

A Review Study on Alternate Low Cost Construction Materials & Techniques for Building Design

Vivek Kumar¹, Vidit Gupta², Shivam Sagar³, Sushant Singh⁴, Mohd. Haroon⁵

¹²³⁴UG Student, Department of Civil Engineering, MIT Moradabad, Uttar Pradesh, India

⁵Asst. Professor, Department of Civil Engineering, MIT Moradabad, Uttar Pradesh, India

Abstract – this paper reviews the Alternate construction materials and techniques for building design in the field of civil engineering. It comprises the important analysis and results from the experimental and literature of many authors. Housing is a great problem in today's world. The most basic building material for construction of houses is the conventional burnt clay brick. A significant quantity of fuel is utilized in making these bricks. Also, continuous removal of upper surface of soil mass, in producing conventional bricks, creates environmental problems. A feasibility study has been done on the comparison of fly ash brick and conventional clay brick. Fly ash is an industrial waste which is just a burden for the industry we can take it free of cost from the industries and can utilize it for the manufacturing of fly ash brick. Fly ash brick have sufficient strength and comparatively low cost than conventional clay bricks. Conventional clay bricks can be replaced with fly ash bricks, which can reduce the overall cost of a house.

Key Words: Housing, Industrial waste, Fly ash brick, Conventional clay brick, Strength, Overall cost.

1. INTRODUCTION

There is a general exodus of rural population to the cities with the rapid industrialization in developing countries. The infrastructure to support these cities, such as buildings for housing and industry, mass transit for moving people and goods, and facilities for handling water and sewage will require large amounts of construction materials. Enhanced

construction activities, shortage of conventional building materials and abundantly available industrial wastes have promoted the development of new building materials.

The rapid increase in the capacity of thermal power generation in India has resulted in the production of a huge quantity of fly ash, which is approximately 50 million tons per year. The prevailing disposal methods are not free from environmental pollution and ecological imbalance. Large stretches of scarce land, which can be used for shelter, agriculture or some other productive purposes, are being wasted for disposal of fly ash.

Fly ash, lime and gypsum are available in mutual proximity in many regions. An economical alternative to conventional burnt clay bricks will be available, if these materials can be used to make bricks and hollow blocks of adequate strength. Lime and gypsum are usually available either from mineral sources or may be procured from industrial wastes. Materials used for the manufacturing of fly ash bricks and their constitution, is as shown in table 1:

| Material | Percentage % |
|---------------------|--------------|
| Fly ash | 60 |
| Sand/stone dust | 30 |
| O.P.C (Lime+Gypsum) | 10 |

Table (1)

The chemical composition of the materials used for the manufacturing of fly ash bricks:

| CONSTITUENTS | PERCENTAGE (%) |
|--------------------------------|----------------|
| Loss on Ignition | 5.90 |
| SiO ₂ | 57.01 |
| Al ₂ O ₃ | 23.83 |
| Fe ₂ O ₃ | 6.66 |
| CaO | 3.34 |
| MgO | 1.77 |
| SO ₃ | 0.56 |

Table (2) Chemical Analysis Of FlyAsh

| CONSTITUENTS | PERCENTAGE (%) |
|--------------------------------------------------|----------------|
| Loss On Ignition | 5.65 |
| CaO | 63.25 |
| SiO ₂ +Al ₂ O ₃ | 25.00 |
| MgO | 4.70 |

Table (3) Chemical Analysis Of Lime

2. LITERATURE REVIEW

Many authors have reported the use of fly ash brick in the replacement of conventional clay brick, for the purpose of cost reduction. Many papers have been published on Low Cost Housing, some of them are:

Bredenoord J carried out study on sustainable Housing and Building Materials for Low-income Households; it is

observed that sustainable goals for low-cost housing and applications are achievable. Measures concerning the physical development of neighborhoods, such as urban density and connectivity are equally as important as measures concerning community development. The final comprise support for community built organizations, small housing cooperatives (or similar forms of cooperation) and individual households – or small groups – that build and increase their houses incrementally. Adequate design and social organization and support are preconditions for achieving sustainability in incremental housing.[1]

F.Pachecotorgal carried out study on Earth construction and Building materials, it is observed that in this paper earth construction has a major expression in less developed countries, on the other hand the mimetic temptations near more poisoning construction techniques based on reinforced concrete and bricks that fired up are likely to favor a change near a clear unsustainable design. In order to disclosure and highlight the importance of earth construction this article reviews some environmental benefits such as non-renewable resource consumption, waster generation, energy consumption, carbon dioxide emissions and indoor air quality.[2]

John M.Hutcheso carried out study on project management of low cost housing in developing countries, it is observed that the study of this paper include designs, cost control systems, communications , contract law and planning. An appreciation of the evidence compounded from the problems portrayed throughout the paper leads to decisions of the need for simplifications of designs, the impact of inadequate local support and hence the need for detailed and complete advanced planning. In addition the conclusions stress the need for the careful collection of self-supportive teams of multi-disciplined professionals and sub professionals.[3]

Preetpal Singh carried out study on Low Cost Housing: Need For Today's World; it is observed that Construction

cost in India is increasing at around 50 per cent over the average inflation levels. It have enumerated increase of up to 15 per cent all year, mainly due to cost of basic building materials such as steel, cement, bricks, timber and other inputs as well as cost of labour. As a result, the cost of building by means of conventional construction materials and construction is becoming beyond the affordable limits particularly for low-income groups of population as well as a big cross section of middle - income groups. So, there is essential to adopt cost-effective construction methods either by up-gradation of traditional technologies using local resources or applying current construction materials and methods with well-organized inputs leading to economic solutions. By using Low Cost Housing Technologies, we can reduce approx. 25% of the total cost of housing.[4]

R.Caponetto carried out study on Ecological materials and technologies in low cost building systems, it is observed that the high recyclability of natural materials that can be used in low cost building associated with construction techniques capable of exploiting the principles of bioclimatic architecture for liveliness needs allow us to create building environmentally conscious and responsible. At the same time the project of a special block was developed to meet the needs of sustainability and ease of construction.[5]

Swaptikchowdhury carried out study on Prospects of low cost housing in India, it is observed that in this paper alternative construction materials mainly natural material such as bamboo, straw, usage of Bagasse -cement boards and panels, bagasse -PVC boards, Coir-CNSL board, Jute coir composites, coconut and wooden chips roofing materials, Manmade materials like fly ash, aerocon panels, ferro cement, rice husk were studied and the potential of these materials to be used as alternate building materials is brought out.[6]

Sengupta Nilanjan carried out study of appropriateness of cost effective building construction technologies, it is observed that this paper studied the acceptability and

adaptability potential of different cost effective building constructions through field survey, literature study and technical calculations and tried to find out the most appropriate one among those.[7]

3. RESULT

Many experimental work have been done on fly ash bricks with different mix and proportions. Combinations were made: (i) fly ash, clay, sand and (ii) fly ash, cement, stone dust and (iii) fly ash, Lime, sand and Gypsum. Maximum compressive strength found 93.25 Kg/cm² for mix 30:40:30, 105 Kg/cm² for mix 35:07:58 and 174 Kg/cm² for mix of 40:30:20:10 respectively.[8]

4. CONCLUSION

The investigation has been done shows the following conclusions:

1. Fly ash is an industrial waste from the power stations; there rise a big problem of utilization of fly ash.
2. Fly ash can be used for different purposes as it shows the cementing properties when mixed with water.
3. The fly ash bricks can be manufactured easily and show sufficient strength.
4. Cost of the fly ash brick is very low as compared to conventional clay brick.
5. Conventional clay bricks can be replaced with the Fly ash brick.

5. DISCUSSIONS

From the conclusion we can say that Fly ash brick is a good building material and can be used as an affordable building material to replace conventional clay brick. Use of fly ash brick as a building material for the construction of walls is not only viable alternative to conventional clay brick but also a solution to a difficult an expensive waste disposal problem.

6. REFERENCES

- [1] Bredenoord J, (2016), "Sustainable Housing and Building Materials for Low-income Households", Jr ArchitEng Tech 5: 158.
- [2] F.Paceco torgal , Said jalai, (2012), "Construction & building materials, Construction & building materials", 29, pp-512-519.
- [3] John M.Hutcheson, (2011), "Project Management of Low Cost Housing in Developing Countries", Journal Architectural Science review, Vol-28, pp 8-11.
- [4] PreetpalSingh, Gurjeet Kumar, (2016), "Low Cost Housing: Need For Today's World", International Journal of Engineering Research-Online A Peer Reviewed International Journal, Vol-4, Issues-3.
- [5] R.caponette & G. De Francisc, (2013) "Ecological materials & technologies in low cost building system"Int.Journal for housing sciences,Vol-37, pp-229-238.
- [6] Swathikchowdhury, SangeetaRoy,(2013)"Prospects of low cost housing in India",Geomaterials, pp-60-65.
- [7] Sengupta Nilanjan & Roy Souuvanic ,(2013), "Study of Appropriateness of cost effective building construction technologies in India".
- [8] R.V.Shinde,(2016) "Study of Engineering Properties of Fly Ash Bricks for Construction", IJRSEI, pp-2347-6710