

DESIGN AND FABRICATION OF SUPERADOBE AND ITS SCOPE IN KERALA

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Abstract - Superadobe is a form of a building practice that can be adopted all over the world for constructing permanent or temporary structures. It is also known as Earthbag construction. It is a form of low cost and fast construction technique. Superadobe is a compression structure that can be easily built by unskilled labor. It uses the structural principles of single and double curvature compression structures with buttresses to avoid over turning. Our project idea avoids the use of buttresses by increasing the width and remove the friction providing barbed wire with an iron rod. Usually, this type of construction practice can be used for rehabilitation purposes and reducing temperature in high-temperature areas. The superadobe structure can resist earthquake flood control, erosion control, hillside slopes and embankments. The work includes the study of soil, selecting the PP (polypropylene) bag and making a simple structural drawing for effective construction. Hence we construct a prototype of superadobe building with degradable polypropylene bags. Thus it comes under the category of sustainable construction and in earthquake engineering studies

Key Words: Rehabilitation, Buttress, Polypropylene, Degradable, Barbed Wire

1. INTRODUCTION

Superadobe technology is a conventional construction technique developed by Iranian architect Nader Khalili which is not originated from the modern architecture design experience, but the influence of traditional rural buildings and landscape. This type of construction help to build own houses without the use of heavy equipment, with materials native to the country of use. Side slopes and infrastructures square measure applications during which the superadobe system has a nice prospect. There is another term for earth building normally named as "Cob" in traditional English. They mostly used for building with clay, sand, and straw. But superadobe is a kind of building that uses sand and clay or soil of higher stiffness for construction.

1.1 SCOPE AND OBJECTIVE

Designing a building for survival and rehabilitation is much beyond the scope of design for beauty and science. With resemblance of such a scope, the earthbag building is proving to be of much efficient, low cost and also a low-impact

alternative to present-day conventional seismic construction practices. Introduction to the project should also have to focus on its structural concept which should be simple and easy to convince. Going deeper the objective just focus on

- To construct a shelter during the time of disaster with unskilled labor.
- Unreliable cost for safer temporary shelter houses.
- The project is to make sure that the total strength of the superadobe increases day by day there for it can deviate the water of higher strength, construct the double-story building easily, resist landslide erection and high earthquake protection.

2. MATERIAL USED

The material used here is

2.1 POLYPROPYLENE BAG

Polyethylene bags have many good characteristics that are very similar to the other major poly bag substance. The polypropylene is completely clear and gets degradable when exposed to UV rays. They are not static resisting so it will not affect soil degradation.

High-Density Polyethylene – HDPE

HDPE is mostly used for manufacturing outlets. The chemical composition of the polymer that consists of a long chain of straight molecules whose structure is linear throughout and features minimal branching. This structure of HDPE results in highly dense plastic bags that are sturdy, light in weight and relatively opaque in nature. The bag is also extremely resistant to chemicals, water, and even heat comparably. It can conceal the content carried because of its opaque nature and it is safe for packing. It is also used for manufacturing used in handling, packaging or serving materials that require a CO₂ or oxygen barrier.

Low-Density Polyethylene- LDPE

These types of plastic bags are commonly used in the manufacturing stage. The polymer is constructed with short and branched chains that are prepared with low density. This results in a plastic film that is light in weight and of low tensile strength. The resulting bag is not stretchable like the

HDPE. The plastic is of a low melting point, making it for heat sealing applications. The light polymer is easy to see through it.

Linear Low-Density Polyethylene- LLDPE

These are a common type of plastic bag material used for the manufacture of plastic bags. The polymer is improved with non-branching chains but the tensile strength is low compared to that of HDPE. The gauge and clarity of LLDPE are slightly lower compared to high-density polyethylene plastic but the strength can be maintained. Thus they are more cost-effective and preferred compared to low-density polyethylene plastics

Medium Density Polyethylene MDPE

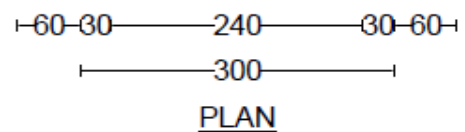
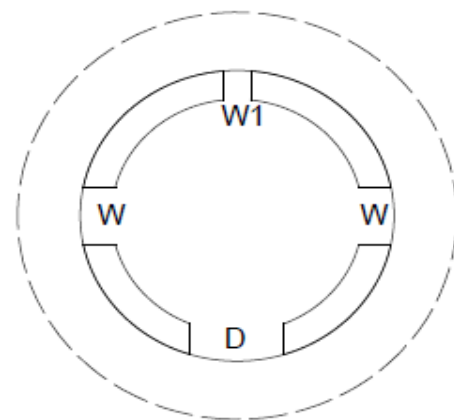
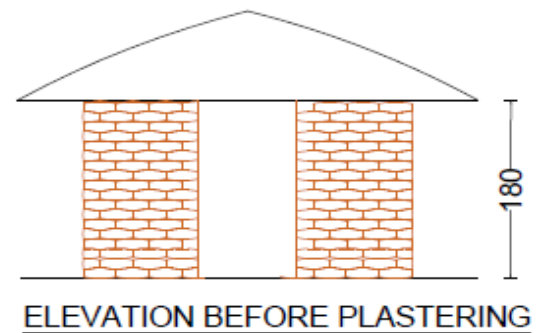
This is in between high density and low-density polyethylene. Though it is not as opaque as high density, it is not as clear as low-density polyethylene but it is also not dense enough to accommodate bulk storage. It comes with low tensile properties and easily stretches and are tolerant of chemical encounter.

3. METHODOLOGY

A wide variety of materials are being used to construct Superadobe building. Normally earth or sand, cement or lime, and polypropylene bags are being used. What is important is that they should be UV resistant or else the wall should be quickly covered in plaster. If the filling material is weak to bind together then the bags have to be really strong and UV resistant or else plastered right away. The material can be either wet or dry, but the structure will be more stable when the tube's contents have been moistened during filling. Other materials needed include water, shovels, tampers, steel rod of 1-1.5cm diameter, scissors, large plugs or pipes, and small buckets or plastic pots for filling the sacks.

3.1 PROPOSED SYSTEM DESIGN

The proposed design consists of drawing and its analysis of foundational work. The foundation is considered with the relevance of the present situation of the area. In Kerala, we have faced earthquake with a magnitude of 2.2 on the Richter scale that hit I dukki district on Thursday morning as it was centered in the forested area of kulamavuam and a flood that affects 14 districts resulting in massive distractions are the relevant situation taken for the construction.



PIC -1: Autocad drawing

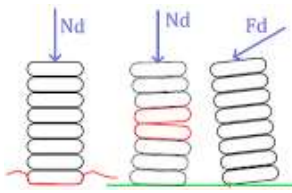
3.2 CONSTRUCTION PROCESS

The foundation for the structure is formed by digging a 15-20 cm deep circular trench with a 300 cm diameter. A trench of 15 cm was laid with gravel of 5-8 cm thick and bag having soil of higher bonding strength. A thread is anchored to the ground in the center of the circle and used as a compass to trace the shape of the base. Another thread is fastened just outside the wall. The center thread is used to ensure the accuracy of each new superadobe layer as it is laid and tamped. The thread must be made of non-stretchy material to ensure an accurate geometry. On top of each layer of tamped, filled tubes, iron bars of 10 mm diameter is passed through the PP bag to help stabilize the location of each consecutive layer: it plays a crucial role in the tensile strength of the structure - it is the 'mortar'. Window voids are placed by a wooden frame attached to the top of the soil-filled PP bag.

3.3. PROVIDING REINFORCEMENT

The barbed wire is provided only to make friction but if an over lift is taken place the wire will lead to a worse conditions such as the tearing of bag and allowing water to rush into it.

So in order to avoid this our project proposed for hammering a rod into 3 layers of the bag so that they will join together with any uplift.



4. CONCLUSION

Superadobe is one of the inexpensive and environment-friendly technology. It helps to build the structures without the use of heavy equipment. It only needs low energy input and is resistant to extreme weather conditions. Building these type of structures helps to create a green and healthy human culture with small waste production and low environmental pollution

REFERENCES

- [1] Razia Kamal and Md. Saifur Rahman 2018, 'A study on feasibility of super adobe technology –an energy efficient building system using natural resources in Bangladesh', IOP Conference Series: Earth and Environmental Science, IOP Conf. Ser.: Earth Environ. Sci. 143012043
- [2] Pavan Gund and V. C. Patil, 'Green Building by Superadobe Technology', Journal of Advances and Scholarly Researches in Allied Education, Vol. XV, Issue No. 2, (Special Issue) April-2018, ISSN 2230-7540
- [3] Ziling Zhaoa, Qi Lub , Xinbo Jiangc, 'An Energy Efficient Building System Using Natural Resources', ScienceDirect, Elsevier

Numerical analysis of soil bags under compression (Yousef ansari, Richard merifield-published 8 may 2011)