known as micro silica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultra fine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of spherical particles with an average particle diameter of 150 nm.

**Table 4: Physical Analysis of Silica fume**

| Physical characteristics | Typical characteristics of silica fume from Vendor ASTRA Chemicals |
|---|---|
| Specific gravity | 2.146 |

**1.7 ALUMINIUM POWDER:**

Since 1920 the usage of aluminium powder as air entertainer in concrete was begin. The Swedes first discovered a mixture of cement, lime, water and sand that was expanded by adding aluminium powder to generate hydrogen gas in cement slurry. The specific gravity of aluminium powder is about 2.7

**Mechanism of Aluminium powder as Air Entertainer:** When we mix fine powder of Aluminium to the slurry and it reacts with the calcium hydroxide Present in it thus producing hydrogen in the form of bubbles. The bubbles expand the cement paste and concrete rises thus it becomes lighter than the conventional concrete. After the mixing process, when the aluminium powder is added to the mix in order to increase its volume which will be from 2 to 5 times more than the original volume of the paste.

The reaction is shown in the following equation:

$Ca(OH)_2 + 2Al + 6H_20 \rightarrow Ca[Al(OH)_4]_2 + 3H_2$ (GAS)

The increase in volume depends upon the amount of aluminium powder added .But by conducting several based on available literatures aluminium powder is used at a rate of 0.25% – 1% by volume of cement.

**1.8 ZINC POWDER:** Zinc metal is classified as a transition metal and is ductile, flexible, and able to conduct electricity and heat. It comes in the form of a bluish-gray powder having Atomic Number = 30 and Atomic Mass = 65.39. The specific gravity of zinc powder is about 7.0

**Mechanism of Aluminium powder as Air Entrainer:**

When zinc powder is added with the slurry and made to react with the calcium hydroxide liberated during the hydration process, to give out large quantity of hydrogen gas. This hydrogen gas when contained in the slurry mix gives the cellular structure when it is compared with the conventional concrete this mix of concrete is lighter.

$2Zn + Ca(OH)_2 + 6H_2O \rightarrow Ca[Zn(OH)_3]_2 \cdot 2H_2O + 2H_2$ (GAS)

Presence of hydrogen gas in the slurry gives the cellular structure for the mix. similar to the aluminium powder the dosage of Zinc powder was decided to used at a rate of 0.25% – 1% by volume of cement.

**1.9 USED ENGINE OIL:** Lubricants are used for a wide range of applications, including engine and transmission lubricants, hydraulic fluids, metal working fluids, insulating and process fluids and greases. It has been reported in the literature that the leakage of oil into the cement concrete in older grinding units resulted in concrete with greater resistance to freezing and thawing. This means that adding used engine oil into fresh concrete mix could be similar to that of adding an air entraining agent (chemical admixture).When compared to other commercial Air Entrainers this used engine oil is very cheaper for this project used engine oil was purchased from motor bike restoration shop in Nellore which was costing rupees five per liter.

`We got the chemical composition of the used engine oil from the literature of S.C. Chin, N. Safi, and M.F. Nuruddin.

| Chemical Composition | Used engine oil (%) | New engine oil (%) |
|---|---|---|
| SiO2 | - | 0.85 |
| Fe2O3 | 0.43 | 0.18 |
| CaO | 15.9 | 21.0 |
| SO3 | 37.0 | 36.3 |
| P2O5 | 8.95 | 13.4 |
| ZnO | 17.7 | 25.6 |
| Cl- | 15.9 | - |

**Figure-1: composition of used engine oil**

**Mechanism of used engine oil as air Entrained**

When used engine oil is added to the mix, during mixing process air will be get dispersed into the oil, this leads to formation of air bubbles these bubbles are so small in size and due to higher viscosity of oil those oil bubbles will tends to rise very slowly and forms thin layer called lamella at air & oil interface thus making oil as air entrainment agent. In our project an attempt was made to know which extent used engine oil will perform as an air entraining agent.

## 2. OBJECTIVE

1. The main objective of this project is to make an attempt to produce a light weight concrete mix of M20 grade by the usage of chemical admixtures which is going to be economical and also having more slump than conventional concrete (M20 grade) and at the same having strengths (compressive and split tensile strength) equal or nearly equal to the compressive and split tensile strengths of conventional concrete.

2. Chemical admixtures such as Aluminium powder, Zinc powder and used engine oil were added to light weight mix for the production of light weight concrete and the proportions of main ingredients(cement, coarse aggregate, fine aggregate and water) were as per light weight concrete mix design.

3. Aluminium powder, Zinc powder and used engine oil were used as our chemical admixtures. The Aluminium powder and Zinc powder were used at dosages of 0.2 5%, 0.5%, 0.75% and 1% while used engine oil was used at dosages of 0.05%, 0.1%, 0.125% and 0.15%.

4. The main functional usage of chemical admixtures is to expand the concrete mix and increasing the workability there by reducing the usage of water content as a result reducing the cement content at the same w / c ratio. This is the reason why light weight mix is economical and lighter than the conventional mix.

5. In order to compensate the adverse effects of chemical admixtures on compressive and split tensile strength of concrete we used mineral admixtures such as Flyash GGBS Silica Fume

6. Therefore an experimental study has been conducted on concrete with addition of mineral admixtures with different percentages like 10% and 20% by weight of cement. Each percentage of mineral admixture mix chemical admixtures i.e. aluminium zinc and used engine oil with percentages of 0.2 5%, 0.5%, 0.75% and 1% was added.

7. In this project comparison between conventional concrete, conventional mineral admixture concrete and light weight concrete is done regarding to the properties such as workability (slump), compressive strength and split tensile strength is done.

**3.TESTS & RESULTS OF MATERIALS**

**3.1. CEMENT:** By altering the proportions of ingredients of cement , by adding other ingredients or by changing the intensity of grinding, different cements useful for particular situations can be manufactured.

**Table 5: Physical Analysis of cement**

| Physical characteristics | Typical characteristics |
|---|---|
| Specific gravity | 1.830 |

**3.1.1 PROPERTIES OF PORTLAND CEMENT**

This table is obtained from “concrete technology” by M.S.Shetty, page No:15

**Table 6: Constituents of Cement**

| Sl. No. | Constituent | Percentage |
|---|---|---|
| 1 | CaO | 63 |
| 2 | $SiO_2$ | 20 |
| 3 | $Al_2O_3$ | 06 |
| 4 | $Fe_2O_3$ | 03 |
| 5 | MgO | 1.5 |
| 6 | $SO_3$ | 2 |
| 7 | K20 | 1 |
| 8 | Na20 | 1 |

The following are the laboratory tests which are carried on cement:

- Setting time test
- Fineness test
- Compression test
- Soundness of cement

**3.1.2 SETTING TIME TEST**

**Table.7: Initial and Final setting time**

| Sl. no: | Characteristics | Values obtained | Standard values |
|---|---|---|---|
| 1 | Standard consistency | 24.1mm | 33 to 35 mm |
| 2 | Initial setting time | 150 min | Not be less than 30mins |
| 3 | Final setting time | 160 min | Not be greater than 600min |

**3.1.3FINENESS TEST**

Fineness of cement is known by sieving it on standard sieve. The proportion of cement of which the grain sizes are larger than the specified mesh size is thus determined. Standard size of the sieve for the test is 90µm.

Fineness of the sample is 10 %.

**3.1.4 SOUNDNESS OF CEMENT**

The soundness of the given sample of cement is determined by "Le Chatelier" Method.

**Table.8: Soundness of cement**

| Description | Measuring distance(mm) |
|---|---|
| Storing period distance (A) | 7 |
| Boiling period distance (B) | 9 |
| Cooling Period distance ( C ) | 8 |
| Soundness value ( C – A) | 1 |

**3.2 SPECIFIC GRAVITY AND WATER ABSORPTION OF COARSE AGGREGATE BY WIRE BASKET METHOD**

The specific gravity and water absorption is determine by wire basket method according to IS 2386 Part-3

**Table.9: Absorption and specific gravity of Sand**

| Description | Trail-1 | Trail-2 | Trail-3 |
|---|---|---|---|
| Water absorption | 0.41 | 0.40 | 0.40 |
| Bulk specific gravity | 2.756 | 2.754 | 2.755 |

**3.3AGGREGATE IMPACT VALUE**

By impact testing machine we evaluated the toughness of the stone according to IS 2386 Part-4

**Table.10: Aggregate impact value**

| Description | Trail-1 | Trail-2 | Trail-3 |
|---|---|---|---|
| Wt of sample passing 12.5 mm sieve and retained don 10 mm sieve W1 | 376.0 | 378.50 | 374.5 |
| Wt of sample passing 2.36 mm W2 | 70.5 | 69.0 | 68.5 |
| Wt retained 2.36 mm W3 | 305.5 | 309.5 | 306.0 |
| AIV= (W2 / W1 ) x 100 | 18.75 | 18.23 | 18.3 |
| Average | 18.43% | | |

**3.4 SIEVE ANALYSIS OFAGGREGATE**

Percent of individual grain sizes present in the sample is determine by sieve analysis

**Table.11: Sieve analysis of aggregate**

| Sieve size | wt retained (g) | Cumulative wt retained (g) | % retained | % passing |
|---|---|---|---|---|
| 40mm | 0 | 0 | 0 | 100 |
| 20 mm | 1764 | 1764 | 828 | 91.72 |
| 10 mm | 18384 | 20148 | 94.59 | 5.41 |
| 4.75 mm | 924 | 21072 | 98.94 | 1.06 |

**3.5 FLAKINESS AND ELONGATION INDEX TEST**

The Flakiness and elongation index test of the aggregate sample is obtained as

FI = 18.29 %

EI = 23.67 %

**4. MIXING CASTING AND TESTING OF CONCRETE:**

**4. 1 MIXING:** In this project M20 grade concrete was selected and hand mixing process was done. The process of mixing of constituents of light weight concrete is explained clearly as follows

a. **In case of Al & Zn powder:** In case of aluminium and zinc powder first dense weight concrete will prepared then just before going to cast or test the aluminum or zinc powders was added and once mixed with trowel, now it will starts expanding roughly 2 to 3 times of its original size then it is immediately proceeded to casing if only we are going to do casting, if we are going to testing of workability i.e., slump cone test then only test is done after test it is not good for casting since the structure formed by hydrogen bubbles is highly gets disturbed after test, if we use that for casting then result may be inaccurate so only single operation is done after the addition of aluminium or zinc powder i.e., either casting or testing is done only one thing is done.

b. **In case of used engine oil:** In case of used engine oil it is added to the mix during mixing process along with the constituent materials only and this is done because in this instance air is entrained not by chemical action but by physical action i.e., air will be get dispersed into the oil, this leads to formation of air bubbles these bubbles are so small in size and due to higher viscosity of oil those oil bubbles will tends to rise very slowly and forms thin layer called lamella at air & oil interface thus making oil as air entrainment agent

**4. 2 CASTING:** Required quantities of cement fine Aggregate and coarse aggregate if required other material as per requirement were weighed batched. Measured quantities of cement and sand mixed then if there is addition of any chemical or mineral admixtures were added according to clause 4.2 of chapter-5 of this book then measured quantity of coarse aggregates were spread out over dry mix of cement and sand and mixed thoroughly in dry state until uniformity of color was achieved. Water was measured exactly and added to the dry mix and it was thoroughly mixed to obtain homogenous concrete.

The 150mmX150mmX150mm cube moulds were cleaned and the inner side and bottom of the moulds were coated with waste oil for easy removal of mould casting. The mix was placed in three layers. Each layer was compacted using a tamping rod of 600 mm in length and 16 mm diameter with 25 blows. The cubes were removed after 24 hours and put to curing cubes were immersed in a clean water tank till the date of testing.

**4.3 COMPRESSIVE STRENGTH TEST:** Concrete specimens are then removed from curing pond and wiped clean on the day of testing. Then they are placed under compression testing machine in such a way that the load is applied in direction of perpendicular the direction of casting, then load is applied continuously without any shock approximately at a rate of loading is 140kg/m2/min.

The load is increased until the specimen fails and the maximum load is recorded for each specimen.

**4.3 SPLIT TENSILE STRENGTH TEST:** Placing the cylindrical specimen on the plywood strip are used which are having thickness of 3.175 mm width of 25 mm and whose length slightly more than the length of specimen or equal to length of specimen is acceptable one of the plywood strip is kept between on lower plate and cylinder and another plywood strip is placed which rests between upper plate and cylinder. Now we apply the load continuously and without shock, at a constant rate and then record the maximum load at failure indicated by the testing machine also note the mode of failure and appearance of fracture when cylinder failed.

**5. EXPERIMENTAL INVESTIGATION**

**5.1:COMPRESSION STRENGTH TEST:**

Fig.2: Compression Testing

Table12: slump in mm with different mineral admixtures at different Zinc powder dosages

| USED ENGINE OIL | 0.05% | 0.1% | 0.125% | 0.15% |
|---|---|---|---|---|
| FLYASH 10% | 150mm | 150mm | 155mm | 160mm |
| FLYASH 20% | 130mm | 140mm | 150mm | 150mm |
| GGBS10% | 60mm | 80mm | 90mm | 90mm |
| GGBS20% | 50mm | 60mm | 80mm | 80mm |
| SILICA FUME 10% | 55mm | 55mm | 60mm | 70mm |
| SILICA FUME | 40mm | 50mm | 50mm | 60mm |

Table13: slump in mm with different mineral admixtures at different Aluminium powder dosages

| ALUMINIUM POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 160mm | 170mm | 175mm | 180mm |
| FLYASH 20% | 150mm | 160mm | 165mm | 170mm |
| GGBS10% | 90mm | 110mm | 120mm | 140mm |
| GGBS20% | 70mm | 90mm | 110mm | 120mm |
| SILICA FUME 10% | 80mm | 85mm | 120mm | 130mm |
| SILICA FUME | 70mm | 80mm | 110mm | 120mm |

Table14: slump in mm with different mineral admixtures at different oil dosages

| ZINC POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 150mm | 165mm | 175mm | 175mm |
| FLYASH 20% | 140mm | 150mm | 160mm | 160mm |
| GGBS10% | 80mm | 110mm | 120mm | 120mm |
| GGBS20% | 70mm | 100mm | 110mm | 120mm |
| SILICA FUME 10% | 70mm | 80mm | 95mm | 110mm |
| SILICA FUME | 60mm | 85mm | 100mm | 100mm |

Table15:28 days compressive strength with different mineral admixtures at different used engine oil dosages

| USED ENGINE OIL | 0.05% | 0.1% | 0.125 % | 0.15% |
|---|---|---|---|---|
| FLYASH 10% | 28.8N/mm 2 | 27.6 N/mm 2 | 27.4 N/mm 2 | 26.8 N/mm 2 |
| FLYASH 20% | 32.2 N/mm2 | 31.9 N/mm 2 | 31.2 N/mm 2 | 30.1 N/mm 2 |
| GGBS10% | 29.7 N/mm2 | 28.4 N/mm 2 | 27.6 N/mm 2 | 27.2 N/mm 2 |
| 32.9GGBS20 % | 32.9 N/mm2 | 32 N/mm 2 | 31.6 N/mm 2 | 30.9 N/mm 2 |
| SILICA FUME 10% | 31.1 N/mm2 | 30.6 N/mm 2 | 30.2 N/mm 2 | 30 N/mm 2 |
| SILICA FUME | 32 N/mm2 | 31.7 N/mm 2 | 31.7 N/mm 2 | 30.9 N/mm 2 |

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Table16:28 days compressive strength with different mineral admixtures at different Aluminium powder dosage

| ALUMINIUM POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 22.1 N/mm2 | 19.8 N/mm2 | 18.6 N/mm2 | 18.4 N/mm2 |
| FLYASH 20% | 27.1 N/mm2 | 26.5 N/mm2 | 26.1 N/mm2 | 25.7 N/mm2 |
| GGBS10% | 24.1 N/mm2 | 23.8 N/mm2 | 23.4 N/mm2 | 23.1 N/mm2 |
| GGBS20% | 26.0 N/mm2 | 25.7 N/mm2 | 25.4 N/mm2 | 24.8 N/mm2 |
| SILICA FUME 10% | 25.2 N/mm2 | 24.7 N/mm2 | 24.1 N/mm2 | 24.1 N/mm2 |
| SILICA FUME | 26.0 N/mm2 | 25.7 N/mm2 | 25.2 N/mm2 | 25 N/mm2 |

Table 17:28 day's compressive strength with different mineral admixtures at different Zinc powder dosage

| ZINC POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 21.6 N/mm2 | 20.9 N/mm2 | 20.1 N/mm2 | 19.9 N/mm2 |
| FLYASH 20% | 26.7 N/mm2 | 26.2 N/mm2 | 25.8 N/mm2 | 25.5 N/mm2 |
| GGBS10% | 23.5 N/mm2 | 22.8 N/mm2 | 22.6 N/mm2 | 22.4 N/mm2 |
| GGBS20% | 23.5 N/mm2 | 25.1 N/mm2 | 24.6 N/mm2 | 24.0 N/mm2 |
| SILICA FUME 10% | 24.6 N/mm2 | 24 N/mm2 | 23.8 N/mm2 | 23.1 N/mm2 |
| SILICA FUME | 25.5 N/mm2 | 24.9 N/mm2 | 24.7 N/mm2 | 24.0 N/mm2 |

5.2: SPLIT TENSILE STRENGTH TEST:

Fig.3: Split Testing

Table18:28 days split tensile strength with different mineral admixtures at different used engine oil dosage

| USED ENGINE OIL | 0.05% | 0.1% | 0.125% | 0.15% |
|---|---|---|---|---|
| FLYASH 10% | 2.310 | 2.286 | 2.258 | 2.220 |
| FLYASH 20% | 2.250 | 2.518 | 2.481 | 2.462 |
| GGBS10% | 2.830 | 2.784 | 2.733 | 2.730 |
| GGBS20% | 2.842 | 2.812 | 2.780 | 2.742 |
| SILICA FUME 10% | 3.291 | 3.262 | 3.240 | 3.196 |
| SILICA FUME | 3.262 | 3.140 | 3.100 | 2.890 |

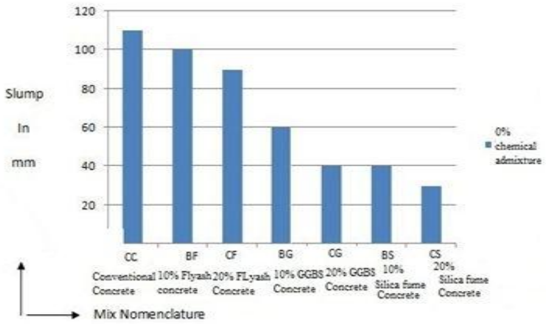
Table19:28 days split tensile strength with different mineral admixtures at different Aluminium powder dosage

| ALUMINIUM POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 1.890 | 1.862 | 1.781 | 1.740 |
| FLYASH 20% | 2.120 | 1.980 | 1.920 | 1.876 |
| GGBS10% | 2.310 | 2.230 | 2.160 | 2.100 |
| GGBS20% | 2.510 | 2.462 | 2.330 | 2.240 |
| SILICA FUME 10% | 2.710 | 2.691 | 2.662 | 2.630 |
| SILICA FUME | 2.680 | 2.591 | 2.540 | 2.500 |

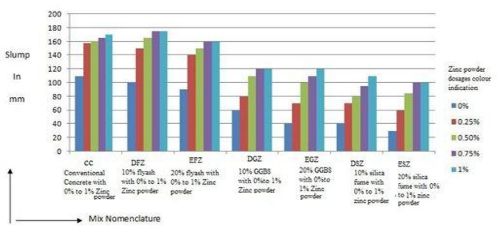
Table20:28 days split tensile strength with different mineral admixtures at different Zinc powder dosage

| ZINC POWDER | 0.25% | 0.5% | 0.75% | 1% |
|---|---|---|---|---|
| FLYASH 10% | 1.781 | 1.680 | 1.590 | 1.462 |
| FLYASH 20% | 1.980 | 1.864 | 1.812 | 1.770 |
| GGBS10% | 2.100 | 2.100 | 1.965 | 1.910 |
| GGBS20% | 2.310 | 2.210 | 2.170 | 2.164 |
| SILICA FUME 10% | 2.631 | 2.541 | 2.500 | 2.486 |
| SILICA FUME | 2.541 | 2.470 | 2.410 | 2.350 |

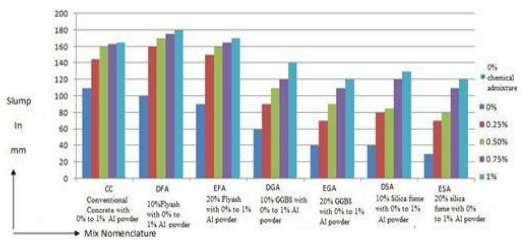
Graph-1:slump in mm with different mineral admixtures



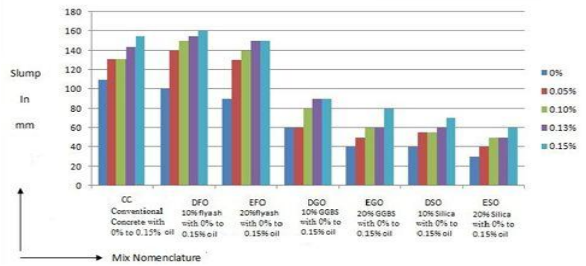
Graph-2:slump in mm with different mineral admixtures at different Zinc powder dosages



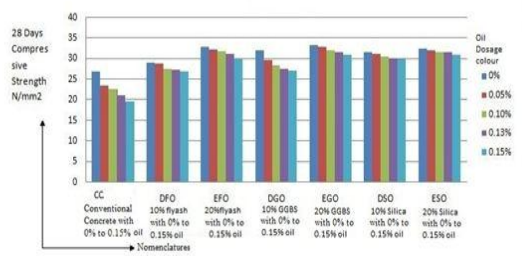

Graph-3:slump in mm with different mineral admixtures at different Aluminium powder dosages



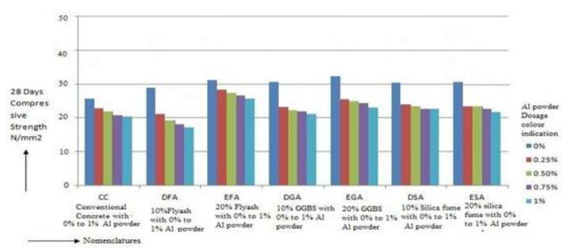

Graph-4:slump in mm with different mineral admixtures at different oil dosages



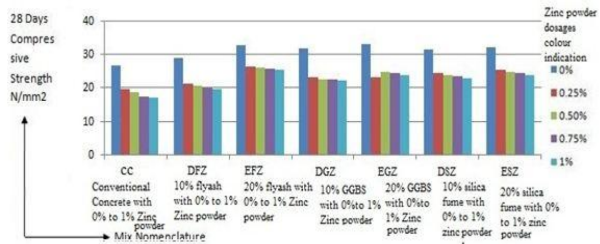

Graph-5:28 days compressive strength with different mineral admixtures at different used engine oil dosages



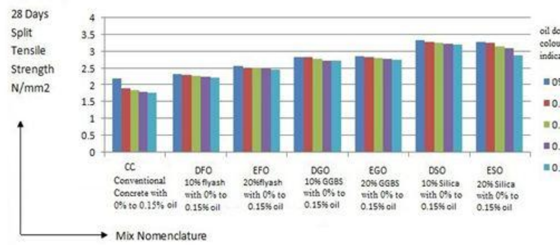

Graph-6:28 days compressive strength with different mineral admixtures at different Aluminium powder dosage



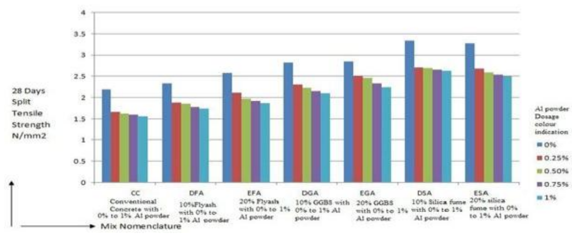

Graph-7:28 days compressive strength with different mineral admixtures at different Zinc powder dosag



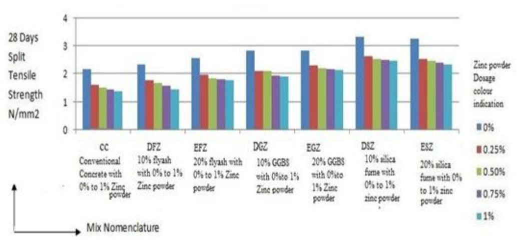

Graph-8:28 days split tensile strength with different mineral admixtures at different used engine oil dosage




Graph-:928 days split tensile strength with different mineral admixtures at different Aluminium powder dosage



Graph-10:28 days split tensile strength with different mineral admixtures at different Zinc powder dosage




**5.3CONVENTIONAL CONCRETE:**

**Workability;** Workability of Conventional Concrete in terms of slump is observed to be 110 mm

**Compressive strength at 28 days;** When the cubes of 15cmX15cmX15cm which is cured in curing pond for 28 days and tested in compressive testing machine the compressive strength observed to be 26.8 N/mm2

**split tensile strength at 28 days;** When the cylinders of 15cm diameter and 30cm in length which is cured in curing pond for 28 days and tested in compressive testing machine the compressive strength observed to be 2.193 N/mm2

## 6. CONCLUSIONS

Based on the experimental results we conclude that the light weight concrete made of Fly ash and with small dosages of used engine oil was increasing the workability at the same time it also has not shown considerable effect on compressive strength and split tensile strength of concrete at 28 days.

- Workability of 10% Addition Fly ash concrete with addition of used engine oil at dosages of 0.05%, 0.1%, 0.125% and 0.15% compared with conventional concrete workability is increased by maximum of 45% when 20% Flyash concrete with same oil dosages is compared with conventional concrete with different dosages of oil increased by maximum of 7%
- When the 28 days compressive strength 10% Fly ash concrete cubes with used engine oil at dosages of 0.05%, 0.1%, 0.125% and 0.15% are compared with conventional concrete containing same oil dosage it increased by maximum of 20% . When the 20% Fly ash concrete with same dosage of is compared with the same above conventional concrete it increased 28 days compressive strength by maximum of 37%
- When the 28 days split tensile strength of 10% of Fly ash concrete cylinders with used engine oil at dosages of 0.05%, 0.1%, 0.125% and 0.15% are compared with conventional concrete with same oil dosage it increased 28 days split tensile strength by maximum of 15% and when 20% Fly ash concrete cylinders with same oil dosages are compared with the same above conventional concrete the Split tensile strength increased by maximum of 37%

Since Used engine oil is a waste material which is cheaper than Aluminium powder and zinc powder similarly Fly ash is also a waste material which is cheaper than GGBS and Silica fume.

On other hand this light weight concrete mix which is made of fly ash and with small dosages of used engine oil is having less content of cement than that of the conventional concrete. Finally this light weight concrete which was prepared was more economical than the conventional concrete.

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