Study of Light Weight Brick by Using Cement, Sand, Fly Ash with Foaming Agent

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Abstract— The use of light weight concrete is found to be advantageous in the self-weight of any structure. Self-weight of foamed light weight concrete is lighter than normal concrete nor brick. It became a sweet solution in civil industry. Foam concrete is a vast majority of concrete containing no large aggregates, only fine sand and with extremely light weight materials containing cement, water and foam. It can be considered relatively homogeneous when compared to normal concrete, as it doesn't contain coarse aggregate phase. Application of foamed light weight concrete on the wall of high rise building will decrease structural load while lower structural load the structural dimension will significantly decrease and construction cost too. Our project represent that foam concrete is effective sustainable material for construction with use of effective cost in foam concrete as replacement of coarse aggregate material. Compressive strength, density test and water absorption test that have been performed with various proportion of foaming agent for 0.1%, 0.2%, 0.3%. Comparison used 1 cement: 1 aggregate. Aggregate consist of sand & fly ash added material 0%, 15%, 30%, 45%, 60% & 75% by weight of sand. Cement water factor 0.35% & foam 30%, 40% & 50% of light weight concrete volume. Cylinder sample dimensions are 75mm in dia and 150mm in depth. The study concludes an optimal mix design with 10% fly ash along with 10% stable foam to create light weight foamed concrete brick with fly ash.

Keywords: Brick, Fly Ash, Wall Material, Foam, Compressive Strength, Water Absorption, Specific Strength

I. INTRODUCTION

Mortar is a homogeneous mixture, it's produced by intimately mixing cementitious materials, water & inert materials, such as sand, till required consistency for constructing together with masonary units.

Rapid industrialization in urbanized area is another reason of growing population in countries. Today's civil engineering field need new materials such as light weight blocks & bricks. Concrete is the most utilized construction material today's world. In concrete structures, self-weight is a major portion of the total load of the structure. Foam concrete is a type of porous concrete which reduces the density of concrete considerably. It's mixture of cement, sand, water, stable foam but no coarse aggregate. Foamed concrete is also known as foamcrete, reduced density concrete is a light weight concrete. Mass of the foamed concrete is lighter than normal concrete but strength of light weight foamed concrete is lesser the normal concrete. Weight of light weight concrete 300-1800 kg/m^3, other hand usual concrete weight is about 2400 kg/m^3 (AL Bakri Abdullah et al., 2012). Foamed light weight concrete (FLWC) effects the percentage of foam in light weight concrete (Othuman Mydin 2013). Hence the foamed concrete needs to be cast in mould normal foamed concrete when cast in moulds must be demoulded after 24 hours. This imposes constraints on the productivity of the block manufacture. The problem encountered in building and structures is effect of larger dead load by ordinary brick concrete.

Fly ash is a hazardous and toxic substances (B3 waste) which can be used as an aggregate of filler or cement replacement in concrete or as a brick material (Bing et al., 2012).The addition of fly ash in light weight concrete mixtures can be categorized as Green High Performance Concrete (GHPC) which can increase the ability of concrete mixtures.

II. PROPERTIES OF CEMENT

Cement is the most important ingredient of concrete. One of the important criteria for the selection of the selection of cement is its ability to produce improved microstructure in concrete.

S. No.	Properties	Value
1	Specific Gravity	2.98
2	Initial Setting Time	30
3	Final setting time	550
4	Standard consistency (%)	29
5	Fineness (m^2/kg)	225

III. PROPERTIES OF FINE AGGREGATE

A fine aggregate which passes through 4.75mm IS sieve. It shall consist of natural sand, crushed stone sand or crushed gravel sand stone dust or marble dust, fly ash and Surkhi conforming from IS: 2686-1977.

S. No.	Characteristics	Value
1	Type	Crushed (M-Sand)
2	Specific Gravity	2.68
3	Total Water Absorption	1.02%
4	Fineness Modulus	2.508
5	Grading	III

IV. METHODS

The best light weight concrete will be obtained which will be based on its maximum compressive strength and other mechanical behavior. Therefore, the optimum percentage of foam and fly ash that will be gained the highest compressive strength would be optimized. As a mixing procedure, at the early stage, cement, aggregate, fly ash and water mixed to produce slurry in mixer. Then the foam bubbles added to the slurry in mixing machine to produce the foaming concrete.

V. OPTIMIZATION OF STABLE FOAM

To obtain optimum percentage of stable foam, various percentage of stable foam substitute with normal concrete

paste. For this purpose form 5% of stable foam starts to substituting with paste and increase this percentage till decreasing in strength occurred. According to fig 2, 5%, 10%, 15% and 20% of stable foam was replaced with normal weight concrete paste and the specimens were cured in distilled water for 28 days. By increasing foam percentage at 10% the decrease in compressive strength occurs. Specimens were produced at 10% of foam for brick as it's obtained as foam optimum percentage.

VI. Optimization of Fly Ash

Later the optimum percentage of foam was found, to figure out optimum percentage of fly ash, various percentage of fly ash substituted with cement by weight. To reach this aim, as previous works, 5%, 10% and 15% of fly ash replaced in foamed concrete paste with cement then cured in water for 3,14,28 days.

VII. Compressive strength

After curing for 28 days the foaming light weight concrete sample was tested for compressive strength. The sample shape of the each composition amounted to 4 samples. The testing equipment used is Shimadzu University Testing machine with capacity of 5000Kgf. The compressive strength test sample is according to ASTM 495-99 a.

VIII. Water absorption test

It is determined for brick specimens. They were placed in oven at temperature of 105ºC for 3days. After 3days the specimens were taken out from the oven and immersed in distilled water for 24hours. The specimens weighted in all steps. According to previous work, water absorption percentage is decreased in concretes with high volume of fly ash contents. This happen due to lack of hardening of fly ash based concrete during the early ages. Due to the presence of high volume fly ash, hardening and related properties are attained at a later period of curing compared to ordinary concrete.

IX. Results and discussion

A. Compressive Strength

Light concrete percentage foam 30%, 40% and 50% produce specific gravity 868.4 - 1582.4 kg/m^3 fulfill criteria as light concrete. The percentage of 30% foam in light weight concrete with various fly ash percentages produces specific gravity of 1203.7 - 1582.4 kg/m^3, compressive strength of 7.089-12.525MPa. Foam percentage 40% in light concrete with 15%, 30%, 45%, 60% & 75% fly ash percentage yield 1044.1 - 1298.8 kg/m^3 with compressive strength 3,012 - 6,756 MPa.

Table shown below reinforces previous research that light weight concrete less than 1000kg/m3 occurs at 50% foam percent with a low compressive strength of 0.981-1.664MPa.

B. Density

The result of density foamed light weight concrete test 894 - 1636 kg/m^3 fulfilled the criteria as light concrete, which is maximum 1900kg/m^3 (Al Bakri Abdullah et al. 2012; Othuman Mydin 2013). This study support previous studies that foamed light weight concrete with the same percentage of fly ash and increasing foam percentage yield lower density. Chat below shows the density foamed light weight concrete value increases with the maximum percentage of fly ash 45%. It is the novelty of this research that is the increasing of foamed light weight concrete weight in percentage of fly ash 45% & decrease in the percentage of fly ash 60% & 75%.

C. Water absorption

The volume of water absorbed by foamed concrete was approximately twice that of an equivalent cement paste but was independent of volume of air entrained, ash type or ash content. To the purpose of water absorption test of bricks three specimens of each composition are tested and the average results of water absorption and weight of specimens in comparison with normal weight concrete are illustrated with normal weight concrete are illustrated in below table.

X. Conclusion

As per test results shows that if increase the fly ash percentage gradually strength also increased with 20% with foaming agent 0.3%. Density test result shows that increases the foaming agent density of concrete decreased. So experimentally prove that it's used for soil having low bearing capacity areas. Water absorption decreases with increase in foaming agent.

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