# Green Building by Superadobe Technology

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***Abstract – Superdobe is a form of earth bag construction that was developed by Iranian architect "Nader Khalili". The technology uses layered long fabric tubes or bags filled with adobe to form a com-pression structure. The resulting beehive shaped structures employs corbelled arches, corbelled domes, and vaults to create single and double-curved shells that are strong and aesthetically pleasing. It has received growing interest for the past few years in the natural building and sus-tainability movements. In the last century earth bag buildings have undergone extensive research and are slowly gaining worldwide recognition as an optimum solution to the global epidemic of housing shortages. The technique's current pioneer is Nader Khalili who originally developed the superadobe system in 1984 in response to a NASA call for housing designs for future human set-tlements on the Moon and Mars. His proposal was to use moon dust to fill the plastic Superadobe tubes in layer. The Super Adobe Method is now use in Canada, Mexico, Brazil, Chile, Iran, India, Siberia, Thailand, as well as in the U.S.***

***Keywords: Superadobe Construction, Earthen Housing, Corbelled Structure, Emergency Shelter, Eco Dome, Layered Construction.***

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## INTRODUCTION

Approximately one third of the people of the world live in houses built with earth, and tens of thousands of towns and villages have been raised practically from the ground they are standing on. Today, world consciousness about the use of natural resources and the new perception of building codes as the steward not only of individual's safety, but of the planet's equilibrium, are leading us into the new millennium of sustainable living.

A Super adobe structure is made by filling long or short sandbags with earth from the building site and stacking or coiling them in to layers with barbed wares in between to serve as mortar and reinforcement. Bags and wire alone are adequate for short term use, such as in disaster relief; for a permanent home, cement or lime is added to the earth, the walls are coated with plaster, and the exterior gets a waterproof coating. Many Super adobe buildings use the structural principles of single and double curvature compression shells that have made arches and domes last for centuries, but Super adobe can also form rectangular shapes.

## FUTURE STUDY

Green building and sustainable development are the two main parameters which need to be focused as per environment point of view.

Advancement in concrete and other material will minimize the need of vast additional cement production capacity and thus will leads to sustainable development at global scale.

## OBJECTIVES

1) To develop buildings which use the natural resources to the minimal at the time of construction as well as operation? Green buildings emphasize on the resource usage efficiency and also press upon the three R's - Reduce, Reuse and Recycle.

2) Maximizes the use of efficient construction materials and practices; boosts the use of natural sources and sinks in the building's surroundings; minimizes the energy usage to run itself; uses highly proficient equipment for the indoor area; uses highly proficient methods for water and waste management. The indoor equipment includes lighting, air-

conditioning and all other needed equipment.

3) To ensure minimum negative impact on the environment by the construction and operation of a building, the factors which are to be kept in mind are - to preserve the external environment to the building location; to improve the internal area for the residents of the building; and also preserve the areas which are not close to the building.

4) Saving Energy: Energy saving through green building concept occurs in two ways. First is reduction in the amount of energy that is consumed in lighting, air conditioning and other building operations. Second is the usage of energy sources which do not produce any greenhouse gases and are renewable in nature. Green Buildings emphasize more on natural lighting and concepts of temperature control and efficient design to further reduce the carbon footprint as well as reduce cost of operation.

5) Saving water: Green Buildings use various methods to reduce water usage, treat and reuse waste water and filter water from sourced from precipitation. The target is to be able to achieve zero water table negative impact from the green building.

6) Reducing Waste: Waste reduction is one of the most important issues that are to be dealt with. In the US alone, the waste from construction and demolition of buildings accounts for sixty percent of the total non-industrial waste. Green Building concept emphasizes on improving the design of the product, re-using and recycling materials. It results in tremendous waste reduction and also helps to reduce the environmental impact of the building.

7) Improving Health and Productivity:- Hygiene and proper conditions inside the building also help in boosting human productivity. Hence various businesses concentrate on this aspect. Green Building concept provides for cleanliness and sound working conditions for employees and other inhabitants.

## LITERATURE REVIEW

**Prof. Hemant Salunkhe:** Super adobe technology is one of the most trending topics all over the world which is been put forward to reduce the significant impact of the construction industry on the environment, society and economy. The globe is in an urgent need of sustainable and a smart development as the problem of pollution and global warming is rapidly increasing all over the world. A drastic climatic changes also been noticed and being experienced all over the world due to increase in the Green House Gases (GHG's)

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This paper discusses the concerns over energy securit y measures and energy conservation in Indian context with a brief idea of different policies made and effected to construct new and renovate existing buildings in a direction towards Green Building concept .The potential for energy savings is 40-50% in new buildings designed based on Green Buildings where as for existing buildings it can go up to 20-25% based on retro fitting measures. The incremental cost vis-à-vis conventional building is around 5-8% with a payback period of 2-4 years. The importance and benefits of Green Buildings have been highlighted in the paper in a view to save our planet and sustain life.

## METHODOLOGY

*Superadobe Materials*

Many different materials can be used to construct Superadobe. Normally earth or sand, cement or lime, and Superadobe polypropylene tubing; bags can be polypropylene, or burlap. What is important is that they are UV resistant or else quickly covered in plaster. Virtually any fill material will actually work including un-stabilized sand, earth, gravel, crushed volcanic rock, rice hulls, etc. If the fill material is weak 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 is more stable when the tube's contents have been moistened. Other materials needed include water, shovels, tampers, wheel barrow, mechanical pumps, scissors, compass, large plugs or pipes (for windows), and small buckets or coffee cans for filling the sacks. If you decide to go the quicker way, then electric or pneumatic tampers can make the tamping easier, electric or gas powered bucket chain that can reach 7 meters or higher would eliminate the need of manual filling of sacks or tubing using coffee cans or small pails.

*Construction Process*

The foundation for the structure is formed by digging a 30 cm deep circular trench with 2 to 4m diameter. Two or three layers of the filled polypropylene sand tubes (superadobe tubing) are set below the ground level in the foundation trench. A chain is anchored to the ground in the center of the circle and used like a compass to trace the shape of the base. Another chain is fastened just outside the dome wall: this is the fixed or height compass and gives you the

interior measurement for every single layer of superadobe bags as they corbel ever higher.

The height compass is exactly the diameter of the dome. The center chain/compass is used to ensure the accuracy of each new superadobe layer as it is laid and tamped. The compasses must be made of non-stretchy material to ensure an accurate geometry.

On top of each layer of tamped, filled tubes, a tensile loop of barbed wire is placed to help stabilize the location of each consecutive layer: it plays a crucial role in the tensile strength of the dome - it is the 'mortar'. Window voids can be placed in several ways: either by rolling the filled tube back on itself around a circular plug (forming an arched header) or by waiting for the earth mixture to set and sawing out a pointed arch void. A round skylight can even be the top of the dome.

It is recommended to not exceed the 4m diameter design in size, but many larger structures have been created by grouping several "beehives" together to form a sort of connected village. of domes. Naturally this lends itself to residential applications, some rooms being for sleeping and some for living.

*Exterior Treatment*

Once the corbelled dome is complete, it can be covered in several different kinds of exterior treatments, usually plaster. Khalili developed a system that used 85% earth and 15% cement plaster and which is then covered by “reptile”, a veneer of grapefruit sized balls of cement and earth. Reptile is easy to install and because the balls create easy paths for stress, it doesn't crack with time. There are many different possibilities. Some Super adobe buildings have even been covered by living grass, a kind of green roof but covering the entire structure. Any exterior treatment and building details would need to be adapted to a region’s specific climatic needs.

## CONCLUSION

Super adobe is an adobe that is stretched from history in the new century. It is like an umbilical cord connecting the traditional with the future adobe world. Individuals are enabled once again to build their own homes without the use of heavy equipment, with materials native to the country of use. Super adobe has been used internationally by UN for emergency housing prototypes and is currently in limited use on several continents and under construction in several places. While many challenges lie ahead, it is still a hopeful and exciting time to be part of this quest to create a sustainable human culture.

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