LIGHT WEIGHT CELLULAR CONCRETE

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Abstract : This *Paper work focuses on Cellular Lightweight Concrete (CLC), also known as Foamed Concrete, is one of the most important types of cement used in construction because of its numerous advantages and applications over traditional concrete. Portland concrete, sand with or without fly ash, and stable foam are blended to create cellular light weight concrete. The cellular light weight concrete is made by combining Portland concrete, sand with or without fly ash, and a stable foam. When compared to regular cement, the density of this cube is surprisingly low (300kg/m3 to 1850kg/m3). Cellular Lightweight Concrete has been widely used, and it has gained popularity as a result of its reduced density and comparable quality to regular blocks. It is created by the homogeneous dispersion of air that rises throughout the cement pile. The foam contains unattached air bubbles, resulting in millions of small voids/cellular in the mix, resulting in a lighter cement load. CLC is available in a variety of regulated densities, ranging from 400 kg/m3 to 1,800 kg/m3. In this vein, this paper presents a close examination of CLC using a comparable grade of block with a smaller thickness as compared to blocks. Furthermore, based on the findings in a dead load of the complete structure, the cost savings in structural design requirements were investigated, which included a general capital reduction. In the research, reserve funds in steel were discovered due to the usage of CLC obstructs, with the weight of the shaft portion being 8.635kg.*

Keywords **- Foam concrete, Light weight concrete, Fly ash, Sand replacement, synthesis foam.**

I. INTRODUCTION

1.1 General Introduction:

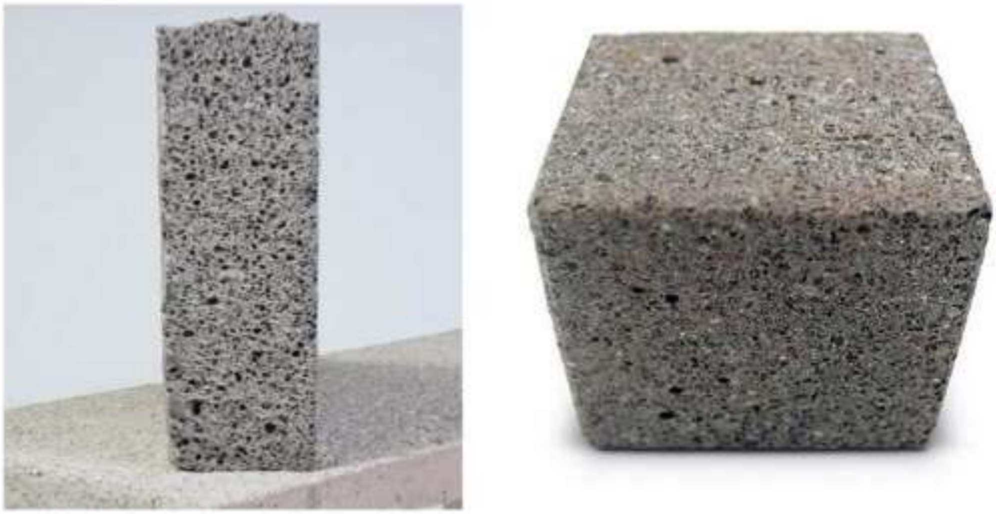
Concrete is known as a typical material which is broadly utilized in the development business, from essential work to multi-story building and uber structure. Concrete is where blend by concrete, water, and aggregate (fine) which must be useful, protection from freezing, synthetic compounds obstruction, low permeability, wear obstruction, and economy. CLC innovation has been utilized in more than 45 nations of the world in the course of recent years to develop over a hundred thousand houses, schools, medical clinics, mechanical, business structures and so on.

The presentation in India of an altered form utilizing over 25% fly ash has made it a considerably more eco-accommodating and financially savvy rendition of CLC. All the while, the item carries quality lodging nearer to the majority at a quicker and at a lower cost. CLC is the first of its sort with an extremely straightforward technique for creation, which can without much of a stretch be embraced in

pre-thrown plants or even at the venture site itself under encompassing conditions. It requires just an ostensible speculation. The CLC form with fly ash as one of its significant constituents is as yet less expensive and greater condition neighborly. CLC has moderate encapsulated vitality content and performs very well as warm protection. Cubes are made to demanding measurements and are typically laid in flimsy bed mortar that is applied with a toothed trowel, albeit progressively customary thick-bed mortar can be utilized. CLC has a long life and doesn't deliver poisonous gases after it has been set up. It offers a considerable material reserve funds as meager concrete and no rock is utilized. Cell Lightweight Concrete (CLC) is delivered by the blending of sand, fly- ash concrete foam and water in imperative extent in prepared blend plant or common solid blender.

The blended slurry is then filled molds of pre-thrown cubes/auxiliary segments/amassed structure work of building components. It is basically air-relieved, in this way can be created at venture site, using gear and forms typically being used for ordinary cement. The foam is delivered with the assistance of a Foam Generator by utilizing a foaming specialist. The foam contains secluded air bubbles, which makes million of detached modest voids/cells in the blend bringing about lighter load of cement. CLC has a long life and doesn't deliver poisonous gases after it has been set up. It offers a significant material reserve funds as meager concrete and no rock is utilized. It is simpler to deal with and place one CLC hinder when contrasted with equivalent volume of blocks. (1 Block=14 Bricks approx.). CLC, as customary solid ages well, expanding its quality by as much as half (!) somewhere in the range of 28 and 90 days in the wake of pouring, As long as CLC draws mugginess from the environment it will continue expanding its mechanical properties. Restoring happens inside a similar period as customary cement. On the off chance that throwing is done at night, the solid could be demoulded the following morning. Restoring can be speeded up by warmth, steam or synthetic (quickening agents). CLC is a great and serious material for low-ascent; load-bearing development and outside dividers just as apportioning work in multi – celebrated structure.

Light weight Concrete is a versatile material which consists primarily of a cement based motor with at least 20% of volume air. The material is now being used in an ever increasing number of applications, ringing from density void fills. Lightweight concrete has a surprisingly long history and was first patented in 1923, mainly for use as an insulation material, although there is evidence that the romans used air entertainers to decrease density, this was not really a true lightweight concrete. A significant improvement over the past 20 years in production equipment and better quality surfactants (foaming agents) has enables the use of foamed concrete on a large scale.Not everyone knows that density and compressive strength can be controlled. In light weight concrete this is done by introducing air through the proprietary from process which enables one to control density range from 1800, 1700 and 1600 down to 300 kg/m3 Compressive strengths range from up to 40 mpa down densities. Centrally It has non – combustible and features cost saving through construction speed and ease of handling.The technology is the result of over 20 years of R & D researching the possible application it is used over 40 countries worldwide today and has not reached the of its possible uses.



(Figure 1 : Foam Concrete)

II. LITERATU REREVIEW

Kunhanandan E.K &Ramamurthy.K [1], The consistency of the base mix, (defined as the water-solids ratio to attain design density) to which foam is added, is an important factor which affect the stability of mix. This consistency mainly depends on the filler type. The consistency of base mix is reduced considerably when foam is added. This reduction in consistency of foam concrete is probably due to the reduced self-weight and greater cohesion resulting from higher air content. The regression equations for spread can be effectively used for predicting the water requirement for the production of a stable and workable mix. The variation of the flow time with corresponding percentage spread exhibits showed good correlation between these measured values. An appropriate workability value is arrived at as 45 % of spread at which a foam concrete mix of good stability and consistency can be produced.

Tayyeb A, Et.al [2] The production of low cost Foam concrete using locally produced detergent as FA in place of commercially available FA is feasible. Foam concrete mix produced with a dosage of detergent at the rate of 0.4 per cent by weight of cement, having cement and sand in the ratio of 60 and 40 per cent, respectively was found to be the best mix design when compared with control mix. This mix design exhibited excellent properties, falling well within the range prescribed by ASTM, PCA and ACI. Foam concrete with a desired oven-dry density ranging from 58 lb /ft3 to 47 lb/ft3 having a compressive strength in the range of 750 psi to 490 psi can be produced using the locally produced detergent. Such Foam concrete has properties comparable with the control mix. An increase in compressive strength with increase in s/c ratio was observed, however, both the strength started dropping as the s/c ratio approached 0.83. It is due to the uneven air-entrainment of the mix at higher s/c ratio resulting in non- homogeneous mix. Water absorption of Foam concrete decreased with the increase in density of the mix design in both control as well as detergent mixes. Values of the thermal conductivity calculated in this study are excellently located in range prescribed for Foam concrete. Cost analysis concluded 0.4D60C40S as to be 42.73 per cent less costly than the corresponding control mix design

Shibi Varghese et.al [3], discussed that Foamed concrete consists of cement, water, fly Ash and air voids. It is relatively homogeneous and do not contain coarse aggregate phase. Properties of foamed concrete depend on the type of binder and foaming agent used.

TapeshwarKalra et.al [4] revealed the fly ash concrete has economic and environmental advantages. It also makes concrete sustainable. In India presently less than 50% of fly ash produced is consumed.

Maheshkumar H. Tharkrele [5], revealed conducted experimental study on foam concrete investigation two foam concrete mixtures are produced with and without sand and attempts have been made for selecting the proportions of foam concrete mix for the target plastic density of 1900 kg/m3. 18 cube specimens are prepared and tested for mixtures, then their physical (Density) as well as specific structural(Compressive Strength) properties were investigated, Specific Strength and Percentage Strength gain for foamed concrete is compared with normal weight concrete and the results are reported.

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III. PROPOSED METHODOLOGY

3.1 MATERIAL AND THEIR PROPERTIES

A. Cement: The concrete utilized for the creation of foam concrete is 53 grade Ordinary Portland Cement (OPC). Different test are performed to discover the properties of concrete in deciding the pace of addition of solidarity and consistency of value. The lab tests performed are fineness test, specific gravity test, fineness test and setting time concrete test. The got qualities are aligned and contrasted and the standard range for deciding the reasonableness of concrete for the foam concrete.

B. Fly ash: Fly ash also called as pummeled fuel debris, is one of the coal burning items, made out of the fine particles that are driven out of the evaporator with the pipe gases. Fly ash is utilized in an ideal manner to supplant sand in solid creation. Fly ash is a heterogeneous material. SiO2, Al2O3, Fe2O3 and every so often CaO are the primary concoction parts present in fly ashes. Focal points of utilizing fly ash are lessens the dead weight of a structure and further more gives brilliant warmth and sound protection. The fly ash utilized for the foam concrete is Class fly ash. This kind of fly ash produces consuming of harder, more established anthracite and bituminous coal. This fly ash is pozzolanic in nature, and contains under 7% lime (CaO). Having pozzolanic properties, the polished silica and alumina of Class fly ash requires a solidifying specialist, for example, Portland concrete, quicklime, or hydrated lime—blended in with water to respond and deliver cementations mixes. Then again, including a chemical activator, for example, sodium silicate (water glass) to Class Fly debris can shape a geo polymer.

C. Aggregate: The Aggregate utilized is fine Aggregate which is pummeled stream sand. The sand is sieved and acquired better than 300mm. The particular gravity of sand got is 2.52. No use coarse Aggregate.

D. Foaming Agent: Chemical process in which a substance is separated by response with water, oftentimes brought about by there being available a limited quantity of some other substance, for instance, a corrosive Any of an incredible and significant gathering of complex normal substances, framing an extraordinary piece of all living material, as long CHAINS of AMINO-ACIDS, into which they might be separated by HYDROLYSIS, required in nourishment for lifting weights and got essentially from meat, cheddar, eggs, and fish. result Material or impact created by any procedure not withstanding that which is its main reason.

3.2 METHODOLOGY

The method to set up a foam concrete with wanted properties shifts somewhat. For the normal density of 1000-1200 kg/cum, required blend structure estimation was done according to ASTM. The raw material, for example, concrete and water were blended to form slurry in a foam concrete blender then pre-shaped stable synthesis foam was brought into the concrete lattice and mixed in a similar blender. The crushed glass were mostly supplanted with fly ash and combined. Foaming agent was weakened in the proportion of 1:20 with the water and both were filled the air compressor machine under the strain to get foam. The foam got by blending under pressure was poured onto blender to get foam concrete. When the Foam was totally mixed, the foam concrete was prepared for pouring. The foam concrete was put physically. The foam concrete once poured accomplishes green quality following 24 hours and must be left for air curing. Water relieving is a discretionary that will be accomplished for 7 or 28 days. For our investigations just air curing was done.In the cast-in-situ procedure, blending and putting of cement is done at site. The other technique for pre-cast panels and blocks are accessible fit as a fiddle and sizes for various purposes. Henceforth we can accomplish the density extending 500 to 1800 kg/m3. For the exploratory reason the foam concrete is casted in molds as solid shapes utilizing a similar procedure at required thickness. The length, width and profundity of the 3D shapes are 150 mm. The solid shapes were casted and demoulded following one day and were permitted to be restored. 4 type of molds were set up with 0% , 10%, 20%, and 30% substitution of crushed glass by fly ash respectively.

(Figure 2 : Mixing of Foam Concrete)

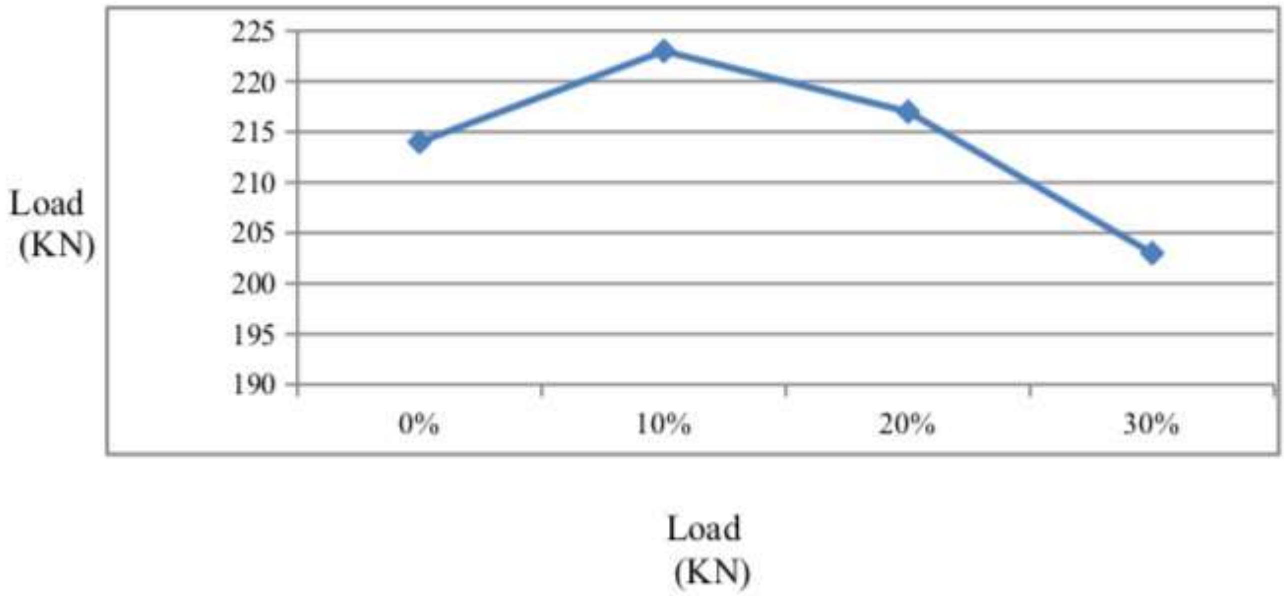
3.3 TEST RESULTS AND DISCUSSION

Compressive Strength Test Result:

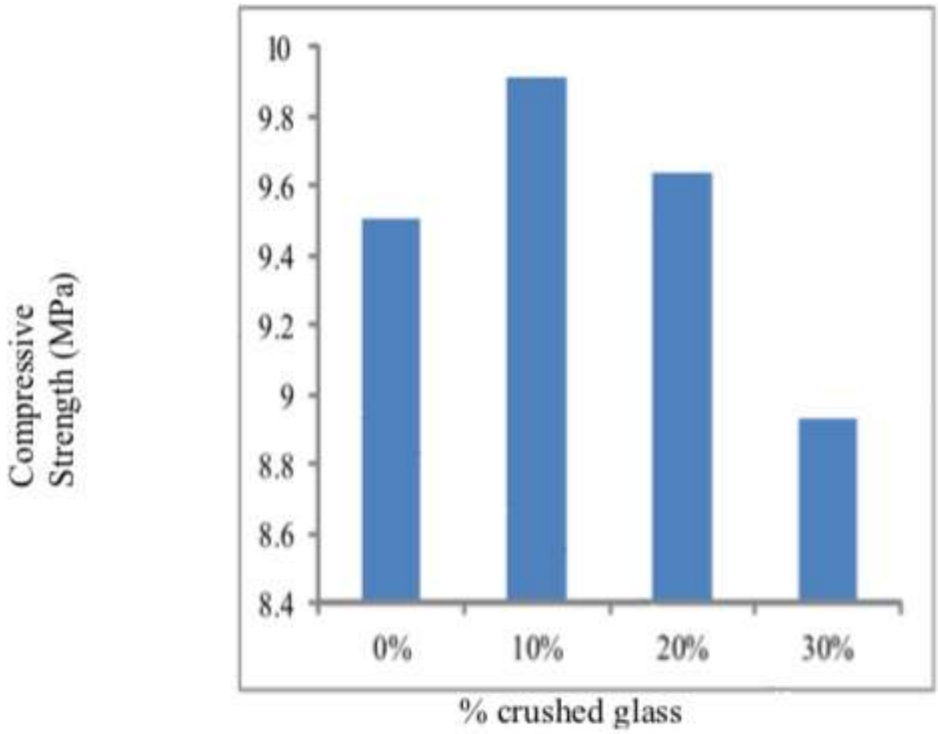
The compressive strength test is carried out on concrete blocks of size (150 X 150 X 150) mm. The test is conducted on four set of concrete blocks with fly ash replaced by crushed glass by 0%, 10%, 20%, and 30%. The compressive test is performed after 28 days curing and it is found that among all the concrete blocks with different percentage of crushed glass, the block with 10% replacement of fly ash by crushed glass has given more compressive strength. So according to our research fly ash should be replaced by crushed glass by 10% to achieve good compressive strength.

Sr. No	Batch (% Crush Glass)	Load in KN	28 days Compressive Strenght
1	0%	214	9.5 Mpa
2	10%	223	9.91 Mpa
3	20%	217	9.64 Mpa
4	30%	203	8.93 Mpa

Table :- Compressive Test Results



Percentage Crushed glass vs load



Percentage Crushed glass vs Compressive Strength

Discussion:

The use of foam concrete with 10% crushed glass replacement will enhance the compressive strength of concrete. The waste glass can be used in proper way by utilizing it in concrete and reducing the waste. The physical properties like density also remains less, as in case of foam concrete voids makes the concrete light in weight and introduction of crushed glass does not make any large changes in weight of concrete.

CONCLUSION

1. Partial replacement of fly ash by 0%, 10%, 20%, 30% crushed glass was conducted. Out of which the 10% replacement specimen was found to give more compressive strength than the other specimen.

2. This study shown that the density of foam concrete is less than the normal concrete.

3. Foam concrete can be used for construction of partition wall, gap filling, thermal insulation, etc. but it is not applicable for load bearing walls as it is not capable of resisting the load of building.

FUTURE SCOPE

- It can be used in non-load bearing structures to reduce the dead load.
- The waste glass can be used for good cause.
- Compressive strength of foam concrete is enhanced.
- It can be used for insulation purpose.

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