International Journal of Advances in Engineering & Scientific Research, Vol.4, Issue 2, Feb-Apr-2017, pp 55-64 ISSN: 2349 –3607 (Online) , ISSN: 2349 –4824 (Print)

www.arseam.com
Impact Factor: 2.48

Cite this paper as : *Vaibhav Joshi, Swastik Bhatnagar, Akshay Rawat, Sharad Chauhan, Shaurya Rawat & Sharma A.K (2017) AN EXPERIMENT STUDY OF COMPARISON BETWEEN FLY ASH BRICK AND TRADITIONAL RED BRICKS, International Journal of Advances in Engineering & Scientific Research, Volume 4,(Issue 2,Feb-Apr-2017), pp 55-64 . ISSN: 2349 –3607 (Online) , ISSN: 2349 –4824 (Print),*

AN EXPERIMENT STUDY OF COMPARISON BETWEEN FLY ASH BRICK AND TRADITIONAL RED BRICKS

Vaibhav Joshi[1], Swastik Bhatnagar[1], Akshay Rawat[1], Sharad Chauhan[1], Shaurya Rawat[1] & Mr. A. K. Sharma[2]

[1] B.Tech Student, Dept. of Civil Engg, Graphic Era University, Dehradun, India

[2] Assistant Professor, Dept. of Civil Engg, Graphic Era University, Dehradun, India

Abstract:

In this paper, effort have been made to study the different proportion percentage of fly ash bricks and been compared with traditional red bricks. Various test such as tolerance, water absorption, efflorescence and compressive strength test were conducted both fly ash as well as red bricks. In the experimental study we found that fly ash bricks are much stronger and absorb less water than fly ash bricks. We even have find the optimum percentage of fly ash to be used in a composition to get good strength while keeping the composition economically feasible.

Key words- Cement, Fly ash, Fly ash bricks, stone dust, red bricks.

INTRODUCTION

Fly ash is a by-product from thermal power plant using coal as fuel product. This by-product of coal combustion is collected by electrostatic precipitator(ESP) before the flue gases reaches chimneys. Fly ash contain substantial amount of silicon dioxide(SiO_2), aluminum oxide (Al_2O_3), iron oxide(Fe_2O_3), calcium oxide(CaO), and magnesium oxide(MgO). Though these compositions may vary depending upon the type of coal burned.

Indian coal on an average produce 30 to 40% ash and hence fly ash utilization is a prime factor. India currently generated 100million tones of fly ash every year. Therefore, using fly ash as building material have been very significant and is been used in major civil engineering projects.

A lot of air pollution is produced in manufacturing of red bricks. Whereas in fly ash manufacturing is very eco-friendly. Fire operation in manufacturing fly ash bricks is not required.

EXPERIMENTAL SETUP: -

- Dimensional and Tolerance Test
- Waster Absorption Test
- Compressive Strength Test
- Efflorescence Test

Dimensional and Tolerance Test-

20 bricks or more stack bricks are selected randomly. Foreign or loose particles of clay are removed that are stick to bricks. In a level surface these bricks are placed and measured length wise, height wise and width wise. The permissible limit as per IS 128940: 2002 for 20 bricks are:

a) For modular bricks

length 3720 to 3880 (3800±80mm)

width 1760 to 1840 (1800±40mm)

height i) 1760 to 1840 (1800±40mm) – for 90mm high bricks

ii) 760 to 840 (800±40mm) – for 40mm high bricks

b) For non-modular size

length 4520 to 4680 (4600±80mm)

width 2160 to 2240 (2200±40mm)

height i) 1360 to 1440 (1400±40mm) – for 70mm high bricks

ii) 560 to 640 (600±40mm) – for 30mm high bricks

Water Absorption Test-

bricks are dried in oven at a temperature of 105 to 115ºC till all the moisture get evaporated. After oven dry the bricks sample are cooled and weight (W_1). After that bricks are put in pond of water for water absorption for various period of days. After the period the bricks are again weighted (W_2) and water absorption is calculated as-

$$\text{Water Absorption in \% by weight} = \frac{(W_2-W_1) \times 100}{W_1}$$

Compressive Strength Test-

Cement mortar (1:3) is prepared and is filled in the frog and all void in the bed face of bricks. The sample prepared is under damp jute bag for 3 days in clean water. After curing of bricks the bed face area is calculated and the bricks specimen is placed in universal testing machine. Plywood sheets are attached at the top and bottom face of bricks. Loads is applied at constant rate and failure load is noted.

$$\text{Compressive strength} = \frac{\text{Maximum load at failure(N)}}{\text{Average area of bed face(mm}^2\text{)}}$$

Efflorescence Test

Efflorescence is the deposition of salt of sulphate of magnesium, calcium, sulphate and carbonate (sometimes chloride and nitrate) of sodium and potassium are found in efflorescence.

In this test the end of brick is placed in a dish filled with water in such a way that the depth of immersion being 25mm. The whole assembly is placed in ventilated room (at temp 20 to 30°C) until all the water in the dish is

absorbed by the bricks and rest water get evaporated. Cover the dish containing the brick with suitable glass cylinder so that excessive evaporation from the dish may not occur. When the water has been absorbed and bricks appear to be dry, place a similar quantity of water in the dish and allow it to evaporate as before. Examine the bricks for efflorescence after the second evaporation and report the results

NIL-When there is no perceptible deposit of efflorescence.

SLIGHT- Not more than 10% area of the brick covered with a thin deposit of salt.

MODERATE- Covering up to 50% area of the brick.

HEAVY- Covering 50% or more but unaccompanied by powdering or flacking of surface.

SERIOUS- When there is a heavy deposit of salts accompanied by powdering and/or flacking of the exposed surfaces

TEST PERFORMED AND RESULT OBTAINED

FOR FLY ASH BRICKS: -

TOLERANCE TEST

Table 1 Tolerance Test For Fly Ash Bricks

SPECIMEN	Length(mm)	Width(mm)	Height(mm)
Fly Ash (40%)	4590	2230	1430
Fly Ash (45%)	4570	2210	1400
Fly Ash (50%)	4600	2230	1430
Fly Ash (60%)	4620	2210	1440

Result-Tolerance limit is under permissible limit.

WATER ABSORPTION TEST

WATER ABSOPRTION TEST FOR 7DAYS

Table 2 Water Absorption Test For Fly Ash Bricks

Specimen	7 days	14 days	21 days	28 days
Fly ash 40%	13.40%	13.70%	13.98%	14.05%
Fly ash 45%	12.89%	13.25%	13.42%	13.45%
Fly ash 50%	12.57%	13.19%	13.22%	13.25%
Fly ash 60%	11.78%	12.65%	12.68%	12.72%

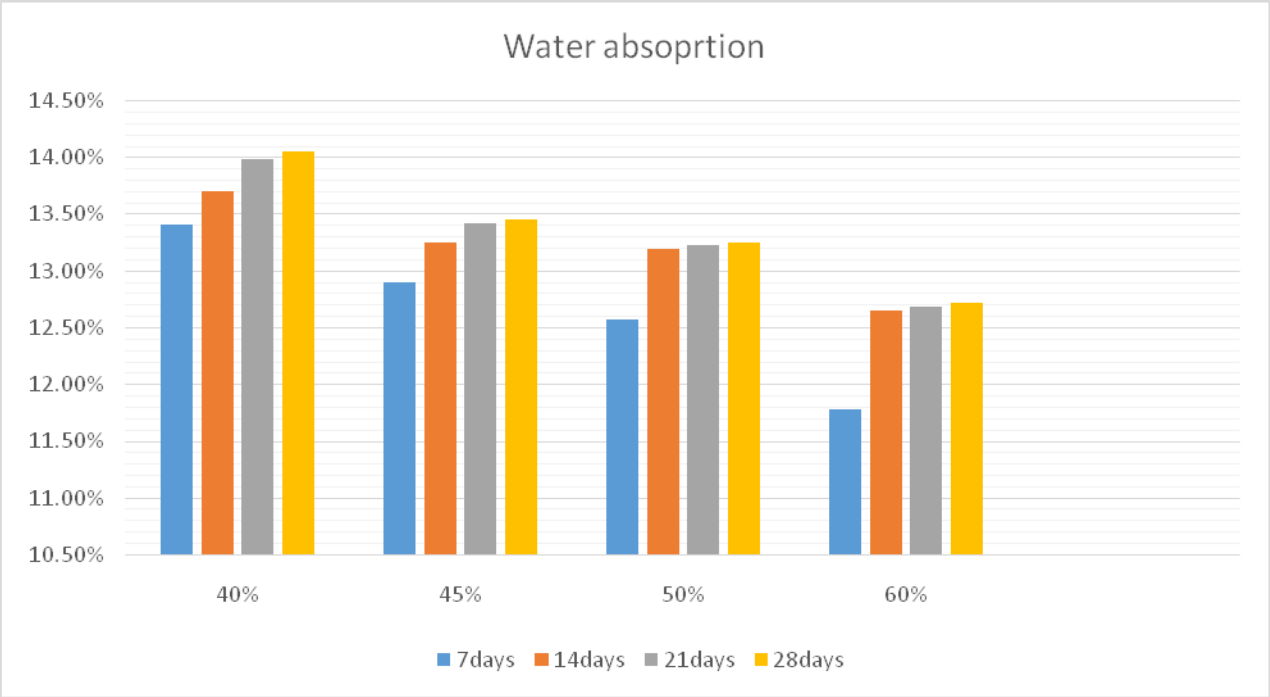

Fig 1 Water absorption for different period of fly ash bricks

COMPRESSIVE STRENGTH TEST

FORMULA FOR CALCULATION

Formula for calculation of compressive strength is given by:-

$$\text{Compressive Strength} = \frac{\text{Maximum load at failure(N)}}{\text{Avg. area of bed face}(mm^2)}$$

Table 3 Compressive Strength of Fly Ash Bricks

Specimen	7days (MPa)	14days (MPa)	21days(MPa)	28days (MPa)
Fly Ash 40%	5.34	5.44	5.83	7.42
Fly Ash 45%	5.70	6.15	6.85	7.63
Fly Ash 50%	6.44	7.20	7.90	8.5
Fly Ash 60%	5.79	6.32	6.85	7.52

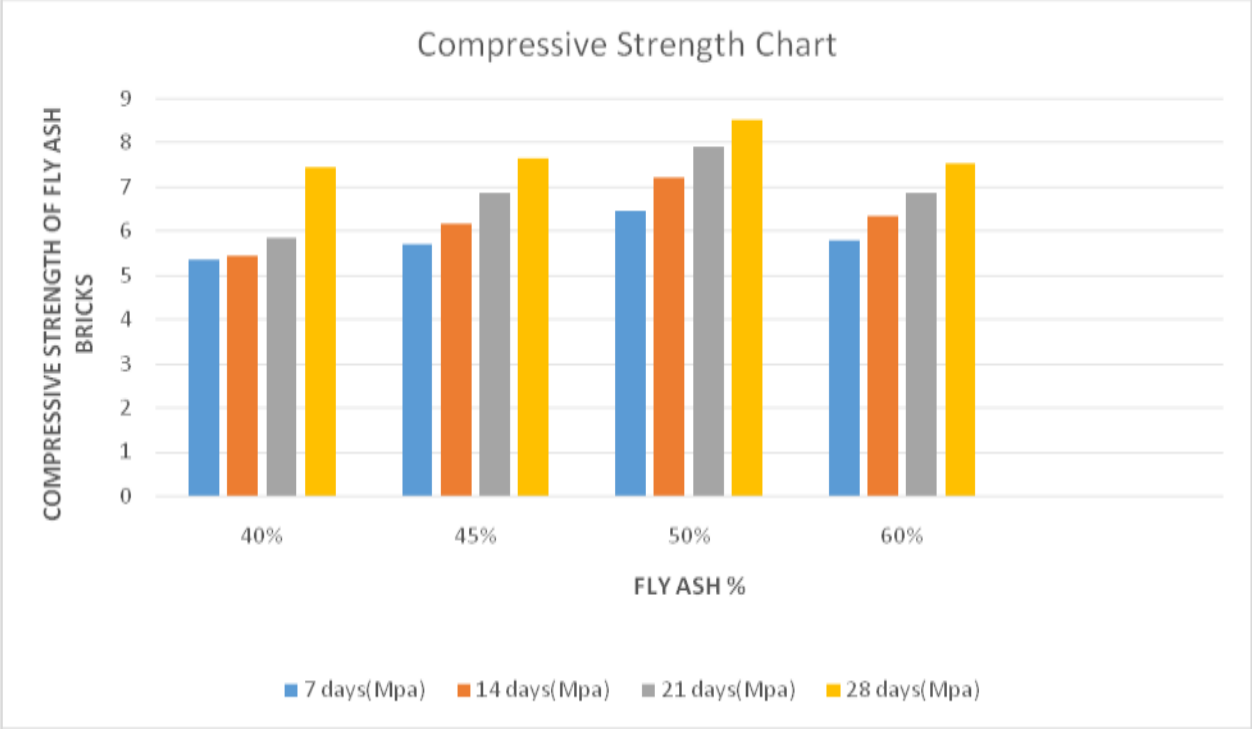

Fig 2 Compressive strength of fly ash bricks for different period

EFFLORESCENCE TEST FOR FLY ASH BRICKS

Table 4 Efflorescence for fly ash bricks

Specimen	Efflorescence
Fly Ash Bricks 40%	SLIGHT
Fly Ash Bricks 45%	SLIGHT
Fly Ash Bricks 50%	SLIGHT
Fly Ash Bricks 60%	NIIL

TEST ON TRADITIONAL RED BRICKS: -

TOLERANCE TEST

Table 5 Tolerance Test For Fly Ash Bricks

SPECIMEN	Length(mm)	Width(mm)	Height(mm)
REDBRICKS	4620	2180	1430

Results;-Tolerance test is under permissible limit

WATER ABSORPTION TEST

Table 6 Water Absorption For Traditional Red Bricks

SPECIMEN	7 Days	14 Days	21 Days	28 Days
RED BRICKS	11.64%	14.65%	15.71%	16.29%

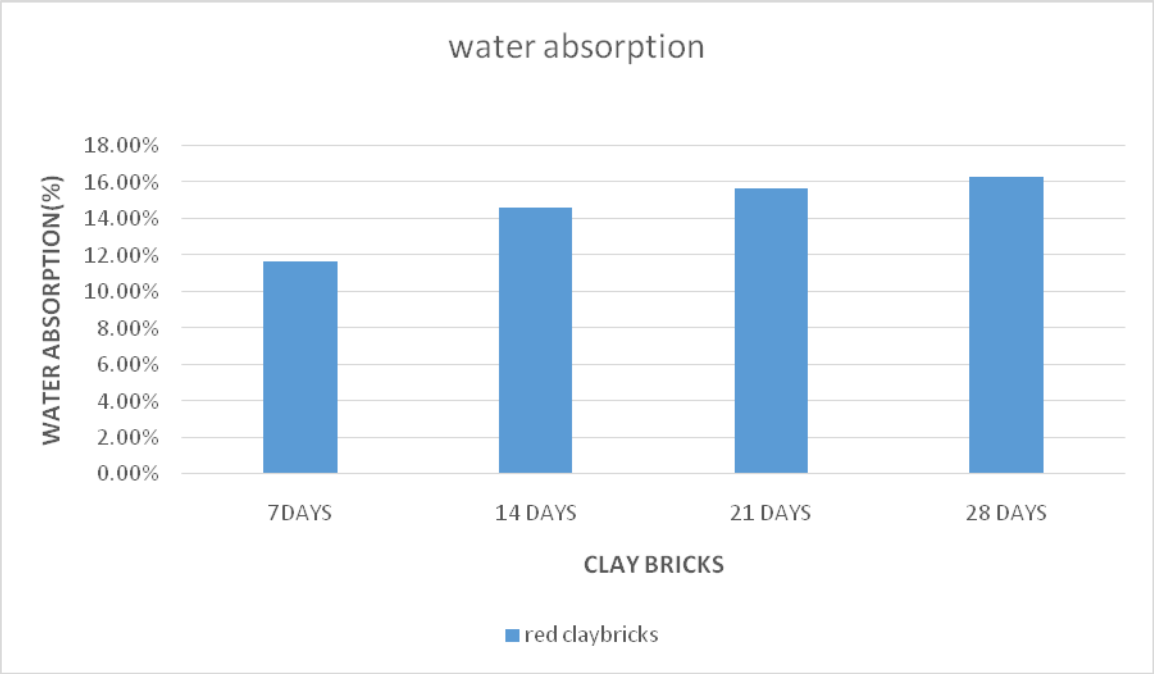

Fig 3 water Absorption of red brick for different period

COMPRESSIVE STRENGTH TEST

Table 7 Compressive Strength For Traditional Red Bricks

SPECIMEN	7 Days(MPa)	14 Days(MPa)	21 Days(MPa)	28 Days(MPa)
RED BRICKS	5.22	5.76	6.54	6.93

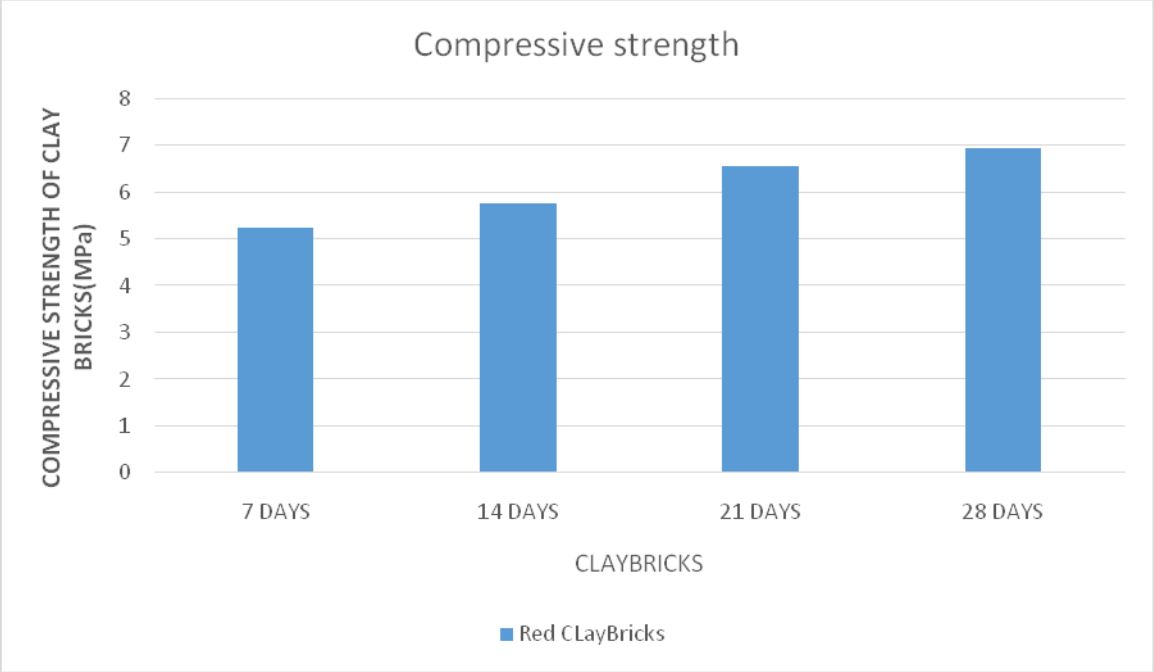

Fig 4 Compressive strength of red clay bricks for different periods

EFFLORESCENCE TEST

MODERATE as approx. 30% area is covered by salts.

ANALYSIS

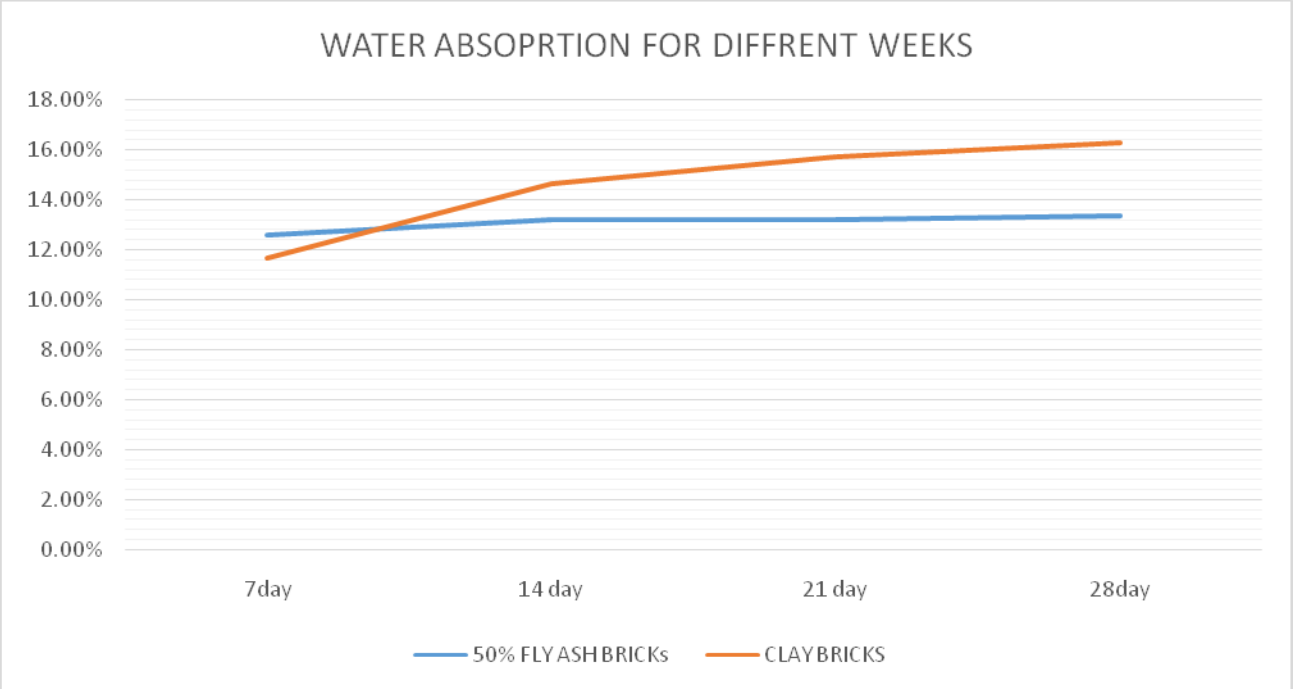

Fig 5 Comparison of water absorption between fly ash and red clay bricks

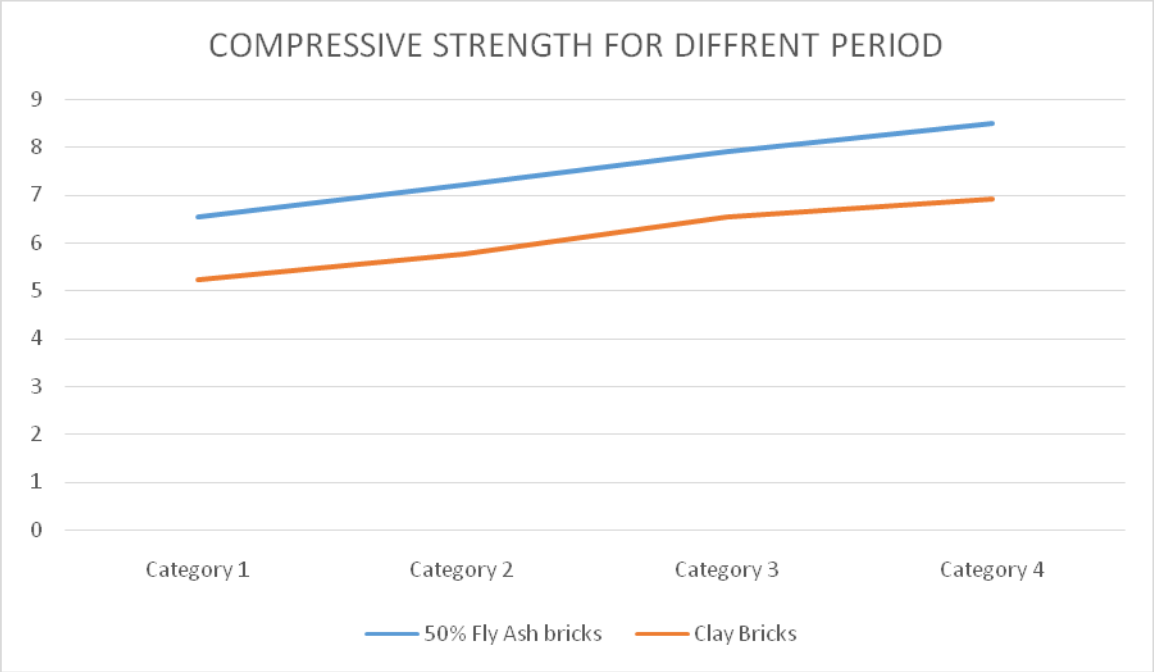

Fig 6 Comparison of Compressive strength between fly ash and red clay bricks

CONCLUSION

Fly ash utilization in the country has remained less than 30% during the past 5years and it might take several years to reach final goal of present utilization. It is estimated at present nearly 160 million tonne fly ash is produced every year, out of which hardly 40-50% is used in all possible applications.

To utilize such a huge quantity of ash, we have to take necessary actions from government side and from non-government side for utilization point of view.

Table.8 Comparison Between Fly Ash Bricks And Traditional Red Bricks

Properties	**Red bricks**	**Fly ash bricks**	**Remarks (for fly ash bricks)**
Colour	vary	uniform	good appearance
Density	1600-1750 kg/m^3	1700-1800 kg/m^3	Higher load bearing
Compressive Strength	8.5 (for 28days of 50% fly ash)	6.93(for 28days)	Higher load bearing
Water absorption	11-16.5%	11-14%	less dampness
Dimensional Stability	under permissible limit	under permissible limit	saving mortar upto 25%
Wastage during	up to 10%	less than 2%	saving in cost upto 8%
transit plastering	thickness vary on both sides of the walls	even on both sides the of walls	saving in plaster upto 15%

Thus, Fly ash is best used in Fly ash bricks. It may be concluded that the use of fly ash in brick manufacturing industry is techno-economically, if utilized by application of optimum technologies. Fly ash brick manufacturing is a potential field of application where in large scale utilization of fly ash is possible. It can be inferred that fly ash bricks are better alternative to traditional red clay bricks in terms of 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 in wealth.

REFERENCE:

1. Chou, Mei-In Melissa, et al. "FUEL 28-An environmental feasibility assessment of fired brickscontaining fly ash." abstracts of papers of the American chemical society. vol. 232. 1155 16th st, nw, Washington, dc 20036 use: amer chemical soc, (2006).
2. Cicek, Tayfun, and Mehmet Tanrıverdi. "Lime based steam autoclaved fly ashbricks." Construction and Building Materials 21.6 (2007): 1295-1300
3. Dayal, Freeda C., D. Tensing, and Mercy R. Shanthi. "In-plane shear behaviour of BrickMasonry-A Literature Review on experimental study." International journal of civil and structural engineering 2.4 (1995) 1146.
4. Fatih, Tütünlü, and Atalay Umit. "Utilization of fly ash in manufacturing of building brick." International ash utilization symposium. Center for applied energy research, University of Kentucky Paper. Vol. 13 (2001).
5. Kumar, Ravi, and Deepankar Kr Ashish. "Study of properties of light weight fly ashBrick." International Journal of Engineering Research and Application (IJERA) 29 (2014).
6. Kute, S., and S. V. Deodhar. "Effect of fly ash and temperature on properties of burnt claybricks." Journal of the Institution of Engineers. India. Civil Engineering Division 84.AOU (2003): 82-85.
7. Kayali, Obada. "High performance bricks from fly ash." Proceedings of the World of Coal AshConference, Lexinton, Kentucky (2005).
8. Kumar, Rinku, and N. Hooda. "An experimental study on properties of Fly ash bricks." Int. J. Res. Aeronaut. Mech. Eng 2.9 (2014): 56-67.
9. Mistry, Sameer, et al. "Fly Ash Bricks Masonry: An Experimental Study." National Conference on Recent Trends in Engineering & Technology (2011).
10. Prasad, HN Rajendra, et al. "An Approach for Alternative Solution in BrickManufacturing." International Journal of Science, Environment and Technology 3.3 (2014).

INDIAN STANDARD CODE REFERRED: -

1. IS 6491: 1972 Methods of sampling fly ash
2. IS 3495 Method of testing of burnt clay Building bricks
   (Part 1): 1992 Determination of Compressive strength
   (Part 2): 1992 Determination of Water Absorption

(Part 3): 1992 Determination of Efflorescence

3. IS 12894: 2002 Pulverized Fuel Ash Lime Bricks-Specification (First revision)
4. IS 3812 Pulverized Fuel Ash –Specification

(Part 1): 2003 for use as Pozzolana in Cement, Cement Mortar and Concrete

(Part 2): 2003 for use as Admixture in Cement Mortar and Concrete.