STUDY OF COMPRESSIVE STRENGTH OF FLY ASH CONCRETE BRICK WITH 1:6 AND 1:8 CEMENT MORTAR RATIO WITH VARIOUS PERCENTAGE OF RECRON FIBER

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Abstract

The fly ash bricks are comparatively lighter in weight and stronger than common clay bricks. fly ash bricks are better alternative to conventional burnt clay bricks in structural, functional and economic aspects. This industry has the potential to consume at least 50% of the ash production in India. By use of this aspect we can convert waste into wealth The main factors governing the strength of a brick structure include brick strength, mortar strength and elasticity, bricklayer workmanship, brick uniformity, and the method used to lay brick The cement mortar structures are weak in tension and strong in compression. Due to this the structure having low ductility and there are propagation of cracks. To avoid this problem generally narrow steel fiber, mild steel fiber, recron fibers, sugarcane bags fibers are used in the cement mortar to reinforced.. In this study ,investigations has been made to analyze the influence of bond strength on compressive strength of brick masonry and the compressive strength of brick prism of fly ash concrete brick with variation in percentage of Recron fiber with cement mortar of 1:6 and 1:8 ratio

Keywords: *Compressive Strength, Brick Masonry, Brick Prism, Cement Mortar, Recron Fibers, Fly Ash Concrete Brick.*

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1. INTRODUCTION

Recent studies shows that the recron fiber reinforced brick work attain its full strength. and has more crack resistance when compared with other materials added with cement mortar. This investigation attempted to understand mechanisms of bond developed between mortar and brick and conclude that the brick-mortar bond is essentially mechanical in nature. Improve the network of hydration products with the addition of lime, but there is inadequate evidence for bond strength improvement. In this research,10 different mortars made with sets of combinations of OPC and polypropylene fiber (PPF),we reused with sand and cement. The compressive strength of masonry prisms, made of one brick long, three bricks high, we restudied for each mortar at the age of 28 day. The study showed that the behavior of cement brick is superior to the silt brick Compressive strength of masonry prisms were affected by mortar strength, addition of fiber. The used prism is recommended to be used as a mean of quality control. This research evaluated the effect of increased bond strength on compressive strength of masonry prisms without altering the brick and mortar characteristics. Brick mortar strength is poor, the prism failure is also accompanied by a failure of the brick mortar bond. Attempt has made to study the performance of cement mortar with recron fiber at various percentages. The recron fiber mixed mortar is used for analysis of compressive strength behavior in brick masonry. Experimentally investigated the increase in the compressive strength for the various percentage of recron fiber added with the various ratio of cement mortar in brick work at the thickness of mortar between brick layer. They use 6 no of brick to make one brick prism. They made brick cube for 0.5%,1%,1.5%, 2% of recron fiber with 1:6,1:8, ratio of cement mortar for the thickness of cement mortar between brick layer of 12mm .They have concluded that 1.25% of fiber for12 mm mortar thickness gives better result, when compared that other percentage of recron fiber and mortar mix ratios.

2. EXPERIMENTAL PROGRAMME

The main objective of the present research and investigation is to determine the optimum mix percentage to be mixed to obtain maximum compressive strength, and to find the characteristic of brick masonry using cement mortar mixed with the optimum mix percentage of recron fiber.

Experimental program

1. Determination of physical properties of in gradients.
2. Casting of prism of bricks

2.1 Methodology

Six numbers of bricks are used to determine the compressive strength of brick prisms. fly ash brick of size 225x100x75mm are used for the test. Bricks are arranged in three layers, each layer has two numbers of brick .Each layer of brick is bonded with the 12 mm thickness of mortar. Recron fiber is added with the mortar in weight basis, fiber is partially replaced for“ wet mortar weight”. We did only for 12 mm of mortar thickness. We made two no of samples

and the average value of compressive strength is taken in to account we made prisms for 1:6, 1:8 ratio of cement mortar, each cement mortar mix prepared for the various percentage of recron fiber. Brick prisms are cured using gunny bags. Compressive strength is determined at 28 days curing time.

2.2 Materials and Methods

Recron fibers are used with regular cement mortar of OPC 43 GRADE with Fly ash brick.

2.2.1 Cement

43 grade, "Ordinary pozzolana cement" is used for cement. We used shree cement for the project. The properties of cement were determined as per the IS 4031:1968 and results are follow in the Table 1.

Table 1: Properties of cement

Properties	**Values**
Compressive strength	47.08 N/mm^2
Initial setting time	80 minutes
Final setting time	195 minutes
Standard consistency	29%
Specific gravity	3.10

2.2.2 Fine Aggregate

River sand was used as fine aggregate. Properties of natural aggregates. The properties should comply with the norms laid down in IS 383:1970 specifications for fine aggregates from natural sources for concrete. Aggregates should be chemically strong, hard ,durable of limited porosity free from the properties of the fine aggregates are in table no.2

Table 2: Properties of fine aggregates

Sieve size	Cumulative retained Wt. in gm	Percentage Wt. Retained	Percentage passing	Percentage passing zone III According IS: 383- 1970
4.75 mm	27	2.7	97.3	90 – 100
2.36 mm	60	6.0	94.0	85 – 100
1.18 mm	186	18.6	81.4	75 – 100
600µ	356	35.6	64.4	60 – 79
300µ	584	58.4	41.6	12 – 40
150µ	950	95.0	5.0	0 – 10
Pan	1000	100	0.0	Nil

The fine aggregate confirms to be of ZONE III
Specific gravity - 2.48
Voids Content – 32.6%

Table3. Properties of Recron fiber

PROPERTIES	VALUES
Cut length	6mm or 12mm
Shape of fiber	special for improved holding of cement aggregates
Tensile strength	4000-6000 kg/ cm^2
Melting point	> 250^{o}C
Dosage rate	Mortar Use CT 2012 (6 mm) at 125 gm /cement bag 1:4 cement ratio

2.3 Fly Ash Brick

Fly ash bricks (cement bonded) shall be locally made. Bricks shall have smooth rectangular faces with sharp and square corners. Bricks shall be hand or machine moulded and shall be made from the admixture of suitable good quality of fly ash, sand and cement as per the composition mentioned below in the Table 4 and 5.

Table 4: Content in fly ash brick

Sr. No.	**Particulars**	**Specifications**
1	Fly ash	50-70%
2	Sand	15-20%
3	Lime & Gypsum	15-20%
4	Cement	05-08%

Table 5: Properties of fly ash brick

Sr. No.	Particulars	Specifications	Remarks
1	Weight of Bricks	2.75 – 3.25 Kg / Brick	Depend upon Sand quality
2	Compressive Strength	70–120 Kg/cm^2	Nil
3	Water Absorption	12-16%	Depend upon product recipe

2.4 Mix Proportion

The cement mortar mix used for the experimental study was 1:6 and 1:8.The quantity of materials required to make set of two number of brick cube are in the given Table 6

Table 6: Mix Proportion Details

% of fiber	Sand In Kg	Cement In Kg	Fibre In Kg	Sand In Kg	Cement In Kg	Fibre In Kg
	1:6			**1:8**		
0%	30	5	0	40	5	0
0.5%	30	5	0.025	40	5	0.025
1%	30	5	0.05	40	5	0.05
1.5%	30	5	0.075	40	5	0.075
2%	30	5	0.1	40	5	0.1

2.5 Preparation and Testing of Specimens

Identify the brick prism
I/D = C60, C60.5, C61, C61.5, C62, C80, C80.5, C81, C81.5, C82
C = Fly ash concrete brick prism
6 = 1: 6 Mix cement mortar
8 = 1:8 Mix cement mortar
0, 0.5, 1, 1.5, 2 = Percentage of Recron fiber

2.6 Casting of Brick Prisms

Six numbers of locally available second class bricks were used to construct masonry of size 225 mm x 212 mm x 324mm and 225 mm x 212 mm x324 mm were constructed with cement mortar ratios 1:6 and 1:8.The required quantity of sand and cement is calculated previously according to the required cement mortar ratio. Then they mixed properly. Then recron fiber is added on the basis of weight of wet cement mortar. They mixed well, then brick cube prepared. The casted brick prisms were kept under normal atmosphere for next one day. Then it was kept under curing using gunny bags, process for a period of 28days.

2.7 Compressive Strength Test for Brick Prisms

The compressive strength test is the most common test conducted because most of the desirable characteristic properties of mortar and the structural design purpose are quantitatively related to compressive strength. The test was conducted in calibrated compression testing machine of 50 tonnes capacity as per the specifications given in IS-3495. The prisms were properly held in position to apply axial load gradually till the crushing load is reached. The test specimen with flat face horizontal and mortar filled face facing upward between plywood and carefully centered between ply wood were tested by axially applied load at the rate of 5KN per minute till the failure.

3. RESULTS AND DISCUSSIONS

3.1 Results

Two types of bricks are used in fly ash concrete bricks. The compressive strength of brick masonry prism with mortar mix of 1:6 and 1:8 with the variation of recron fiber quantity percentage 0%, 0.5%, 1%, 1.5% and 2% were found.. The curing was done with the help of gunny bags with water for 28 days. Then the specimens was tested for the compressive strength of the brick masonry.

The results found after the testing of the different bricks prisms are given below in the Table 7 and 8.

Table 7: Compressive strength of prism 1:6 fly ash concrete bricks in C/ M mixed with **recron fiber**

I/D	Size	load	area	Strength	Avg. Compressive Strength	
	Cm^2	tonnes	Cm^2	Kg/Cm^2		% Change
C60	23 X 23	21.0	529.0	39.7	39.5	zero
C60	23 X 23	20.8	529.0	39.3		
C60.5	23 X 23	22.9	529.0	43.3	42.8	8.36
C60.5	23 X 23	22.4	529.0	42.3		
C61	23 X 23	21.1	529.0	39.9	40.5	2.53
C61	23 X 23	21.7	529.0	41.0		
C61.5	23.5 X 23.5	21.1	552.3	38.2	40.0	1.26
C61.5	23 X 23	22.1	529.0	41.8		
C62	23 X 23	20.0	529.0	37.8	39.2	-0.75*
C62	23 X 23	21.5	529.0	40.6		

*Lower due to less workable mortar with high quantity of fibers

Table 8: Compressive strength of prism 1:8 fly ash concrete bricks in C /M mixed with recron fiber.

I/D	Size	Load	Area	Strength	Avg. Compres sive Strength	
	Cm^2	tonnes	Cm^2	Kg/Cm^2		% Change
C80	23 x 23	11.5	529	21.74	21.6	zero
C80	23 x 23	11.3	529	21.36		
C80.5	23 x 23	12.5	529	23.63	24.0	11.11
C80.5	23 x 23	12.9	529	24.39		
C81	23 x 23	11.3	529	21.36	21.2	-1.85*
C81	23 x 23	11.1	529	20.98		
C81.5	23 x 23	10.7	529	20.23	20.1	-6.94*
C81.5	23 x 23	10.6	529	20.04		
C82	23 x 23	10.4	529	19.66	19.8	-8.33*
C82	23 x 23	10.5	529	19.85		

*Lower due to less workable mortar with high quantity of fibers

3.2 Interpretations for Compressive Strength

1. Compressive strength of C60 is 39.5 kg/cm^2
2. Compressive strength of C60.5 is 42.8 kg/cm^2 is 8.36% more than C60 prism
3. Compressive strength of C61 is 40.5 kg/cm^2 is 2.53% more than C60 prism
4. Compressive strength of C61.5 is 40.0 kg/cm^2 is 1.26% more than C60 prism
5. Compressive strength of C62 is 39.2 kg/cm^2 is 0.75% less than C60 prism
6. Compressive strength of C80 is 21.6kg/cm^2
7. Compressive strength of C80.5 is 24.0 kg/cm^2 is 11.11% more than C80 prism
8. Compressive strength of C81 is 21.0 kg/cm^2 is 1.85% less than C80 prism
9. Compressive strength of C81.5 is 20.1 kg/cm^2 is 6.94% less than C80 prism
10. Compressive strength of C82 is 19.8 kg/cm^2 is 8.33% less than C80 prism
11. In the case of fly ash concrete the strength was found to be 8.36 % higher than ordinary cement mortar for 1:6 ratio cement mortar and 11.11% for 1:8 ratio cement mortar

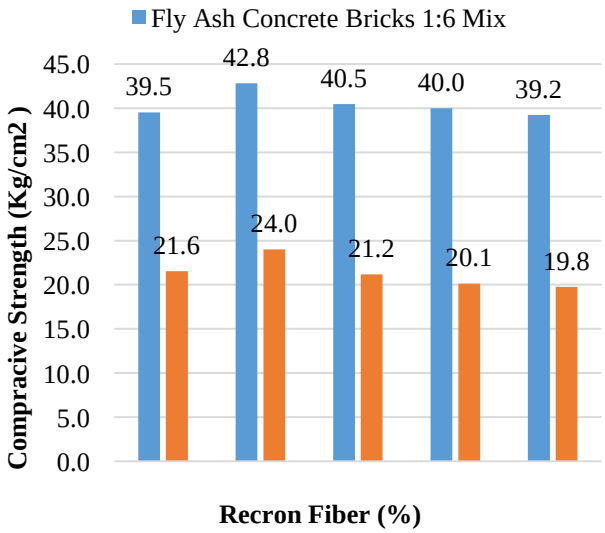

Fig 1: Comparison of compressive strength of Fly ash concrete brick with 1:6 and 1:8 cement mortar ratio with various percentage of Recron fiber.

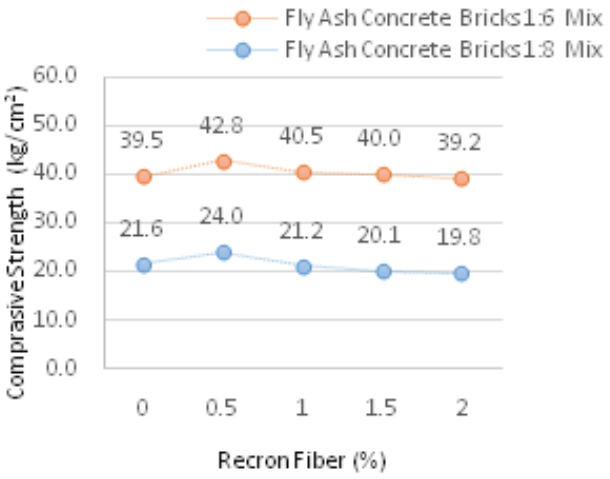

Fig 2: Comparison of compressive strength of Fly ash concrete brick with 1:6 and 1:8 cement mortar ratio with various percentage of Recron fiber

4. CONCLUSION

1. Compressive strength of cement mortar is increasing by mixing of recron fiber up to a optimum percentage of fiber then decreasing..
2. Optimum value of recron fiber is nearly equal to 0.5% for fly ash bricks with mix ratios 1:6 and 1:8.
3. Percentage of decreasing the compressive strength of cement mortar is decreasing with a higher percentage of fiber.
4. Workability of mortar is decreasing when percentage of fiber is increases.
5. The study can be extended for the same combinations with the different ratio mortar as well as other admixture.
6. The study can be extended for flexural strength of mortar with different admixture.
7. The study can be extended for different heights of the brick prism.

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