iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** IV **Month of publication:** April 2024

DOI: https://doi.org/10.22214/ijraset.2024.60957

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

"Development of Rammed Earth Wall Panels"

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Abstract: ***Cutting edge engineers commit cautious consideration to the environment of a extend and think about authentic building strategies they can make more feasible structures. Rammed-earth development is a warm mass structure which cools the internal spaces of house amid hot, summers and keeps warm amid winters. It is a noteworthy building strategy ancient of approximately 2,000 a long time, and the strategies of local specialists offer recommendations as to how cutting edge engineers can effectively apply the method.***
Keywords: Rammed earth construction, Fly Ash, Agricultural waste (rice straw, rice husk), natural materials (soil, sand), Sustainability

I. INTRODUCTION

All six continents of the world have utilized the thousands-year-old natural building technique known as rammed earth (pise). There are numerous advantages to rammed earth constructions. They are inexpensive to produce and use a low-tech building approach. Both hot and cold climates can use them, and they require little upkeep. This method uses natural raw materials like dirt, chalk, lime, or gravel to build floors, walls, and foundations.

This is an old technique that has been resurrected as a sustainable building technique. All continents, with the exception of Antarctica, are home to rammed earth buildings, which can be found in a variety of settings such as tropical, semiarid, wet, and temperate deserts. Having appropriate soil and designing a house that fits the area.

II. LITERATURE REVIEW

The advantages of rammed earth construction, such as its ability to save energy and water, make it a promising material for many applications.

However, the proliferation of these techniques is being hindered by a drop in research. The necessity to continue the optimization research of rammed earth walls using modern technology, from its prescription and mix proportion additive and construction tools, etc., is brought up based on the review of Revolution history and contemporary practice. This will help to achieve its reactivation and promote low-tech green buildings.

Which consistently promotes the rejection of this method. While many writers have offered advice on how to create rammed earth walls safely in the literature, very few have discussed quality control both before and throughout the building process.

1) There are very few worldwide norms or laws governing the use of rammed earth in construction, in contrast to other prevalent modern building materials like concrete, mortars, or burned clay bricks.
2) In scenarios involving both samples and walls, this study presents a basic methodology and defines unified criteria for the production and quality control of this constructive technique, based on statistical analysis.
3) To create a uniform, mixture soil, sand, fly ash are thoroughly mixed
4) To increase its solidity, this moist earth is put into a shape in thin layers and rammed. Together with compressive strength and water resistance, density increases.

III. MATERIALS AND METHODS

The goal of the current project is to develop sustainable building techniques for rammed earth wall panels by utilizing naturally occurring materials such fly ash, gravel, sand, and soil.

It is made of materials derived from natural resources that are renewable.

Table 1 enumerates the different materials and notes where local sources can obtain them.

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Table 1: List of materials used and there local place of collection

Sr. No.	Name of Material	Name of Place
1	Soil samples	Local fields Tumsar ,Bhandara
2	Sand	Wainganga river - Tumsar
3	Rice straw	Rice fields, Tumsar , Bhandara
4	Fly ash	Adani Power plant , Tirora
5	Lime	General shop ,Tumsar
6	Rice husk Ash	Local farms at Tumsar
7	Gravel	Wainganga river, Tumsar

The various materials are used are shown in Figures


Fig : Black soil


Fig. : Red soil.




Fig. : Fly ash.


Fig.: Sand.


Fig.: Rice husk ash

Fig.: Materials used for Rammed earth wall panel

A. Methods used for construction of Rammed earth wall panels

1) Soil identification and preliminary soil site tests
2) The drop test
3) The jar test -"Particle size test"
4) Soil mixing
5) Foundations
6) Formwork
7) Ramming
8) Plastering, Rendering and Re-touch

The traditional method of building with Rammed Earth involves mixing dirt and sand. However, these examples are made using the modified method that follows.

a) Local fields are used to gather samples of clayey soil.
b) The percentage of fine grains (clay and silt) is determined by sieve analysis.
c) Collected fly ash is used to make geopolymer.
d) The compressive strength of rammed earth cubes is tested by adjusting the proportions of clayey soil, fly ash geopolymer, and appropriate amounts of sand and gravel.
e) 12” x 12” x 1.8” wooden molds will be used to prepare the rammed earth wall panels.



fig. Soil identification



Fig. :- Drop test

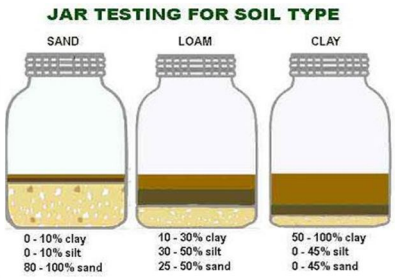


fig. Jar test



Fig. Soil mixing



fig. Formwork



fig. Ramming

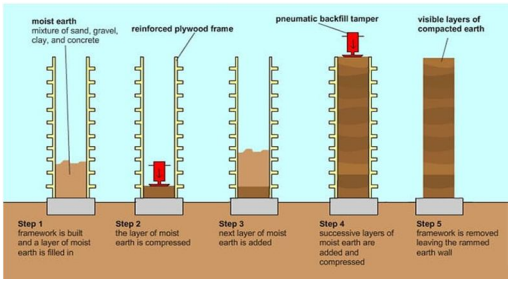


fig. Pouring of soil mix and compaction



fig. Foundation



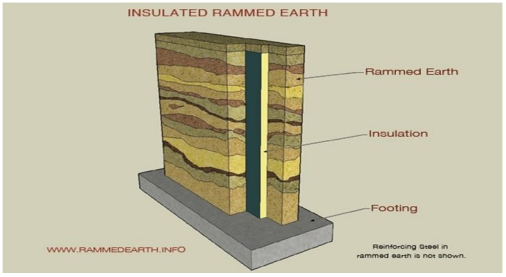


Fig. Developed Rammed earth wall panel

B. Environmental Effects And Sustainability

1) Compared to other building methods that use more cement and other chemicals, rammed earth construction is more environmentally friendly and sustainable. Rammed-earth buildings often have low embodied energy and produce very little waste because they are constructed using locally accessible resources.

2) It is advised to employ waste materials in order to lessen the impact of SRE on the environment.
3) Rammed-earth building may help lessen the harmful effects of artificial materials used in traditional building methods and the ecological effects of deforestation.
4) When it comes to building solid masonry structures, rammed earth is arguably the least harmful building material and method currently accessible on the commercial market.
5) The highly processed and designed form of rammed earth has the potential to produce considerable emissions, although rammed earth itself has relatively low emissions.

IV. RESULTS AND DISCUSSIONS

A. *Properties of Rammed Earth are*

Thermodynamic Mass Rammed earth's inadequate thermal insulation qualities have been noted. It takes thick walls to give out a high thermal mass. It to improve wall cross section thermal performance, better insulating techniques are required.

1) *Noise Reduction:* There is extremely little noise transmission due to the walls' thickness and density.
2) *Study:* Research from CSIRO and centuries of use across the globe have demonstrated how resilient and weather-resistant rammed earth is.
3) *Low Maintenance:* Once constructed, rammed earth homes require little to no maintenance for many years. Finishing rammed earth walls inside or out with plaster, gab, or paint is not necessary.
4) *Earth is Fireproof*: it never burns. Thus, rammed earth ought to be resistant to fire.

B. *Environmental Benefits of Rammed Earth Construction*

1) Because it regains strength faster and shrinks less quickly than concrete, rammed earth lasts longer. Because rammed earth can resist temperatures as high as this, it has a higher chance of surviving a fire than other materials. It also has increased corrosion resistance, which is crucial given the harm pollution has done to the ecosystem. Conventional building materials have a substantially lower lifespan due to acid rain.
2) *Lowers Energy Consumption:* When mixing, less energy is needed. Massive amounts of coal or natural gas are required to heat the raw materials that are used to make other building materials like steel, cement, and bricks. Since fly ash is already a byproduct of other processes, using it to build green concrete doesn't require much additional energy.
3) *Lasts Longer:* Rammed earth has a longer lifespan as it regains strength faster and shrinks less rapidly than concrete t. Rammed earth offers a higher chance of surviving a fire than other materials since it can withstand temperatures as high . Furthermore, considering the damage pollution has caused to the environment, it has greater corrosion resistance, which is vital. Because of acid rain, conventional building materials have a much shorter lifespan.
4) *Reduces Carbon Dioxide Emissions:* Up to 90% less carbon dioxide is released during the construction of Rammed earth building. Rammed earth for building will be very helpful in the worldwide drop down emissions.

C. *Applications of Rammed earth*

1) It is use to construct residential buildings which gives excellent thermal insulation and appearance.
2) It is used in public and institutional buildings.
3) It can be used at places where cement, steel construction leads to increased in cost and natural materials available easily



Fig. Applications of Rammed earth

V. CONCLUSIONS

After all seen in this project, we have arrived to several conclusions:

1) Earth building techniques are highly significant in today's world for a variety of reasons, including their advantages, lower costs, and the fact that they require no material transportation, which provides us with a strong argument for lowering the energy required to build structures—a very positive environmental outcome of all the earthwork methods, rammed earth exhibits superior qualities and strength because of the ramming process. It can also be further enhanced by adding additives like fly ash, rice straw, and other Geopolymers.

2) This method strengthens and increases the wall's resistance to water. Earth materials' properties, especially those of mixes, are simple to calculate and, for the most part, intuitive to comprehend. When doing both field and lab tests,

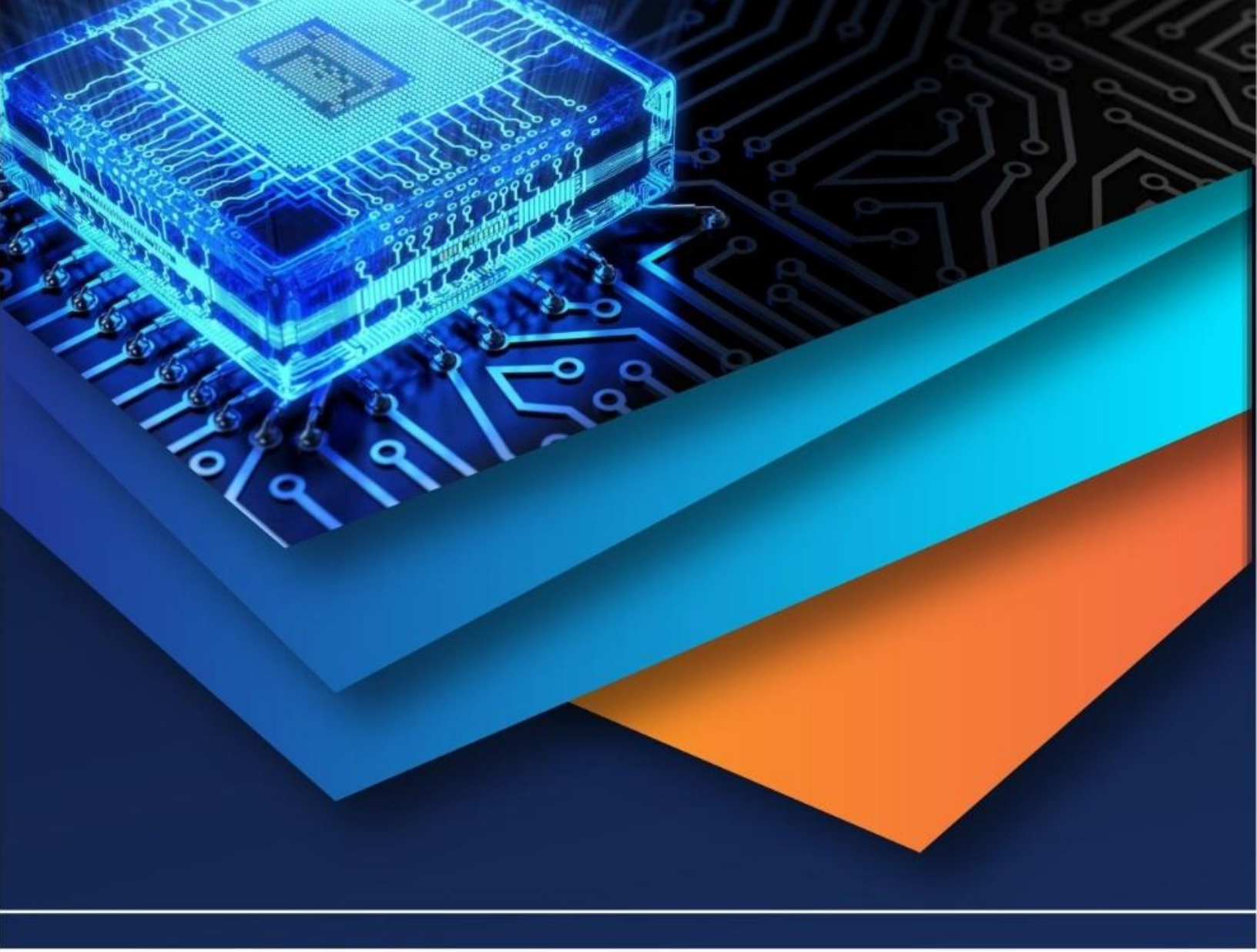
3) The costs of a house with brick walls and one made of rammed earth have been compared. About 55% of the entire cost of building a brick wall is associated with rammed earth walls. The issue of expensive housing may be solved by building sturdy, reasonably priced rammed earth homes. Earthen structure comes in a variety of shapes worldwide. It represents the least carbon-intensive method of constructing sturdy structures in nearly all cases.

4) Global warming is a grim reality of the twenty-first century. It is very evident that 8% of the world's carbon emissions are currently caused by the manufacturing of cement alone. One significant element of the puzzle in the fight against climate change is reducing the usage of cement. Eliminating or reducing the requirement for cement is a fantastic

REFERENCES

[1] Berge, Bjørn(2009). The Ecology of Building Accoutrements. Architectural Press
[2] Boltshauser, Roger & Rauch, Martin(2011). HausRauch einModell modernerLehmarchitektur = The Rauch house a model of advanced complexion armature. Basel Birkhäuser
[3] CRATerre, 1982. Recommendations pour la generality des bâtimentsdu Village Terre. Plan Construction/ AGRA.
[4] Easton,D. 1996. The rammed earth house. White River Junction, Vt. Chelsea Green Pub.Co.
[5] Easton, David(2007). The rammed earth house.Rev. ed. White River Junction, Vt. Chelsea Green Pub. Co
[6] Houben, Hugo & Guillaud, Hubert(1994). Earth construction comprehensive companion. London Intermediate Technology

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