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"Experimental Study on Light Weight Concrete by the Partial Replacement of Cement and Fine Aggregatewith Fly Ash and Thermocol"

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ABSTRACT: -In the Todays scenario several buildings are being constructed Ranging from ordinary residential building to sky- scrap structure. Inall the structure concrete plays a vital role in construction generally tois a mixture of cement , sand , coarse aggregate ,water and type of theadmixture used depends on situation . Now-a-days healthy sand is extracted and transported from river bed being in long distance. The extraction of sand become important issue , posing environment degredation ,thus causing serious threat of flood or diversion of water flow.Never the less the resource are also exhausting very rapidly and economical .To overcome from crisis, partial replacement of cement with fly ash and fineaggregate with themocol can be economic alternative.

This project focuses on investigating the characteristics of M30 gradeof concrete with cement partial replace with fly ash 30 % ,40% and fine aggregate replace with themocol 0.2 % , 0,3% respectively. Thecompressive strength of concrete is increase from 24.96 N/ sq,m to the33.62 N/ sq.m at 30 % of fly ash and the themocol replacement 0.2% of increases from 25.71 N Per Sq.m. to 34.33 N/sq.m at 40% of fly ash and 0.3%themocol replacement.

Key Words—Cement,coarse aggregate,fine aggregate, fly ash&thermocol**.**

I. INTRODUCTION

Concrete is the most widely and oldest construction material in the world. It is obtained by mixing cementing materials, water and aggregates, and sometimes admixtures, in required proportions. The mixture when allowed to cure hardens and forms concrete. The strength, durability and other characteristics of concrete depends upon the properties of ingredients, mix ratio, compaction methods and other factors such as placing, compaction and curing It has high compressive strength, minimal corrosive and weathering effects resulting in excessive use in construction industry. Its high density makes the weight of construction greater than the live load carried and poor insulation characteristics. Intense research in the area of materials for structural application has found various aggregate that are suitable for concrete production. This includes pumice, dintomite, Scotia, volcanic, rice bask and saw dust which are natural while Artificial aggregates include artificial cinders, lightweight expanded clay aggregate, foamed slag and thermocol beads. Lightweight Expanded Clay Aggregate (LFCA) is a ceramic material produced by expanding and vitrifying clay in a rotary kiln at 1200 °C. With this addition, the concrete becomes lightweight, self-curable, acoustic and thermal resistant. Depending on the source and the method of production, lightweight aggregates exhibit considerable differences in particle shape and texture. Shapes vary from cubical to angular, while the textures may range from fine pore to large exposed pores. The porosity of the aggregate in responsible for retention of water, which will aid internal curing. This aggregate renders increased workability Lightweight aggregate concretes are naturally utilized in structures in which major part of the total load is caused by the dead weight of concrete, thereby reducing the dimensions of footing beneath subsoil and eliminates the need for expensive foundations.Now-a-days, the maximum appropriate and extensively used creation fabric is concrete. This constructing fabric, till those days, went via masses of development. The definition of Concrete is the aggregate of cement, water, components or now and again amazing plasticizers. It is synthetic fabric. In the start it's miles soft, ductile or fluid, and steadily may be solid. We can remember this constructing fabric as an synthetic stone. The maximum crucial a part of concrete is cement. The manufacturing manner of this uncooked fabric produces quite a few CO2. It is nicely known, that CO2 emission initiates dangerous environmental changes.

II. LITARATURE REVIEW:

Bharath V B et .al (2020) Light weight concrete plays an important role in structural engineering and its use to steadily increasing light weight concrete using mix M25 and made by partial replacement of cement and fine aggregate by fly ash thermocol. It has many advantages of dead load reduction high thermal insulation, increase the process of building and lowers haulage cos. It is include an expanding agent in that it increase the volume of mixture.

Sneha N. Koleand, Shyam R. Suryawanshi (2017)with the increase in demand there is a strong need to utilize alternative materials for sustainable development. Polystyrene (also known as EPS Foam or Styrofoam) is a highly popular plastic packaging material. Polystyrene is essentially non-biodegradable and taking hundreds perhaps thousands of years to decompose in case of land filling. Other disposal methods or treatments methods are creating hazardous effect on environment. However, this material is having properties such as sound insulation, high thermal conductivity, and lightweight so we can use this material in concrete. This paper highlights the study of properties such as compressive strength and tensile strength of Polystyrene based concrete which is compared with conventional concrete.

Trushna D. Patle et.al (2018) Present study is aimed to investigate combined effect of thermocolwaste and thinner waste[T&T] in concrete. These waste materials that are generated from automobile industry contain Thermocol also. Thermocol waste and thinner waste was mixed with ordinary Portland cement (OPC), sand, aggregate and water to form thermocol-thinner concrete [TTC]. Nine specimen blocks of size 150mm x 150mm x 150mm for each control concrete and TTC for different ratios (1%,2%,3% and 4%) are prepared. The main findings of this investigation reveal that the mixture of waste thermocol and waste solvent as admixture could be used successfully as in concrete composites. The study involvecomparison between control concrete and TTC replacement ratios of 1%,2%,3% and 4% of thermocol-thinner [T&T] in control concrete mix at a water-to-binder ratio of0.40. Initial setting time, final setting time and workability are determined for control.concrete and TTC. In addition, cubes of control concrete and TTC were tested after 7,14 and 28 days curing for compressive strength

Thousif Khan and IbrahimKilledar (2018) Floating concrete is a special type of innovative concrete whose density is less than 1000 kg/m³. Because of its low density and moderate range of their compressive strength, it can be used in non-structural applications as of now. An attempt has been made in this study todevelop a Floating concrete based on trials with an emphasis on overall density. Also, attempt has been made to obtain Floating concrete with considerable compressive strength. The primary aim of the project is to develop floating concrete and to achieve this, different mix proportions were adopted based on absolute volume concept. The successfully developed floating concrete was accomplished in different phases. The cement was used in combination with fly ash was in the range of 200-425 kg/m³. In this study, floating concrete was successfully developed for different densities using the ingredients whose specific gravity is less than that in the conventional concrete. Study reveals pumice and Thermocol beads could be successfully used as an alternative to coarse aggregate which in turn results in lower density when compared to conventional material used in concrete.

AbhijitMandlik et.al (2015) Expanded polystyrene (EPS) geofoam is a lightweight material that has used in engineering applications since at least the 1950s. Its density is about a hundredth of that of soil. It has good thermal insulation properties with stiffnessand compression strength comparable to medium clay. It is utilized in reducing settlement below embankment, sound and vibration damping, reducing lateral pressure on sub-structures, reducingstresses on rigid buried conduits and related applications. Expanded polystyrene waste ina granular form is used as lightweight aggregate to produce lightweight structural concrete with the unit weight varying from 1200 to 2000 kg/m³. The polystyrene of theaggregate concrete was produced by partially replacing coarse aggregate in the reference(normal weight) concrete mixtures with equal volume of the chemically coated crushedpolystyrene granules. This paper reports the results of an experimental investigation intothe engineering properties, such as compressive strength, modulus of elasticity, dryingshrinkage and creep, of polystyrene aggregate concrete varying in density. The main objectives of this study are the cement contents for the concrete mixtures used were 410 and 540kg/m³.

III. MATERIALS USED FOR MIXING:

3.1 Cement

The cement used was ordinary portland cement of 43 - grade conforming to IS 12269- 1987. The cement was check for its freshness and consistency. It was found dry, pure, without any lumps.

3.2 Fine aggregate

Neighbourhood clean waterway sand of Zone II, conforming as per IS 383-1970 were used. The sand was sieved with 4.75 mm. It was free from clay, silt and organic impurities. The aggregate was tested for its physical requirements such as gradation, fineness modulus, specific gravity and bulk modulus in accordance with IS: 2386-1963

3.3 coarse Aggregate

The course aggregate used in this present study was 20 mm and 10 mm down size locally available crushed stone obtained from local quarries. The physical properties have been determined as per IS: 2386-1963. The specific gravity of coarse aggregate was found to be 2.68. The water absorption was 0.25%.

3.4Water

Potable water was fit for mixing concrete as well as for curing of concrete. So it was made confirm that the water is covering all the requirements of its purity and use in concrete mix. Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water is used and curing as per IS: 456-2000.

3.5Thermocol

Thermocol is a Expanded polystyrene (EPS) is a rigid and tough closed cell foam. It is weight, water resistance, dimensional stability and inert nature. Polystyrene foams are good thermal insulators and are therefore often used as building insulation materials, such as in insulating concrete forms and structural insulated panel building systems. Grey polystyrene foam, incorporating graphite has superior insulation properties. They are also used for non-weight-bearing architectural structures (such as ornamental pillars) Discarded polystyrene does not biodegrade for hundreds of years and is resistant to photolysis. Polystyrene foam blows in the wind and floats on water due to its specific gravity. It can have serious effects on the health of birds or marine animals. usually white and made of pre-expanded polystyrene beads.

3.6 Fly Ash

fly ash consists of fine, powdered particles predominantly spherical shape, glassy which is amorphous in nature. The particle size distribution of fly ash is generally similar to silt less than 0.075mm and specific gravity ranges from 2.1 to 3.0 and specific surface area may vary from 170 to 1000m2/Kg.

The colour of fly ash varies from tan gray to black depending upon the presence of unburnt carbon in the ash.

3.1 MIXING PROCEDURE:

3.1.1 Mixing Concrete mix of M30 grade (1:0.75:1.5) was prepared. Concrete cubes were made using steel molds of dimensions 150 x 150 x 150 mm. T&T solution were mixed in control concrete for different proportions. There were total 2 cubes prepared for each mix proportion and that required 3.08 kg of cement, 5.5 kg of sand and 6.75 kg of coarse aggregate for each mix proportion. The preparation was done considering all the specifications of mixing and filling.

3.1.2Curing Cubes have been allowed to set for 24 hours. After 24 hours, cubes were cured in the curing tank so as to enable hydration process for gaining strength. Clean potable water was used and curing has done as per IS: 456-2000

3.1.3Initial and final setting time

IS code used for determining fineness as per IS: 4031 - (part 5) - 1988. By using Vicat apparatus, we have done initial setting time for different percentage of T&T solution in cement.

3.1.4Compressive strength IS code used for determining fineness as per **IS: 516-1959**. Compressive test were carried out for addition of admixture in concrete at different proportions. Initial setting time, final setting time and slump cone were determined for control concrete and Thermocol-Thinner Concrete [TTC]. Also compressive strength of control concrete and TTC were tested after 7 and 28 days of curing.


Figure No.1 (Mixing of Concrete)


Figure No. 2(Cube Casting)

IV. RESULTS AND DISCUSSIONS:

This focuses on investigating the characteristics of M30 grade of concrete with cement project partially replace with fly ash 35%, 40% and fine aggregate replace with thermocol 0.2%,0.3% respectively. The compressive strength of concrete is increases from 33.25 N/mm2 to 35.5 N/mm2 at 35% of fly ash and 0.2% of thermocol replacement; increases from 33.25 N/mm2 to 36.8 N/mm2 at 40% of fly ash and 0.3% of thermocol replacement.


Fig No. 3 (UTM Testing)

4.1 QUANTITY REQUIRED FOR 1 CUBE:

CEMENT	1.54KG
WATER	0.66 KG
FINEAGGREGATE	2.75KG
COURSEAGGREGATE	3.375 KG

SR.NO	SAMPLE	%FLYASH	QUANTIYOFFLYASH	QUANTITYOFCEMENT
1	Normal concrete	0%	0 kg	1.54 kg
2	Mix concrete	10 %	0.15 kg 150 gm	1.39 kg
		20 %	0.30 kg 300 gm	1.24kg
		30 %	0.46kg 460 gm	1.08 kg
		40 %	0.61kg 610gm	0.93 kg

COMPRESSION STRENGTH VALUE FOR REPLACEMENT OF CEMENT WITH FLY ASH AND FINE AGGREGATE WITH THERMOCOL

SRNO	MIX		7DAYS COMPRESSIONSTRENGTH(N/MM^2)	28DAYS COMPRESSIONSTRENGTH(N/MM^2)
1	NormalMix		21.61	30.27
2	FlyAsh	Thermocol		
3	10%	0.1 %	22.86	31.15
4		0.2 %	23.11	31.77
5		0.3 %	23.36	32.02
6	20%	0.1 %	23.86	32.52
7		0.2 %	24.16	32.82
8		0.3 %	24.46	33.12
9	30%	0.1 %	24.71	33.37
10		0.2 %	24.96	33.62
11		0.3 %	25.21	33.87
12	40%	0.1 %	25.41	34.07
13		0.2 %	25.56	34.22
14		0.3 %	25.71	34.33

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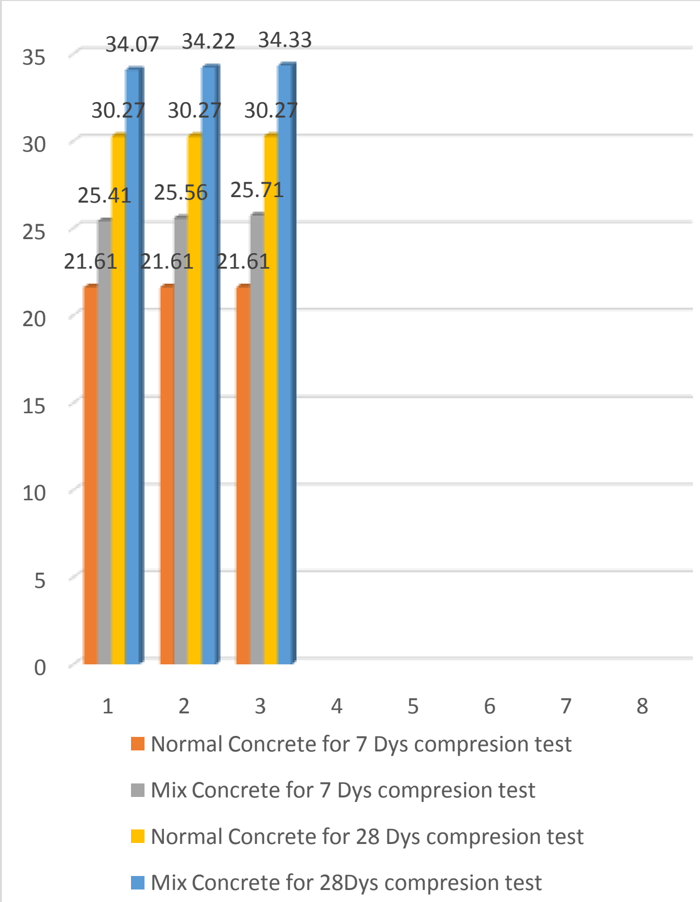
Comparison Charts:

Fig No.4 (Replacement of 10% fly ash with 0.1%,0.2%,0.3% thermocol)



(Fig.No.5 Replacement of 20% of Fly ash By 0.1%,0.2%,0.3% of Thermocol)

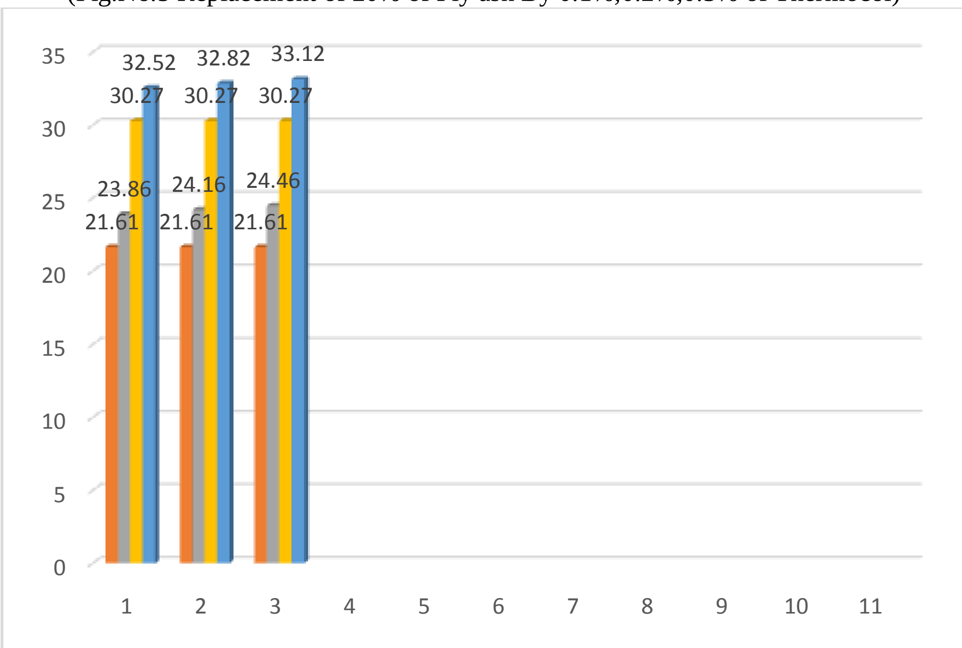


Fig No. 6 Replacement of 30% Fly ash With 0.1%,0.2%,0.3% thermocol

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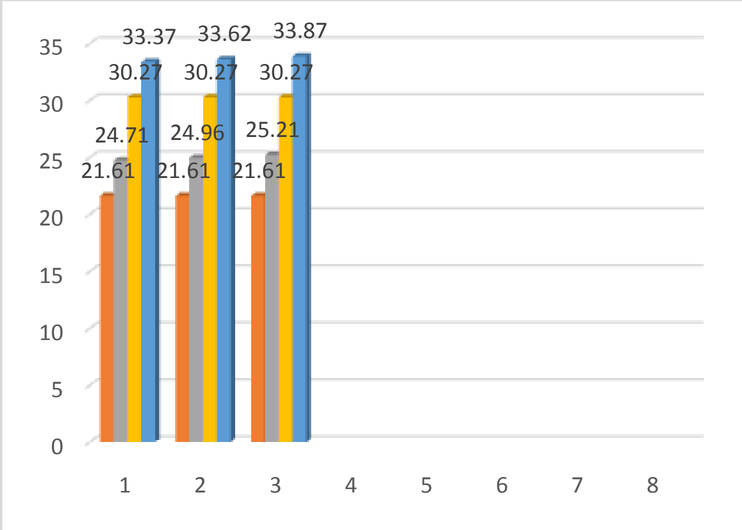
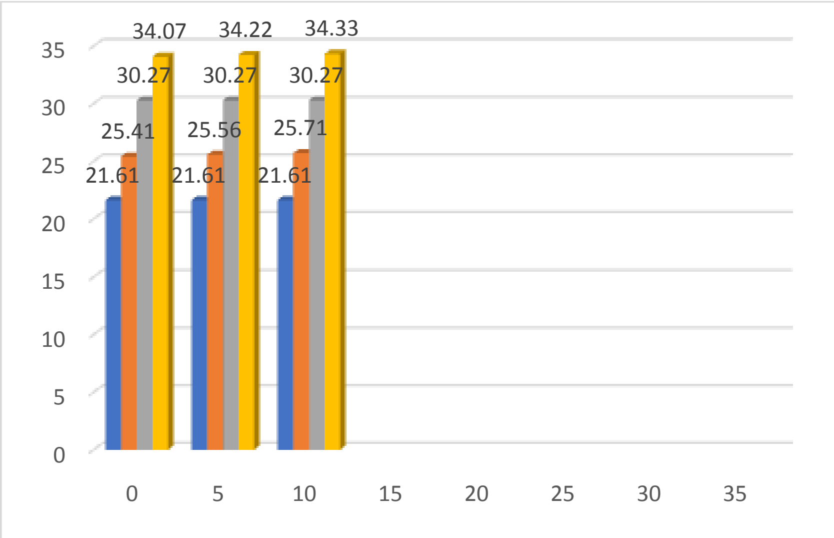


Fig No.7 Replacement of 40% Fly ash With 0.1%,0.2%,0.3% thermocol



4.2 RESULTS :

1.For 28 days of curing period, The strength of concrete at partial replacement of fly ash and thermocol (34.33 N/MM^2) is increased compared to normal cubes(30.27 N/MM^2).

2.For7 days of curing period, The strength of concrete at partial replacement of flyash and thermocol (25.71 N/MM^2) is increased compared to normal cubes (21.61 N/MM^2).

3. After replacement of fly ash and thermocol, The compression strength of concrete is increased upto 13.4%.

4.After replacement of fly ash and thermocol, The overall cost of our project is decreases upto 5.95%.

V. CONCLUSION:

For 28 days of curing period, it is observed that strength of concrete at partial replacement of fly ash and thermocol is increased compared to normal cubes.it was Consist of the 40 Percent of fly ash and themocol was 0.3 Percent.

There is decrease in the density of concrete and increases strength.The Use of fly ash in concrete can save coal & thermal industry disposal costs and produce a greener concreteforconstruction. The cost analysis indicates that percent cement reduction decreases cost of concretea specific profile. The system could be used in many business sectors that will require expert candidates, thus reducing the workload of the human resource department.

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