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## Using Mud Bricks as a Temporary Solution for Gaza Reconstruction

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### Abstract

On Tuesday April 28, 2009 a report for BBC displayed an interview with a Palestinian citizen rebuilt his destroyed house with mud brick and mentioned that, it is a shame to live in a mud house at this age. The researcher was struck by this interview which led to work on this research. Due to the siege, the Palestinians lost the hope to reconstruct their destroyed homes, public buildings and infrastructure. Building with mud bricks as a thermal insulation and environmentally friendly method, works as a fire resistant, sound proof and can be entirely chemical free. It is cheaper; 80 m<sup>2</sup> house made of cement would cost around 16,000 dollars at least, but a mud one with local materials cost just 3,000 dollars. Best of all, it can be made on site in any shape, color or size, made of a mixture of clay, mud, sand, and water mixed with a binding material such as rice husks or straw.

Mud bricks fulfill the compressive strength and heat conductivity requirements. It also keeps indoor temperatures stationary during the summer and winter as a thermal insulation method. It is a traditional building material in much of the Middle East, India, North Africa and the majority of the Islamic cities buildings.

Recently, there have been attempts to revive the use of mud brick through special projects such as those instigated by Hassan Fathy in Egypt, the beautiful Cob House on Mayne Island, Canada, etc.

The mud bricks aim to save energy. The energy crisis experienced in the past have shifted the focus of the economical gain to energy saving.

The research will display all the successful methods of building with mud bricks in order to extract different recommendations from it. This will be a guide for anyone who want to build his own house in a wonderful form, shape, style and colors. Besides different recommendations for the governmental institutions to encourage the citizens to reconstruct their homes by this method and construct models of mud houses to teach the citizens how to build their own homes?

Finally, earthen structures are cheap, environmentally friendly and it is not a shame to live in a mud house but it is a global trend to preserve and to protect the environment.

Mud Brick, Thermal Insulation, Rammed Earth

### 1. Introduction

Earth as mud bricks, has been used in the construction of shelters for thousands of years, and approximately 30% of the world's present population still live in earthen structures [1]. Earth is a cheap, environmentally friendly and abundantly available building material. It has been used extensively for wall construction around the world, particularly in developing countries [2]. Unfortunately these days so many of people think that only building "properly" and "satisfactorily" by using such items as reinforced concrete, cement blocks, burnt bricks, etc. But equally unfortunately the manufacture of steel and cement for reinforced concrete is now called "energy intensive". An enormous amount of energy that is some sort of fuel is used to manufacture these so-called essential materials. [3] Mud may be old fashioned whereas concrete has been in circulation for less than hundred years, despite this, mud could be successfully used even for the best houses." this research will prove that it still fashionable".

## 2. The siege

The continuing Israeli blockade of the Gaza Strip is putting the Palestinians in a continuous challenge to overcome their difficulties especially in their daily life demands. The Palestinians lost the hope to reconstruct their destroyed homes, public buildings and infrastructure. So, as “**Necessity is the mother of invention**”, Palestinians decided to use both of sand bags and mud bricks to reconstruct their destroyed homes.



Figure 1: shows the process of manufacturing the mud bricks in Gaza [4]

## 3. Mud Bricks

A mud brick is a fire free brick, made of a mixture of clay, mud, sand, and water mixed with a binding material such as rice husks or straw. They use a stiff mixture and let them dry in the sun for 25 days. Adobe is a type of mud brick also used today to save energy and is an environmentally safe way to insulate a house. This type of house tends to stay cool in the summer and warm in the winter. Whether it is known as adobe, cob, loam or banco, mud is one of the commonest and most beautiful building materials on the planet. The bricks are then used to construct walls, sometimes on stone foundations, while roofs are made from timber. The whole lot then gets coated in layers of banco, a mixture of mud and rice husks, giving the architecture of the region its organic, sculpted feel. Larger buildings, such as mosques, also have projecting timber struts, which add support and double up as ready-made scaffolding. [5]

### 3.1 The Advantages of Mud Brick Constructions

There are several major attractions associated with earth buildings:

- **Cost Savings**, Earth building can be a very cheap way of building. This is not necessarily always the case however. you become too ambitious in your plans and design a building full of cathedral ceilings and stained glass, you are likely to find that any savings you might make by using mud are offset in the added expense of these features).
- **Thermal Mass & ECO Friendliness**, Thermal mass is a term used to describe the ability of building materials to store heat (thermal storage capacity). The basic characteristic of materials with thermal mass is their ability to absorb heat, store it, and at a later time release it. Mud brick is a natural material that can create a more environmentally friendly building. It has been used since very long time in building techniques. The mixture of mud brick is available in abundance and the only source of energy needed is solar energy. If it is maintained properly, it is durable and many old buildings have been standing perfectly even after many years. If done properly it can place less demand on planetary resources than other types of construction both in the actual building and in the running costs .it also reduces the heating and cooling costs. A mud brick wall performs similarly to a brick veneer wall in terms of heat insulation. [6] It does, however, have better noise insulation qualities and higher thermal mass. (This is because mud bricks are solid and dense. Their density blocks noise and absorbs heat. Effective heat insulation, on the other hand, is largely provided by pockets of air in a material, which trap heat and stop it moving through the material.
- **Self Satisfaction**, Earth building can be so very simple that (with adobe at least) a beginner can attempt and successfully build his own home.
- **Aesthetics**, Earth buildings have an appearance which is very unique. Many people build out of mud simply because they like the look of it. Figures (2, 3, 4, 5, and 6) display different examples for unique successful projects all over the world take into consideration the aesthetics factor.

### 3.2 Examples for Different Projects Constructed from Mud Bricks.

#### 3.2.1 Yemen Towers.

Indeed Yemen is famous for its high rise towers constructed from mud brick as shown in figure 2, Here the height of their homes was an indication of the owner's wealth and power. Land there is also scarce and expensive. Besides the towers served a defensive purpose in troubled times. Each houses a family. In this typical example, the ground floor is for the animals and storage; the first floor for the living rooms and bedrooms; above that would be the kitchen. [7]The top floor contains the mafrai: This is the large room where the owner of the house meets his friends, and it is usually the only decorated room in the house.

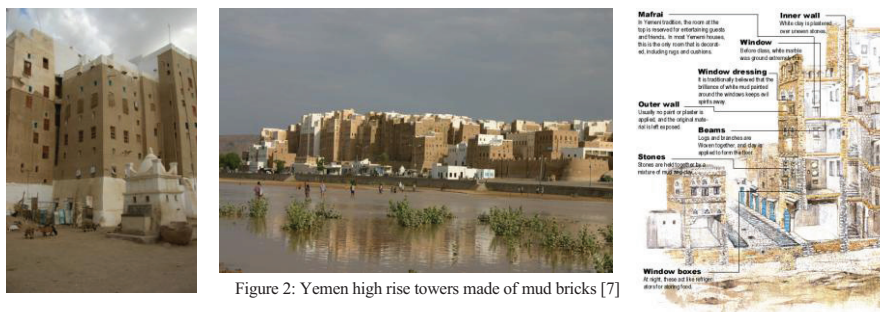


Figure 2: Yemen high rise towers made of mud bricks [7]

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