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OPTIMIZATION OF FLY ASH CONTENT FOR MANUFACTURING OF LIGHT WEIGHT BLOCKS

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***Abstract*— In this study Expanded Polystyrene (EPS) in granulated form with fly ash are taken under consideration to manufacture the light weight masonry blocks. It's a novel concept of using EPS (granulated form) as an addition of raw material for the production of light weight fly ash based masonry blocks. The innovative application of moderate volume EPS (granulated form) in reducing the density of the composite material proved to improve the engineering properties of the material.**

An extensive experimental investigation has been carried out to represent the varied engineering properties of the material consisting of fly ash and EPS (granulated form). There is reduction in unit weight and compressive strength with the addition of EPS granules, however, with the mixing of small percentage of admixture like cement the light weight material can enhance the strength in addition to improve overall properties.

***Keywords*— Expanded Polystyrene (EPS) in granulated form**

I. INTRODUCTION

Fly ash hallow blocks have an important place in modern building industry. They are cost effective and better alternative burnt clay bricks. Concrete hollow blocks being usually larger in size than the normal clay building bricks and less mortar is required, faster of construction is achieved. Also building construction with cement concrete hollow blocks provides facility for concealing electrical conduit, water and sewer pipes wherever so desired and requires less plastering.

In India Besides, the production of cement is not environmentally friendly. The manufacturing of cement is not only a high energy consuming process, but the production of each ton of cement releases approximately 1 ton of carbon dioxide (CO2) into the environment due to the calcinations of the raw materials and the combustion of fuels. In light of the economic benefits, conservation of natural resources, energy saving and environmental friendliness, the use of alternative materials from waste products has become the main focus of engineers and researchers. This project aims at producing lightweight hollow bocks by using the expandable polystyrene. Polystyrene is chosen due to its lightweight properties, with good energy absorbing characteristic and good thermal insulator.

Now a days, Hollow Blocks (HCB) and bricks are becoming very popular. These blocks are being widely used in construction of residential buildings, factories and multistoried buildings. These hollow blocks are commonly used in compound walls due to their low cost. These hollow blocks are more useful due to their lightweight and ease of ventilation. The blocks and bricks are made out of mixture of fly ash, cement, sand, GGBS and EPS. Hollow blocks construction provides facilities for concealing electrical conduit, water and soil pipes. It saves cement in masonry work, bringing down cost of construction considerably. Economy of the structure is one of the basic aspects upon which any design is based. The stability plays an important role but the best designer is one who comes out with design which gives the stable and economics structure. The development of the construction technology is closely related to development of adequate mechanization and handling technology. Hollow block is an important addition to the types of masonry units available to the builders and its use for masonry is constantly increasing

II. LITERATURE SURVEY

RECTIFA RIO (APRIL-2016):-
He is prepared paper name was ''comparative study on proportion of hollow concrete blocks to its compressive strength". The proportion of 1:5 (cement to sand) was proven to be the minimum proportion for gaining the target compressive strength of Quality. Preliminary treatment of sand should be needed as the mud content more than or equal to 5% in order to avoid the failure of target strength. Water cement ratio of 0.5 was

suitably workable for mixing the hollow concrete block as well as the target compressive strength.

JAY.M.PAWAR (JUNE-2015):-

He is prepared paper name was "Effect a Strength and Durability of Fly Ash Based Hollow Concrete Blocks Having Different Configurations Using Polypropylene Fibers". Any type of waste materials which can increase the concrete that can be used to make this kind of hollow concrete blocks so that this blocks should be made eco-friendly. Here I use the fly ash as a partially replacement of cement to made these hollow concrete blocks lighter in weight.

Manolia (2012)

Polystyrene concrete is a lightweight concrete made with expanded polystyrene beads, it is known for its good thermal and caustic insulation properties, and it has also been considered for use as core material in sandwich panels, beams and slab. The mixing of it was done by adding the dry cement and sand together in to mixer and mixed for approximate one minute. It is possible to produce various type of self-compacting polystyrene concrete (SC-PC) by the addition of polystyrene beads as a partial replacement of fine aggregate and using (SBR) polymer with ratio of (10 %) by weight of cement and superplastisizer.

Xu and Jiang (2011)

Has study on lightweight concrete in application of expanded polystyrene (EPS) as substituted to fine aggregate on mechanical properties. The cement content about 500 kg/m3, the volume of EPS is about 25 % and 35 % of sand ratio have result to minimum density of concrete. A saving the sand content could be achieved.

AMAN JATALE

He studied the effects on compressive strength when cement is partially replaced by fly ash and observed that the use of fly ash slightly retards the setting time of concrete. It was also found that the rate of strength development at various ages is related to the w/c ratio and percentages of fly ash in the concrete mix. The modulus of elasticity of fly ash concrete also reduced with the increase in fly ash percentage for a given w/c ratio

III. MAIN AIMS AND OBJECTIVES OF THE PROPOSED WORK

The primary aim of this study was to investigate the feasibility of using a significant portion of fly-ash and EPS granules for beneficial purpose in civil engineering applications that is cost effective and environmentally friendly. The detailed laboratory investigations were planned and carried out for the determination of the best production method and the best mix design. Thus, the main objective of the study undertaken may be summarized as to evaluate various physical parameters of the fly-ash and EPS mixes such as compressive strength, Water absorption, Dry and Wet Bulk unit weights and to select the optimal mixture of EPS among experiments under consideration to manufacture the light weight fly ash, EPS blocks.

IV. MATERIALS

A new alternative light weight building material is prepared by using EPS granules, fly ash, cement, sand, GGBS and water. The EPS granules used for the preparation of light weight building material were irregular in shape having diameter in the range 3-4 mm. These highly compressible EPS granules had density 11 to 32 kg/m ^{3}. The fly ash was collected in dry state from Dirk industry, Nasik, India. The percentage of basic chemical compounds present in the fly ash were SiO2 (57.2%), Al2O3 (31.1%), Fe2O3 (3.3%), CaO (2.3%). The ordinary Portland cement of 53 grade is used as a binding material. Potable water is used to mix these materials.

V. EXPERIMENTAL PROGRAM

The experimental program was planned with an objective to understand and investigate the suitability of fly ash-EPS, GGBS, Sand &Cement mix as a building material. Laboratory model experiments were carried out for the determination of the best mix design so as to select the optimal mixture of EPS among experiments under consideration to manufacture the light weight EPS blocks.

A. Mix proportion for trial numbers

The mix ratio is defined as the ratio of materials by weight. There is no consistent mix proportion adopted for all the cases. In all the mixes, the aim was to reach the target unconfined compressive strength after 28 days, after mixing. The work plan comprise of Mix proportions and preparation of specimens with several different combinations of EPS granules, Fly ash, Sand, GGBS and Cement at suitable W.C. (%). However, it is noted that the compressive strength is obviously influenced by the moulding water content. A pilot project work was also conducted before deciding the range of limits of different mix ratios

B. Experimental Test

Experimental test for investigation of –
Compressive strength,

Water Absorption Test,

Acid Attack Test.

Table No.1

Mix No	Fly Ash	Sand	EPS	GGBS	Crumb Rubber	Cement
1	**60**	15	5	5	10	10
	50	10	5	10	1.95	10
2	30	**30**	5	20	10	10
	20	**50**	5	10	10	10
3	30	20	5	**30**	10	10
	20	20	5	**40**	10	10
4	30	30	5	150	**15**	10
	60	15	5	5	**10**	10
5	35	30	5	10	13	**12**
	50	15	5	10	1.95	**10**

VI. METHODOLOGY

The aim of the present study is to get the optimum percentage of various ingredients like fly ash, GGBS, EPS, cement and crumb rubber to get the maximum compressive strength of hollow block. In this study two variation of the ingredient is selected from from various research papers.

To carry out the experimental investigation total 30 blocks of size 450mm x 210mm x 100mm were casted. For all mixes 3 blocks are casted to determine the compressive strength of 7 days, 14 days and 28 days compressive strength. Normal water sprinkling curing is given to each block. Compression Testing Machine of 2000kN capacity was used to determine the total compressive load taken by blocks at different ages. This ultimate load divided by the cross-sectional area of the blocks [(450mm x 210mm)-(2 x 110 x 110)] yields the compressive strength of blocks.

VII. RESULT

30 blocks of various proportion are prepared as stated above and this blocks will be tested for the Compressive strength, Water Absorption Test, Acid Attack Test. after 7, 14 and 28 days of gaining compressive strength and curing from the time of removal of blocks from the mould.

Fig. 1 Casted Block

Fig. 2 Mixing Material

Fig. 3 Dry Mixing Of Material

Fig. 5 Initial Setting of Blocks

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References

1. Overview of different type of fly ash and their use as a building and construction material Conference Paper · January 2011 Nirdosha Gamage, Kasuni Liyanage, RMIT University Memorial University of Newfoundland
2. Partial Replacement of Cement with GGBS in Concrete Chalamcharla Venu Gopal**,** V**.** Gokul Nath Saveetha School of Engineering, Saveetha. University, Chennai
3. Cement Concrete Hollow Blocks To Replacing Cement By Fly Ash Vinay Kumar.S.R1, Abhijith.M.Arer2, Sangeetha.B.K3, Suma.U.Pateela4, Sweta.C.Patil5 1,2,3,4 Students, Dept. of civil engineering, S.T.J.I.T College, Ranebennur, Karnataka, India. 5 Sweta.C.Patil, Professor, Dept., of Civil Engineering, S.T.J.I.T Ranebennur, Karnataka, India.
4. Ashik Kumar Parashar, Rinko Parashar, "Bricks with Total Replacement of Clay by FlyAsh Mixed with Different Materials", International Journal of Scientific and Research, July 2012.
5. Tutunlu and U. Atalay, "Utilization of fly ash in manufacturing of building bricks," in International Ash Utilization Symposium, Center for Applied Energy Research", 2001
6. Experimental Study on Light Weight Aereated Block with Partial Replacement of Cement by Fly Ash R. Gopinath 1 1Assistant Professor, Department of Civil

Engineering, KGiSL Institute of Technology, Coimbatore

7. IS 2185-3(1984): Concrete masonry units, Part 3: Autoclaved cellular Aerated concrete blocks.
8. BOTTOM ASH AS REPLACEMENT OF SAND FOR MANUFACTURING MASONRY BLOCKS A.J.M.S.S Abeykoon Faculty of Engineering University of Ruhuna Email: srimal.sujeewa@gmail.com C.S.K.R Anthony Faculty of Engineering University of Ruhuna Email: kasun.anthony@yahoo.com G.H.M.J Subashi De Silva Faculty of Engineering University of Ruhuna Email: subashi@cee.ruh.ac.lk
9. Development of Light Weight Geoblocks for Wall Building Units using EPS Beads and Fly Ash Soni Kumari, Department of Civil Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
10. Cement Concrete Hollow Blocks To Replacing Cement By Fly Ash Vinay Kumar.S.R[1], Abhijith.M.Arer[2], Sangeetha.B.K[3], Suma.U.Pateela[4], Sweta.C.Patil[5] *[1,2,3,4] Students, Dept. of civil engineering, S.T.J.I.T College, Ranebennur, Karnataka, India. [5] Sweta.C.Patil, Professor, Dept., of Civil Engineering, S.T.J.I.T Ranebennur, Karnataka, India.*
11. 11th International Conference on Modern Building Materials, Structures and Techniques, MBMST 2013 Experimental Research of Hollow Concrete Block Masonry Stress Deformations Bronius Jonaitisa , Robertas Zavalisb, *