EXPERIMENTAL INVESTIGATION OF LIGHT WEIGHT AGGREGATE CONCRETE WITH SILICAFUME AND FLYASH AS ADMIXTURES

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Abstract: Light weight concrete has become more popular in recent years owing to the tremendous advantages it offers over the conventional concrete. The main specialties of light weight concrete are its low density and thermal conductivity. It's advantages are that there is a reduction of Dead load , Faster building rates in construction and lower haulage and handling costs. We are replacing the cinder instead of coarse aggregate; it is obtained from steel industries. The surface of the cinder is usually rough and high porous due to mineral structures. Low specific gravity of cinder in compression with natural aggregates resulted in the concrete made with cinder to be lighter than normal concrete. Based on the literature, the main function for usage cinder material is to minimize the cost and it is reduced to disposal of waste material and it helps in reduction of Dead load. An experimentally has been conducted on concrete with partial replacement of conventional coarse aggregate by another light weight aggregate. The M20 concrete mix is designed using ISI method. In current investigation, the replacementof coarse aggregates with cinder of varying percentages of 0,25,40,60,75,100 and cement is replaced with silica fume of percentages like 5, 10, 15,20%and fly ash with varying percentages of 10,20,30,40 and determine the mechanical properties like compressive strength and split tensile strength subjected to 28 days curing.

KEY WORDS :Light weight concrete, cinder, silicafume, flyash, Compressive strength, split tensile strength.

I. INTRODUCTION

Lightweight concrete can be defined as a type of concrete which includes an expanding agent in that it expands the volume of the blend while giving extra qualities, for example, nailbility and diminished the dead weight. It is lighter than the customary cement. The principle fortes of lightweight solid are its low thickness and warm conductivity. Its preferences are that there is a lessening of dead load, speedier building rates in development and lower haulage and taking care of expenses.

Lightweight cement keeps up its expansive voids and not framing laitance layers or concrete movies when put on the divider. Be that as it may, adequate water bond proportion is imperative to create satisfactory attachment in the middle of concrete and water. Deficient water can bring about absence of union between particles, subsequently misfortune in quality of cement. In like manner an excessive amount of water can bring about concrete to keep running off total to frame laitance layers, therefore looses quality.

Lightweight solid can be arranged either by infusing air in its organization or it can be accomplished by precluding the better sizes of the total or notwithstanding supplanting them by an empty, cell or permeable total. Especially, lightweight solid can be classified into three gatherings:

- No-fines concrete
- Lightweight total cement
- Aerated/Foamed cement

No-fines solid can be characterized as lightweight cement made out of bond, water and coarse total. Consistently dispersed voids are framed all through its mass. The fundamental qualities of this kind of lightweight cement is it keeps up its huge voids and not shaping laitance layers or bond film when set on the divider. Figure 1 demonstrates one case of No-fines concrete

Figure 1: No-fines concrete.

No-fines concrete normally utilized for both burden bearing and non-load bearing for outer dividers and segments. The quality of no-fines solid increments as the bond substance is expanded. Be that as it may, it is touchy to the water organization. Inadequate water can bring about absence of union between the particles and consequently, resulting misfortune in quality of the cement. In like manner an excessive amount of water can bring about bond film to keep running off the total to frame laitance layers, leaving the majority of the cement lacking in concrete and in this way debilitates the quality.

No-fines concrete typically utilized for both burden bearing and non-load bearing for outer dividers and segments. The quality of no-fines solid increments as the concrete substance is expanded. In any case, it is delicate to the water arrangement. Deficient water can bring about absence of union between the particles and in this manner, resulting misfortune in quality of the cement. Similarly an excess of water can bring about bond film to keep running off the total to shape laitance layers, leaving the heft of the cement insufficient in concrete and along these lines debilitates the quality. Permeable lightweight total of low particular gravity is utilized as a part of this lightweight cement rather than standard cement. The lightweight total can be characteristic total, for example, pumice, scoria and those of volcanic beginning and the counterfeit total, for example, extended impact heater slag, vermiculite and clinker total. The fundamental normal for this Lightweight total is its high porosity which brings about a low particular gravity. The lightweight total solid can be partitioned into two sorts as indicated by its application. One is in part compacted lightweight total cement and the other is the basic lightweight total cement. Somewhat compacted Lightweight total cement.

The incompletely compacted lightweight total cement is chiefly utilized for two reasons that is for precast solid squares or boards and cast in-situ rooftops and dividers. The fundamental necessity for this kind of cement is that it ought to have sufficient quality and a low thickness to get the best warm protection and a low drying shrinkage to abstain from splitting. Auxiliary Light weight concrete Fundamentally lightweight total cement is completely compacted like that of the ordinary fortified cement of thick total. It can be utilized with steel support as to have a decent bond between the steel and the cement. The cement ought to give satisfactory insurance against the erosion of the steel. The shape and the surface of the total particles and the coarse way of the fine total have a tendency to deliver cruel cement blends. Just the denser assortments of lightweight total are suitable for utilization in auxiliary cement. Figure 2 demonstrates the component of lightweight total cement.

Figure 2: Lightweight aggregate concrete

The structural light weight concrete is one of the important materials of construction. A concrete which is light in weight and sufficiently strong and to be used in conjunction with steel reinforcement will be a material which is more economical than the conventional concrete. Structural light-weight aggregate is a concrete having 28 days compressive strength larger than 17MPa and 28 days air dried unit weight should not exceeding 1850 kg/m3. The concrete may consist entirely of light-weight aggregate (all light-weight concrete) or combination of light weight and normal-weight aggregates.

II. LITERATURE SURVEY

Light weight concrete is a special type of concrete. One of the weaknesses of the traditional solid is the high self weight of the cement. Thickness of the ordinary solid is in the request of 2200 to 2600 kg/m3. This overwhelming self weight

will make it some degree an uneconomical structural material. Endeavours have been made in the past to diminish the self weight of the cement to build the productivity of the cement as a structural material. The light weight solid is a solid whose thickness shifts from 300 to 1850 kg/m3.

There are points of interest of having low thickness. It helps for lessening of dead load to build the advancement of building, bring down the haulage and taking care of expenses. The weight of the expanding on the establishment is a paramount variable in configuration, especially on account of feeble soil and tall structures. In surrounded structures, the pillars and sections need to convey heap of the floors and dividers. If the floors and walls are made up of light weight concrete it will results in considerable economy. Another most important characteristic of light weight concrete is its low thermal conductivity. This property improves with decreasing density. The adaption of light weight concrete gives an outlet for industrial waste (silica fume) and dismantled waste (cinder) which otherwise creates problem for disposal.

Extensive research works both at national and international level has been done on the use of various admixtures in mortars and concrete with common goal. To modify the properties of traditional concrete to the desired level suitable to the specific circumstances. To bring down the increasing cost economies of cement, building block and high strength concrete, of late, to rehabilitate the existing structures which are deteriorated over period of time and etc. In India, only government educational and research institutions and constructions departments are responsible for research while in advanced countries. The building materials industries and their R & D laboratories have achieved the most remarkable break through an accepted fact is that these encouraging results on the use of admixtures are not penetrating into the user community and the entire research work is getting flocked their organization.

Ganesh Babu. K et al., depicted has the behaviour lightweight stretched polystyrene cement containing silica fume and he concentrated on the Lightweight concrete can be created by supplanting total with lightweight total, either somewhat or completely, contingent on the necessities of thickness and quality, furthermore considered the quality and the sturdiness execution of EPS cements. These blends were planned by utilizing the effectiveness of silica fume at the diverse percentages.

NiyaziUgurKockal et al., portrayed has strength and elastic properties of structural lightweight concrete. The study introduces the impact of attributes of four total sorts (two sintered lightweight fly cinder aggregate, normal weight crushed limestone aggregate and cold-bonded lightweight fly ash aggregate)on the quality and flexible properties of solid blends. Distinctive models were likewise utilized as a part of request to foresee the quality and modulus of versatility estimations of cements. The aftereffects of this study uncovered the accomplishment of assembling high-quality air-entrained lightweight total cements utilizing sintered and frosty reinforced fly powder totals.

Siva LingaRao.Net al., has studied an investigation has been made to understand the behaviour of conventional aggregate concrete in which normal aggregate is replaced with cinder in volume percentages of 20,40,60,80 and 100 and cement is replaced with silica fume in weight percentages of 0,5,8,10,15 and 20.From the study it is reasoned that 60 percent supplanting of ordinary total with ash by volume alongside concrete supplanted by 10 percent of silica smoke by weight yields the objective mean quality. the unit weight of the ash cement is shifting from 1980Kg/m3 to 2000Kg/m3 with distinctive rates of soot.

Bhaskar Desai et al., portray test examination an endeavor is to be made to concentrate on the quality properties of light weight soot total bond solid in distinctive rate extents of 0, 25, 50, 75 and 100 by volume of light weight total solid can be arranged. By utilizing this the properties, for example, compressive quality, split rigidity, modulus of flexibility, thickness and shear stress.

Rathish Kumar P. et al ., has studied the strength and sorptivity attributes of concrete made with cinder based lightweight aggregates. Before this the span of cinder based light weight aggregate was enhanced. The mechanical properties, compressive quality and split tensile strength were learned at the end what's more 28 days for mid-range evaluation concrete with diverse sizes of total. It was noted that with 12.5mm size total and 30% fly ash the mechanical properties were predominant in 20MPa Lightweight Concrete, while 10 mm size total with a 30% fly powder substitution properties of 30MPa concrete.

P.S. Raghu Prasad et al., has concentrated on the coarse aggregates in the customary robust solid concrete were supplanted in part with Cinder (12mm) and tried for compressive strength at the age of 3days, 7days and 21days. From the after effects of the examination, it can be reasoned that strong solid block with 15% substitution of coarse aggregate by cinder records more quality than the traditional one.

Nataraja M C et al.,concentrated on to improvement a stage astute procedure to degree plain and slag solid mixes with smoldered coal ash misuse as coarse total. The blend outline can be managed by utilizing huge measure of GGBS as substitution to concrete. Concrete blends are planned with bond alone and with concrete and GGBS at 30% and 60% substitution levels utilizing blazed coal soot. Concrete with ordinary stone total is additionally thrown and tried for examination.

III. METHODOLOGY

The mix design has been conducted for M20 concrete making use of ISI method of mix design using normal constituents of concrete. In the course of investigation normal granite aggregate has been replaced by light weight aggregate namely (cinder) in percentages of 0%, 25%, 40%, 60%, 75% and 100%. In the present investigation the OPC cement has been replaced by admixture (silica fume) in five percentages (i.e. 5,10,15,20,25) and admixture (fly ash) in four percentages i.e. 10, 20, 30, 40. For the study of various properties, totally 180 specimens have been cast and tested. Here a constant water cement ratio of 0.50 has been adopted.

The experimental part of the investigation has been planned in the following three stages.

Stage 1: Procurement of materials and its testing.

Stage 2: Moulding of specimens and curing.

Stage 3: Testing of specimens.

4.2.1 Procurement of materials and its testing

Materials used in the concrete are fine aggregate, coarse aggregate(granite), light weight aggregate (cinder), cement, water, Silica fume, Fly ash have been procured from various places. Fine aggregate has been procured from Penna River chennur. Coarse aggregate (20mm) has been procured from Kadapa. Local drinking water is used for mixing and curing. Cinder (20mm) has been procured from yerraguntla. The Silica fume is obtained from Astraa chemicals Ltd Chennai.

4.2.2 Cement

Locally available Ultra Tech Ordinary Portland Cement (OPC) of 53 grade of Cement conforming to ISI standards has been procured, and following tests have been carried out according to IS 8112:1989.

- Specific gravity of Cement
- Normal Consistency of Cement
- Initial and Final setting time of Cement
- Compressive Strength of Cement

Moulding of specimens

After the Completion of workability tests, the concrete placed in the standard metallic moulds in three layers and it was compacted by tamping rod. The concrete in the moulds was vibrated for 2 min using the vibrating machine and the surface of the specimens was finished smoothly.

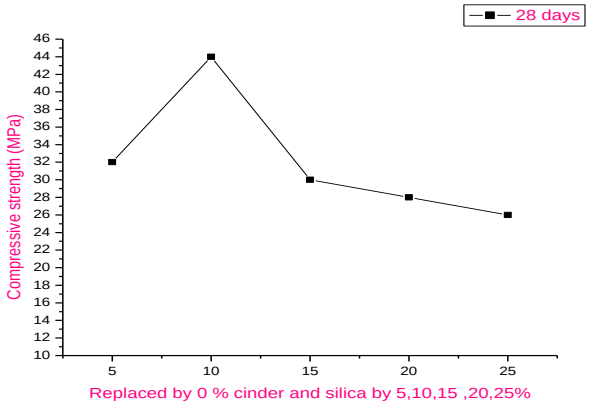
Fig 5. Casting of cubes with vibrator

Fig 6. Curing of specimens

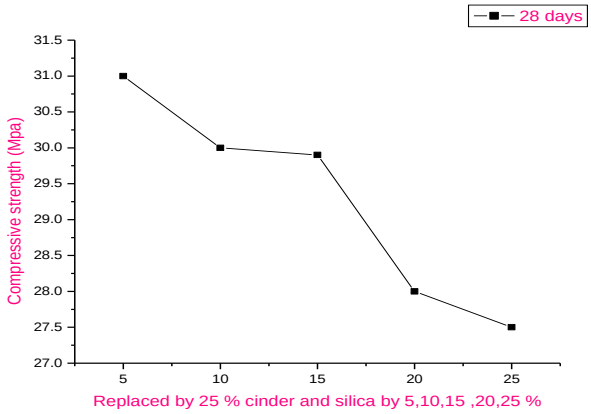
. Fig 7 Testing of cube

Fig 8 Testing of cylinder by split tensile strength

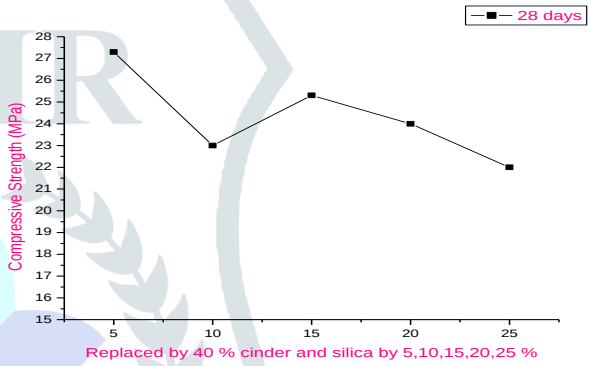
IV. RESULTS&DISCUSSIONS



Graph 1: Replaced by 0 % cinder and silica by 5,10,15,20,25 %



Graph 2: Replaced by 25 % cinder and silica by 5,10,15,20,25 %



Graph 3: Replaced by 40 % cinder and silica by 5,10,15,20,25 %

V.CONCLUSION

- From the study it is concluded that 5 % silica fume is giving the best results when compare to 10% and 15% ,20 % and 25% silica fume. And also from fly ash 20% is giving best results when compare to 10% and 30% and 40 %
- From the study it may concluded that the usage of light weight cinder aggregate to some extent (60%) and granite aggregate (40%) using admixture as silica fume and fly ash has proved to be quite satisfactory strength when compare to various strengths studied.
- It can be conclude that due to porous nature Cinder aggregate's quality is low in comparison with normal aggregate
- The results indicate that the compressive strength is decreases with the increase in percentage of cinder.
- The results indicate that the split tensile strength is decreases with increase in percentage of cinder.

- Compressive strength of 5% silica fume concrete is more than the 10% 15%,20%and 25% silica fume concrete at 28 days Similarly tensile strength of 5% silica fume is greater than the 10% 15% 15%,20%and 25% silica fume concrete at 28 days.
- Compressive strength of 20% fly ash concrete is more than the 10%,30%,40% at fly ash concrete at 28 days Similarly at 10% fly ash and 25% cinder aggregate give better split tensile strength.+ It is concluded that use of cinder is also useful up to certain proportions. So the use of by products also help in control of cost, recycling of materials .so we can also do experiments on durability properties, Nano analysis for cinder aggregate. Micro structural analysis by using cinder aggregate in cracks pattern. We can also study properties on cinder materials by using in different chemical solutions .So we can try this mix proportions in some places with different chemical property soils.

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