EXPERIMENTAL STUDY ON FIBRE AND FLY ASH BASED INTERLOCKING BRICKS

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ABSTRACT

The use of interlocking bricks masonry has gained speedy quality in several foreign countries as an alternate to standard bricks for property housing. It is being always challenge for researchers to make interlocking brick light weight, low cost and improve the performance against aggressive environment. An experimental effort made in this concern. This paper offers the results of associate degree experimental investigation during which the compressive strength, water absorption and density were investigated by using varying percentage of fly ash, stone dust, and sand with different mix proportion. A manmade fibre, glass fibre reinforce polymer (GFRP) utilize as reinforcing material to produce the interlocking blocks which gives appreciable results discuss in detail. The experimental results compared thereupon normal force clay brick and interlocking brick found sturdy in aggressive environments and have decent strength for his or her use in property building construction.The utilization of interlocking blocks workmanship has increased fast prevalence in numerous remote nations as an option in contrast to customary blocks for reasonable lodging. It is as a rule consistently challenge for specialists to make interlocking block light weight, minimal effort and improve the exhibition against forceful condition. A trial exertion made in this worry. This paper gives the aftereffects of a test examination where the compressive quality, water retention and thickness were explored by utilizing fluctuating level of fly debris, stone residue, and sand with various blend extent. An artificial fiber, glass fiber fortify polymer (GFRP) use as strengthening material to deliver the interlocking squares which gives calculable outcomes examine in detail. The test results contrasted and that conventional brunt earth block and interlocking block found solid in forceful conditions and have adequate quality for their utilization in reasonable structure development.tool to evaluate the mechanical performance of the panels comparing to idealized design.

Keywords: fly ash, GFRP, compressive strength, water absorption, density

1. INTRODUCTION

A very high measure of waste is being delivered all around the globe. The most widely recognized strategy for overseeing waste is through its transfer in landfills making in that way colossal stores of waste. In this circumstance, squander reusing is increasing expanding significance [1]. At present in India, around 206 coals based warm power plants are delivering around 160 million tons of fly debris consistently; the evaluations arranged by Ministry of Power just as Planning Commissions up to the year 2031-32 show that age of fly debris during the year 2031-32 would be around 900 million tons for every year [2-3]. While the present yearly generation of fly debris worldwide is assessed around 600 million tones [4].The Government of India showed approaches drive for use and transfer of fly debris [5]. In a tropical nation like India the consumed mud block is the most fundamental structure material for development of houses. It is accounted for that the necessity of blocks for development movement sums to be in excess of 140 billion numbers every year [6]. For satisfy such request fly debris interlocking block might be one of option for maintainable development industry.

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Much trial inquire about did for delivering great quality block with decrease of cost utilizing mechanical squander [7]. And furthermore for diminishing cost and expanding the quality numerous characteristic and artificial strengthening material utilized in the creation of blocks. There are a wide scope of common filaments, to be specific sisal, bamboo, coir (coconut fiber), jute, and numerous others [8]. In this examination work the artificial fiber GFRP present as a fortifying material. The impact of GFRP with greatest level of fly debris in interlocking block is examined. This supporter the utilization of fly debris as the beneficial material to soil by decreasing the utilization of soil in block producing towards endeavors of keeping up environmental equalization through manageable advancement of common assets.

2. METHODOLOGY :

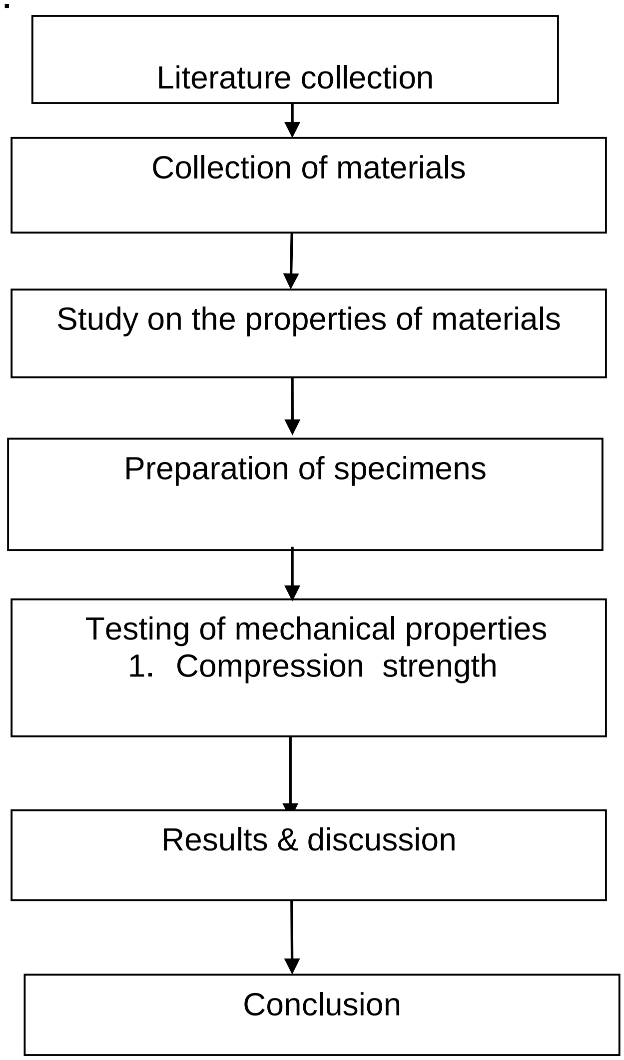

Fig. 2.1 Methodology

3. DISCUSSION AND RESULTS :

3.1Material

For casting of interlocking bricks locally available raw materials like fly ash, stone dust, marble slurry and sand were used. Additional material GFRP was used to investigate the effect on properties of interlocking brick.

3.2Cement

Ordinary Portland cement were used satisfying all the IS requirements was used in making the bricks [16].

Material	Physical Properties	Value
Cement	Specific gravity	3.18
	Specific surface	2250 cm^2/gm
	Soundness	1 mm
	Initial setting time	35 min
	Final setting time	380 min.
	Compressive Strength (1:3 cement sand mortar)	19.2 MPa(3 days) 28.5 MPa(7 days)

Table no.3.1 The physical properties of cement

3.3Fly Ash

The fly ash (see fig 1.a) was collected in dry state from the Paras Thermal power station and the chemical characteristics of the fly ash are given in Table 2.

Material	Chemical Constituents	Percentage
Fly ash	Silica (as SiO_2)	64.23 %
	Alumina(asAl_2O_3)	25.82 %
	Iron (as Fe_2O_3)	4.06 %
	Sodium (as Na_2O)	0.40 %
	Sulphur Trioxide (as SO_3)	0.27 %
	Magnesium Oxide (as MgO)	0.78 %
	Loss of ignition (as I.OI)	0.39 %

Table 3.2-chemical characteristics of the fly ash

3.4Stone dust

Powder form stone dust (see fig. 1.b) available locally used in moderate quantity for preparing the bricks. Its fine size make possible to retain proper shape of the bricks particularly maintaining the edges and corners.

3.5GFRP

GFRP used as reinforcing material

3.6FINE AGGREGATE:

Sand i.e., fine aggregate obtained locally from nearest river passing through 4.75 IS sieve having fineness modulus (F.M)-2.61 and confirming to

Material	Properties	Value obtained
Sand	Specific Gravity	2.48
	Water Absorption	1.05
	Bulking of Sand	26.84%
	Free Moisture	1.00%
	Bulk Density	1500 kg/m^3
	Water Absorption	0.32%
	Fineness Modulus	2.89
	Silt Content	2.1%
GFRP	Nominal dia.	0.09 mm
	Tensile strength	25 N/mm
	Type of wave	Plane

Table 3.3-Physical Properties of the fine aggregate and GFRP

3.7Water

Ordinary tap water was used for both mixing the constituents of the bricks as well as for the curing of bricks.

4. Process operation-Casting of interlocking bricks

For casting the Cement and other constituents were used randomly in varying proportions of 1:10, 1:11 and 1:12. In order to establish the feasibility of producing a binder that can impart adequate strength, three specimen bricks were casted for each mix proportions given in Table 4. A pan mixer and hydraulic machine used for casting the bricks (see fig. 2.a). Before casting the bricks, mixer was properly cleaned. Cement and stone dust were added in dry state, mixed thoroughly and then clean potable water was added to get a mix of desired workability. The mix so prepared for the bricks was then poured in hydraulic machine and bricks were then taken out of it and kept over level surface under the shed for drying purpose. The blocks have geometric size of 230mmx100mmx75mm (see.fig 2.b & c). This machine produces solid blocks of laterite composition mainly and stabilized with cement material.

4.1Curing

The green bricks were allowed for surface dry for one day and cured normally for 28 days by spraying water four to five times in one day (see fig.3.a). After gaining sufficient strength they were submerged in water and sulphate solution at normal room temperature of 27 + 2^{o}C for different ages. Sulphate solution having sulphate (SO_4) concentration equal to 10000 ppm was prepared in laboratory by mixing 14.79 gm $NaSO_4$ in one liter of water.

4.2Testing-Compressive Strength Test Procedure

The casted bricks were taken out from water one day prior to the testing and were tested for compressive strength after 14, 28 and 90 days and water absorption test as per IS 1077-1957 Code.Compressive strength test should be done in compression testing machine. Blocks should be placed between the jaws and load should be applied gradually. Precaution should be taken such that load should be applied to the flanged portion of the blocks. For this cement mortar of proportion

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After 90 days of casting, these bricks were dried to a constant mass in an oven at 105˚. They were cooled to room temperature and their density was obtained by dividing the mass of a brick by its overall volume. The shrinkage of the bricks was not measured. It may be relevant to mention that the cracks were not visible on these bricks with naked eye after 90 days of casting.

Ratio	Mix Designation	Constituent materials (Percentage)			
		Fly As h	Ston e dust	San d	GFR P
1:10	M1	45	35	20	--
	M2	55	25	20	--
	M3	60	20	20	--
	G1	60	20	20	0.10
	G2	65	15	20	0.10
	G3	70	10	20	0.10
1:11	M4	50	40	20	--
	M5	55	35	20	--

	M6	60	30	20	--
1:12	M7	60	45	20	--
	M8	65	40	20	--
	M9	70	35	20	--

5. CONCLUSION :

Based on the experimental investigation according during this paper, following conclusions square measure drawn:

1. Strength of interlocking bricks with increasing fly ash increases with the age.
2. All mix proportions gives satisfactory higher values of compressive strength.
3. At some without GFRP mix ratio 1:11 gives the higher compressive strength greater than 10 N/mm2.
4. Interlocking bricks with economically available fly ash in large proportion have sufficient strength for their use in low cost housing, non-load bearing construction and in regions where good quality burnt clay bricks are not available.
5. Water absorption of interlocking bricks without GFRP is found to be in the range of 6.42 to 12.4 percent, whereas the water absorption for standard burnt clay bricks mustn't be quite twenty p.c. The water absorption of interlocking bricks will increase with the enlarged ash content.
6. The density of interlocking bricks was found to be 7.5 to 25 percent higher than that of the ordinary burnt clay bricks.
7. Interlocking brick with reinforcing agent GFRP increases the compressive strength at maximum utilization of fly ash with the age.
8. The water absorption and density increase with increase in fly ash in GFRP interlocking brick.
9. As density concern the difference between ordinary clay brick and interlocking brick should be minimize with reinforcing agent.

Interlocking bricks require no skilled labour and can be moulded in any shape and size depending on the requirements. These bricks have higher tolerances and no efflorescence as compared to traditional bricks. A number of other benefits also be ascribed for the prospect of interlocking bricks which includes no consumption of mortars, better efficiency in laying and low cost of finishing. It is further needed to develop the awareness among users, professionals and financial supporters for using these waste materials for solving the housing problems in addition to balance economy and achieve energy conservation. For reducing the density of bricks additional experimentation needs with completely different wasted material with natural reinforcing fibre for considering economy and use for multistorey building.

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