Journal of Sciences and Multidisciplinary Research
Volume 10, No. 4, 2018
ISSN: 2277-0135

# ADOBE BRICK, AN EFFECTIVE CONSTRUCTION MATERIAL

Arc. Boyce A. Odoko
Department of Architecture
National Institute of Construction Technology, Uromi, edo state.
E-mail: odokoarch@yahoo.com

## ABSTRACT

Adobe bricks are known to be durable and long lasting when used in building construction, especially in dry climates like in Northern Nigeria or Southwest of the United States of America, New Mexico, for example. In the Southwest of the United States of America, Adobe brick is produced by mixing soil (clay) with binding material straw and water. The straw holds the Adobe brick together like reinforcement, preventing the Adobe brick from cracking. Adobe bricks (mud bricks) are made of earth with fairly high clay content and straw. If produced manually the earth mix and cast in open mold on the ground and then left to dry out. Adobe bricks are only sun dried, not kiln – fired. When used for construction they are laid up into a wall using an earth mortar. Before drying out, the finished walls are smoothed down. Often a clay render is applied as a surface coating. The modern Adobe is stabilized with either emulsified asphalt or Portland cement up to 10% by weight. However, most soil throughout the world is suitable for production of Adobe brick and it is economical. Sun backed clay bricks are one of earliest basic building materials used by man and indeed are still used today. This is because of their simplicity and low cost, low thermal conductivity, good acoustic properties, and at the end of a building's life, the clay material can easily be reused by grinding, wetting or returned to the ground without any interference with the environment.

**Key wards:** Adobe bricks, construction material, earth construction, earth, compressed, soil, brick, rammed earth, earth buildings, style of architecture, popular material, durable and long lasting material, binding material, straw and water.

## INDRODUCTION

Throughout the world, there are buildings that are built of Adobe brick. The great Mosque of Djenne, Mali, in Africa is built with Adobe brick, in the State of New Mexico, United States of America, there are several residential buildings of Multi-million dollars built with Adobe brick, especially in Santa Fe, the state capital. The Middle East, Spain, South

America, there are Adobe buildings. Adobe brick walls must be provided with strong foundation, because, the Adobe is a load bearing wall, therefore, it must have sufficient, strong foundation to bear its weight so that it will not cause cracking of the wall during foundation settling. In the South West of the United States of America, the footing is normally 24 inches and the stem walls are usually 14 inches thick. However, it is better to use reinforced concrete foundation and concrete blocks below grade for adobe foundations because of susceptibility to water.

Humble materials of the earth. When these elements are combined with water, they give birth to a new construction material – adobe bricks. Adobe construction, like rammed earth construction, is a sustainable ancient building technique that harks back to 2000 BC or earlier when the word 'adobe' was used by the ancient Egyptians to describe sun – dried 'mud bricks'. Today the word adobe is synonymous with the architectural style designs common in New Mexico, North Africa and other hot climates. **Livingataschile, FICH.(2014).**

Adobes are dried mud or unburned bricks that have been used for thousands of years in the construction of dwellings and other structures. Even today the majority of the people in the world use mud-brick construction. The term adobe generally is used to describe various building materials made of earth and techniques for using these materials. Most often it refers to sun-dried brick. **George S. Austin. (1984).**

The major problem with the sun-dried brick is its susceptibility to water damage, however, the adobe water deficiency has been overcome by the introduction of some quantity of lime into the clay which stabilizes the adobe brick. The water damage to the sun-dried brick is no longer a problem, the lime which is the stabilizing agent enhances the adobe to resist water damage, thereby, making the brick stronger.

Adobe brick is one of the least expensive building materials to use. Made for thousands of years, adobe brick has remained a consistently popular building material in hot, dry places. Making your own adobe brick very easy. This research conducted emphasizes the advantages of using Compressed Stabilized Earth Brick ( CSEB) for better living. As it promote healthier building material and cost reducing not only in producing but also in service cost. Although, economic potential may attract more rather than ecological reasons, the full scale production of

compressed stabilized earth bricks has demonstrated that this kind of building material have great potential in the future for low to medium cost housing construction and contribute on sustainable development. Earth has been used as a building material for years. From ancient times to the present day, it's been used to build everything from modest shelters to elaborate temples using a wide variety of techniques. Earth construction has witnessed a renaissance in recent years due largely to economic & environmental concerns.

Earth as a building material has already been known for centuries started with plain mud and straw utilized sun dried producing brick adobe with low strength and durability until its evolved to become fired clay brick with mass rapid production in kiln. In the growing concern of awareness regarding sustainable building material and environmental issue, Compressed Stabilized Earth Brick (CSEB) give the view of energy efficient, cost reduction and environmental friendly building materials, overall contribution on the sustainable development.).**Fera Riza et al. (2010).**

I really like the way they've used the adobe styling and used it in a modern home. It reminds me a lot of houses in Arizona or New Mexico. To make possible the construction of the best design entries through building workshops to realize prototypes, as examples to the local people that mud architecture can be durable and beautiful, says Jason Orbe-Smith.

Adobe residential buildings are usually not more than two stories, that is, the ground floor and the first floor respectively, because of its low structural strength. In modern construction, like in masonry wall, there is the wall plate on top of the last course of the masonry unit to provide bearing for the roof rafters. In Adobe brick construction, it is also good to provide reinforced concrete beam on top of the last course of the Adobe brick to bear the roof load. Heavy wood beams can be used as well. In concrete masonry unit construction, door and window openings in masonry wall, reinforced concrete lintel is usually placed above the openings to enable it bear the masonry unit load above it. In like manner, in Adobe brick construction, reinforced concrete lintel should be placed above the door and window openings to enable it bear the load of Adobe brick above it, because of its low cost in construction and as a major heat reservoir and its inherence thermal properties in the massive walls,

construction of Adobe brick houses should be encouraged in Nigeria, especially in the Northern Nigeria where the desert climate is typically hot during day time and cold during the night.

This paper is a review of the state of uses of clay bricks and stabilized compressed earth blocks, we offer an overview of the world general building using clay bricks or stabilized earth blocks. Although, stabilized compressed earth blocks as construction materials are highly unknown to most people, its advantages are seen in terms of rescuing the heritage and also as rediscovered environmentally-friendly building materials.
Earth architecture is an example of eco-compatible construction material because the global availability and the in-situ production make it cost-effective with low embodied energy. **Sadek Deboucha, Roslan Hashim.(2011).**

Its high thermal resistance makes it the favorite material, especially for hot dry climate populations, because it provides a high standard of indoor comfort. Low density compressed stabilized earth blocks have an advantage over higher density ones of acting as better thermal insulators. It is, advantageous in hot and dry climates where extreme temperatures can be moderated inside buildings made of compressed stabilized earth blocks.

The basic necessity of man are food to feed, cloths to wear and shelter to protect man from the weather. During the wandering period of man's existence on earth, food was the main factor that engineered the nomadic movement of man from one place to the other in search for food. Man wondering period came to end when he engaged in crop cultivation. During the crop cultivation stage, caves was mostly the place for shelter and protection for man. From that period on, man developed the living environment to what it is today. The need of shelter for humanity cannot be over emphasized.

This journal is an attempt to discuss readily available construction materials from pre-colonial to post-colonial Nigeria. The effectiveness and quality of the construction materials, and their cost effectiveness. The main focus will be on Adobe Architecture as a low cost major construction material. The construction row -material mud can be found almost everywhere, even, around the construction site, for use.

Adobe is a building material made from earth and often organic material. Adobe means mud brick in Spanish, but in some English speaking regions of Spanish heritage it refers to any kind of earth construction, as most adobe buildings are similar in appearance to cub and rammed earth buildings. Adobe is among the earliest building materials and is used throughout the world. In Arabic, it means construction material produced from the earth. Adobe is one of the earliest commonly used material for building construction worldwide.

From the roof of the World in Tibet or the Andes Mountains in Peru, to the shores of the Nile in Egypt or in the fertile valleys of China, many examples of countries those used earth as a building material in ancient time. India also shows very old earth buildings, like the Shey Palace in Ladakh, which was built with Adobe in the 7$^{th}$ century. And, Tabo Monastery in Spiti Valley, Himachal Pradesh was built with rammed earth in 996 AD. Habtemariam Molla. (2012).

Adobe bricks are most often made into units weighing less than 100 pounds and small enough that they can quickly air dry without cracking. In more modern English usage, the term "adobe" has come to include a style of architecture popular in the desert climates of North America, the United States of America. Livingatlaschile. FICH.(2014).

Northern Nigeria falls within the Savanah area of Nigeria, typified by very little rain fall, temperature differences are extreme between day and night. This construction material, the red laterite soil for molding Adobe bricks can be found around the construction site. In pre-colonial time, puddled mud was the main local available construction material throughout Nigeria, even the villages in Southern Nigeria rain forest, houses are Present day residential houses in Northern Nigeria, most of them are built with puddled mud and in response to the desert climate, the houses have very few windows. The intention of the small windows is to eliminate or reduce the hot dry and dusty air from coming into the building during the day and the cold air from coming into the building at night. During the hot day temperature, the small window reduces the amount of hot sun (radiation) that would be exposed as compare to large window opening. The small window also prevents or reduces the bright day light as well. What is needed now, in Nigeria, in response to the huge house shortage, is to advance from the puddled mud wall system to the present day thick Adobe brick which provides much stronger structure and also controls

the temperature more effectively, with regards to its low cost. There are many mud roof houses in Northern Nigeria, these mud roof houses are encouraged more in Urban centers in case of fire outbreak. Mud is a semi-conductor, therefore, it maintain temperature equilibrium as well as buffer between interiors and exteriors environments.

The use of mud roofs responds to the extreme temperature differences between days and nights. As noted earlier, in Southern Nigeria where there is much rain fall, there are lots of puddled mud houses in towns and villages. In the Niger Delta area of the Southern Nigeria where rain falls the most, majority of the houses in the villages are built with puddled mud. Some of the houses are of thatch roofs these puddled mud houses has been the rain fall, especially during rainy season, even though, the houses are roofed with large overhanging eaves. Regardless of the large overhanging eaves, most part of the puddled mud wall is exposed to the rain that damages the mud wall.

The good news is that there is construction material "Adobe brick", it is produced by mixing soil, straw a binding material and water. The straw acts like reinforcement by holding the Adobe brick together, thereby, disallowing it from cracking. Further, Adobe brick can be stabilized with emulsified asphalt or Portland cement. There are many methods for stabilizing Adobe, ranging from cement to fermented cactus juice.
We use a small percentage of asphalt emulsion, which is the most basic organic compound of crude oil. It coats the individual particles of sand and clay in our adobe blocks to make them virtually water proof. Says Mule Creek Adobe, Inc. manufacturer of adobe blocks.

Solid blocks are usually stabilized with cementing materials, fibers or chemicals to improve their performance properties for construction purpose. This study investigates the properties of compressed earth blocks stabilized with a liquid chemical (Pidiproof Lwt). The paper concludes that the inclusion of the liquid chemical in the compressed earth blocks generally improved the performance properties of the blocks. Humphrey Danso.(2017).

In the Niger Delta area, construction process of puddled mud houses involves erection of two rows of vertical wood sticks wall at about 3 inches to inches apart, with horizontal wood sticks between the vertical wood at the top, middle and bottom of the vertical wood. Next stage, is the roofing

of the house. On completion of the roofing, men will go and excavate soil, they will pure water into the excavated soil, then, they will use their foot to produce the puddle mud. Mostly, women will carry the mud in head pans to the building. Another set of men will then put the puddled mud in between the vertical wood sticks which serves as reinforcements.
In the South East of Nigeria, the Igbo land, you will also find lots of puddled mud buildings in villages and towns. At traditional Igbo village town square used for public functions such as festivals and public gatherings, the surrounding buildings are of puddled mud construction. The shrines of the Igbo deities of the communities are built with puddled mud. Traditional Igbo building has been a continued development of puddled mud buildings which provides the shelter needs of the Igbo communities in Nigeria dating back from Pre-Colonial to Post-Colonial period before the importation of new construction materials such as cement and zinc.

In the South West of Nigeria, just like the rest of Nigeria, there is plenty of mud houses with thatch roofs. The Yoruba people also built their houses mainly with mud dating back from pre-colonial to post- colonial period. In this region, the mud houses are faced with the destructive force of rain fall just like the rest of Southern Nigeria. Again, the houses are roofed with overhanging eaves, still, most of the wall is exposed to the destructive rain. This gives the more reason why construction of mud houses in Nigeria should be advanced to the latest stabilized Adobe brick that has the protection against the destruction from rain fall, and also take advantage of its low cost.

## CONCLUTION

After a critical observation all regions of Nigeria, puddled mud has been the local readily available construction material from pre-colonial to post-colonial era, before the introduction of imported construction materials such as cement and zinc. The buildings are of puddled mud walls, with thatch roof system. As at this moment, there are puddled mud buildings undergoing construction, except that the thatch roofs are being replaced with zinc roof material. In Northern Nigeria, lots of the traditional houses are being roofed with mud in response to the desert climate situation. This is a very good news because of the availability of the construction material, mud, and the economic standpoint of it. Because of the hot climate, the construction material, mud, being a semi-conductor, offers

solution of keeping the hot sun radiation from penetrating through the wall into the building interior.

What is needed in Nigeria now, is to move forward to the advanced stabilized Adobe brick construction material. When Nigerians can mix soil, straw and water, and stabilize it with either emulsified asphalt or Portland cement, it will give a perfect solution to resist rain fall from damaging the building walls, including cracking. Because of its low cost, the average Nigerian can afford to build a house with Adobe brick material. This will go a long way in solving the Nigeria huge housing deficit.

## REFERENCES

Fera Riza (2010)
www.academia.edu/25900873/A_brief_view_compressed-stabilized_Earth_Brick_CSEB

George S. Austin(1984)
adobe.https://geoinfo.nmt.edu/publicatios/periodicals/nmg/6/n4/nmg_v6_n4_p69.pdf

Habtemariam Molla
(2012).Etd.aau.edu.et/bitstream/123456789/4602/3/final%2repo%2ohm-pdf

Humphrey Danso (2017).
www.Sciencepublishinggroup.com/journal/paperinfo?journalid-129...20170606.

Livingatlaschile, FICH (2014). https://www.bamboo-earth-architecture-construction.com/adobe-bricks/

Sadek Deboucha, Roslan H.
(2011).www.academicjournals.org/journal/SRE/article-full-tex-pdf/093c6D821208

**Reference** to this paper should be made as follows: Arc. Boyce A. Odoko (2018), Adobe Brick, An Effective Construction Material. *J. of Sciences and Multidisciplinary Research,* Vol. 10, No. 4, Pp. 1-9