EXPERIMENTAL INVESTIGATION ON CONCRETE WITH BRICK POWDER AND FLYASHAS PARTIAL REPLACEMENT OF CEMENT

< AFSAL P K>[1],<AKSHAY DEV>[2],<ALI MISHAB E CI>[3]<BINCY U I>[4]

[1]*JCT COLLEGE OF ENGINEERING AND TECHNOLOGY ,ANNA UNVERSITY*
PICHANUR,COIMBATORE ,TAMILNADU 641105,INDIA
Akshaysivan78@gmail.com

[2]*JCT COLLEGE OF ENGINEERING AND TECHNOLOGY ,ANNA UNVERSITY*
PICHANUR,COIMBATORE ,TAMILNADU 641105,INDIA
joseanish5060@gmail.com

[3]*JCT COLLEGE OF ENGINEERING AND TECHNOLOGY ,ANNA UNVERSITY*
PICHANUR,COIMBATORE ,TAMILNADU 641105,INDIA
shameershams78@gmail.com

[4]*JCT COLLEGE OF ENGINEERING AND TECHNOLOGY ,ANNA UNVERSITY*
PICHANUR,COIMBATORE ,TAMILNADU 641105,INDIA
rashidrocks09@gmail.com

Abstract: The purpose of this research is to study the properties of fresh and hardened states of M40 grade concrete using brick powder as partial replacement of cement at 5%,10%,15% and fly ash at 15%,30%and 45%. This project investigates quantitatively the strength of concrete mix at different ages.

Keywords:brick powder, fly ash, compressive strength**.**

1. Introduction

Dumping of dust and other waste brick particles, flakes etc. not only occupy land but also create environmental problems. The problem could be reduced to a large extent by using these waste material in cement concrete. the main aim of this study to investigate the feasibility of using waste brick powder in concrete as partial replacement of cement. Cement is replaced by waste brick by waste brick powder in different proportions until 20% by weight. The reason for using brick dust include economical gain and it also reduces the total amount of cement being used in concrete experimental results indicate that brick dust could be used for partial replacement of cement in concrete. concrete cubes prepared with 10% cement replaced by brick powder shows compressive strength comparable to conventional concrete cubes. Prepared with ordinary Portland cement. The presence of brick powder shows the certain properties of concrete could be improved by using brick dust in combination with ordinary portland cement. The result of the investigation confirmed the potential use of this brick powder material to produce pozzolanic concrete.

RAW MATERIALS

A. Cement

Cement is a powdery substance made b calcining lime and clay, mixed with water to form mortar or mixed with sand, gravel and water to make concrete. The specific gravity of Portland cement is generally about 3.12 to 3.9.

Table 1chemical constituents of Portland cement

MINERALS	PERCENTAGE
Lime (CaO)	60 to 67 %
Silica (SiO2)	17 to 25 %
Alumina (Al2O3)	3 to 8 %
Iron oxide(Fe2O3)	0.5 to 6%
Magnesia (MgO)	0.1 to 4%
Sulphur trioxide(SO3)	1 to 3%
Soda and potash(Na2O + K2O)	0.5 to 1.3 %

B. Brick Powder

Brick powder is obtained from the dust of disintegrated bricks also the waste bricks are obtained from garbage of a broken building. The collected waste bricks are pulverized to get the particle passing through 75 micron sieve to get the grading of cement. 5, 10, 15, and 20% brick powder is used as replacement for cement in the experiments

.

Table 2 chemical constituents of Portland cement

MINERALS	PERCENTAGE
Silica(sand)	50-60%
Alumina(clay)	20-30%
Lime	2-5%

C. Fine Aggregate

Sand is used as fine aggregate in mortars and concrete. River sand are usually dunged or drudged from a pit, lake, or seabed. River sand is becoming scarce commodity nowadays. Hence the manufactured sand is playing a major role in construction industry nowadays. Initial tests are one to check the quality of fine aggregate. He fine aggregate used must be free from dust particles, so that the quality of concrete will not get affect

D. Coarse Aggregates

Crushed aggregate is produced by crushing quarry rock, boulders, cobbles, or large size gravel. Recycled concrete is viable source of aggregate and has been satisfactory use in granular sub bases, soil-cement, and in new concrete. Aggregate strongly influence concrete's freshly mixed and hardened properties, mixture proportions, and economy. Consequently, selection of aggregates is an important process. Although some variation in aggregate properties is expected, characteristics that are to be considered include:

- Grading
- Durability
- Particle shape and surface texture
- Abrasion and skid resistance
- Unit weights and voids
- Absorption and surface moisture

E. Water

The water- cement ratio plays a major role in the quality of the concrete. It is the ratio of the weight of water to the weight of the cement used in a concrete mix. Higher water –cement ratio increases the workability of concrete but decreases the strength of the concrete. A lower water-cement ratio leads to higher strength and durability, but it makes the mix difficult to work with a form. So the optimum usage of the water in the concrete is very essential. Workability can be resolved with the use of plasticizers or super-plasticizers. The quantity of the water also varies depending upon the absorption capacity of the materials.

F. Fly ash

Fly ash material solidifies while suspended in the exhaust gases and is collected by electrostatic precipitators or filter, since the particles solidify while suspended in the exhaust gases, fly ash particles are generally spherical in shape and range in size from 0.5μm to 100μm. They consist mostly of silicon dioxide, which is present in two forms: amorphous, which is rounded and smooth, and crystalline, which is sharp, pointed and hazardous; aluminium oxide and iron oxide fly ashes are generally highly heterogeneous, consisting of a mixture of glassy particles with various identifiable crystalline phases such as quartz, and various iron oxides.

Table 3Chemical constituents of fly ash

component	bituminous	Sub bituminous	lignite
Silicon dioxide	20-60	40-60	15-45
Aluminium oxide	5-35	20-30	20-25
Iron oxide	10-40	4-10	4-15
Lime	1-12	5-30	15-40
Loss in Ignetion	0-15	0-3	0-5

MIX DESIGN

The designconcrete mix involves the determinate of the most rational proportion of ingredients of concrete to achieve a concrete which is workable in its plastic state and will develop the rare qualities when hardened. A properly designed concrete mix should have minimum possible cement content without sacrificing the concrete quality in order to make it concrete mix.

The mixture proportioning was done according to Indian Standard Recommended method IS10262 for M40

Table 4 Mix proportion

Cement	Brick powder	sand	Flyash	water	Superplasticizer
3.32	**0.208**	**6.28**	**0.624**	**1.79**	**0.083**
1.65	**0.25**	**4.05**	**0.825**	**1.185**	**0.110**
2.2	**0.83**	**8.08**	**2.49**	**2.38**	**0.33**

. RESULTS AND DISCUSSION

The average strength of concrete was tested after 14 and 28 days of curing. The compressive strength was found to decrease with increase in percentage of replacement but the workability was found to be good. The average compressive strength was shown in the following figure. The combined mix showed 7.5% increase in the final compressive strength.

Table 5 Compressive strength of normal concrete

Specimen	Age Of Specimen	Breaking Load (N)	Strength(N)	Average Strength(N/mm^2)
1	7days	108.81	109.25	9.659
2		105.74		
3		113.2		
1	14days	144.16	149.17	13.19
2		139.12		
3		164.23		
1	28days	215.20	215.55	19.05
2		210.31		
3		220.48		

Table 6 Compressive strength for 5% replacement of Brick powder and 15% fly ash

Specimen	Age Of Specimen	Breaking Load (N)	Average Strength(N)	Strength(N/mm^2)
1	7days	125.40	122.58	10.83
2		121.40		
3		120.96		
1	14days	147.70	167.15	14.78
2		166.22		
3		187.53		
1	28days	252.04	264.97	23.42
2		262.76		
3		280.12		

Table 7 Compressive strength for 10% replacement of Brick powder and 30% fly ash

Specimen	Age Of Specimen	Breaking Load (N)	Average Strength(N)	Strength(N/mm^2)
1	7days	152.84	149.90	13.21
2		143.92		
3		151.76		
1	14days	112.47	153.02	13.53
2		154.36		
3		192.23		
1	28days	284.04	236.52	20.91
2		225.24		
3		200.28		

Table 8 Compressive strength for 15% replacement of Brick powder and fly ash

Specimen	Age Of Specimen	Breaking Load (N)	Average Strength(N)	Strength(N/mm^2)
1	7days	102.40	109.76	9.7
2		108		
3		118.88		
1	14days	120.2	134.36	11.88
2		124.5		
3		158.38		
1	28days	204.72	181.07	16
2		168.36		
3		170.12		

Table 9 Compressive strength for 15% replacement of Brick powder and 45% fly ash

Specimen	Age Of Specimen	Breaking Load (N)	Strength(N)	Average Strength(N/mm^2)
1	7days	106.76	107.73	9.24
2		120		
3		96.45		
1	14days	115.30	106.31	9.4
2		93.2		
3		110.43		
1	28days	160.08	165.76	14.65
2		154.03		
3		183.16		

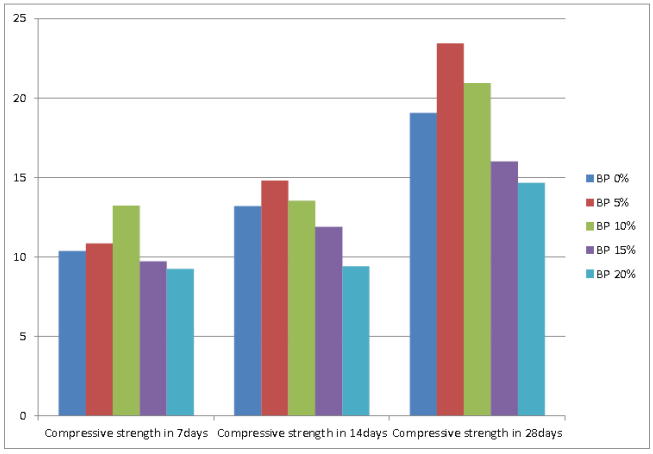

Fig 1 comparisons chart compressive strength at 7th, 14th and 28th day

Conclusion

From the experimental study of concrete with brick powder and fly ash which was partially replaced with cement, the following conclusion were achieved the replacement of brick powder was made in percentage of 5%, 10% and 15% fly ash as 15%,30%and 45% of the weight of cement. The workability of concrete was not affected due to the addition of brick powder and fly ash .after curing of 28 days, the cubes were tested for compressive strength which showed that 40% of the strength was attained for 5% and 10% replacement of brick powder and fly ash with cement and the compressive strength results were equal to the conventional concrete for 15% and 20% after the curing of the concrete it was found that the concrete got a reddish colour whch increased the aesthetical view of the concrete. Thus the partial replacement of cement with brick powder and fly ash helped to increase the compressive strength of the concrete. There is no decrease in compressive strength of the concrete due to replacement of brick powder in cement at the proportion of 5%,10%and 15% and fly ash in 15%,30%and 45% it also gives good aesthetic view to the concrete when compared with the conventional concrete, so the replacement of cement with brick powder and fly ash in concrete is really advisable.

Reference

[1] IS 1489(part 1): 1991- Indian standard specification for Portland pozzolona cement part-1 fly-ash based, 2000.

[2] IS 456:2000-Indian standard code of practice for plain and reinforced concrete,2000.

[3] IS 516:1959-Indian standard for method of test for strength of concrete.

[4] IS 2386(Part 1):1963 Methods of test for aggregates for concrete: Part 1 Particle size and shape.

[5] IS 2386(Part 2):1963- Methods of test for aggregates for concrete: Part 2 Estimation of deleterious materials and organic impurities.

[6] IS 2386(Part 3):1963- Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking.

[7] IS 4031(Part 4):1988 Methods of physical tests for hydraulic cement: Part 4 Determination of consistency of standard cement paste.

[8] IS 4031(Part 5):1988 Methods of physical tests for hydraulic cement: Part 5 Determination of initial and final setting times.

[9] IS 383 : (1970) : Specification for Coarse and Fine Aggregates From Natural Sources For Concrete [CED 2:Cement and Concrete]

[10] IS 10262: (2009) : Guidelines for concrete mix design proportioning [CED 2: Cement and Concrete]

[11] IS 10262:2009 Indian standard Concrete Mix Proportioning guidelines (First Revision).

[12] IS 2269:53 Grade ordinary Portland cement

[13] Rakesh Kumara, B. Bhattacharjeeb, "Porosity, pore size distribution and in situ strength of concrete", Bridges Division, Central Road Research Institute, Department of Civil Engineering, Indian Institute of Technology- Delhi.

[14] Mr. Ankit J Patel, Mr. Sandip P. Patel, Mr. Daxesh Prajapati, Mr.Harsh Patel,"Literature Review on Different Waste Materials Use in Concrete" Shankarshih Vagela Bapu Institute of Technology, Gandhinagar, Gujarat.