CRITICAL REVIEW ON TYPES OF BRICKS TYPE 7: CEMENT SOIL BRICKS

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Abstract - The paper deals with certain details of pressed soil-cement block technology. Earth as a building material has already known for centuries started with soil and cement sun dried producing brick with good strength and durability. As its production process does not pollute the environment In the growing concern of awareness regarding sustainable building material and environmental issue, Cement soil bricks give the view of energy efficient, cost reduction and environmental friendly building materials, overall contribution on the sustainable development. In this paper Earlier developments in soil-cement block technology along with its process of manufacturing and various tests and method use for building construction have been discussed briefly.

Keywords - Cement Soil Bricks, Process of Manufacturing, Tests, Advantages

I. INTRODUCTION

Sand cement brick is a kind commonly used in low- and medium-cost housing development and other commercial constructions in Malaysia. Cement and sand brick is easy to make and inexpensive to produce [11]. Soil Cement Bricks (SCB) is cost effective and energy efficient alternative materials to the normal burnt clay bricks used for construction of buildings. Soil cement blocks are also known as stabilized mud bricks (SMB) or stabilized compressed earth bricks (SCEB). Soil cement bricks are used for load bearing masonry [1]. Sustainable development and the recycling and reuse of waste are widely researched topics. Current production models tend to be linear, with goods being conceived, designed, constructed and used, after which they accumulate in the environment. Sustainability requires closed or cyclic flow models for the production and consumption of materials [2].

Research has shown that large quantities of waste could be successfully employed in the manufacture of building materials, improving their properties and durability [3].

Bricks have been used as a major construction and building material for a long time. They can be found as fired-clay or unfired-clay bricks. The former is most widely used but can be easily replaced by the latter in many applications, with a considerable reduction in energy usage [4]. The blending of cement and clay increases costs, but enables the preparation of bricks with uniform texture, regular dimensions, and flat surfaces. These bricks can be used as apparent bricks, requiring only an impermeable coating as a finish. They can be produced at work sites using simple and cheap equipment [5]. Additional beneficial substances that can be used as fillers in the soil-cement mixture are dusts generated by the mining and processing of natural stones, where the extremely fine and inert particles help to fill empty spaces in the matrix. Additions of waste from other industrial activities can be trapped in the cement matrix, although there are limits to the replacement of soil that must be respected in order to avoid compromising the mechanical properties of the bricks [6]. It is an undisputed fact that shelter is one of the basic human necessities. However, irrespective of the importance of shelter, most people do not have access to good shelter, most especially in developing countries. In fact there is an estimated deficit of between 17 and 18 million housing units in Nigeria in 2012, [7]. The poor are most adversely affected by this housing shortage. The most important building materials for low-cost housing are blocks/bricks [8], but conventional quality concrete blocks are too expensive for low-income communities. Due to high cost of Portland cement, a lot of block producers use less than the recommended amount in the concrete mix making the blocks to be substandard. This is one of the most important contributing factors for the frequent building collapse in the country recently. Bricks / Blocks are solid pieces of hard substances, usually with flat sides, used as construction units [9].

II. HISTORY OF CEMENT SOIL BRICKS

The first known soil-cement application for residential building is dated to about 10,000 years in the construction of the city of Jericho, which was built entirely with soil (but the stabilizer used was animal urine and vegetable waste) (Abiko 1995). When common Portland cement is added to soil, the resulting building material is termed soil-cement and according to Neves (2000), soil-cement is a mixture of soil, cement, and water that when compressed acquires mechanical strength and durability necessary for construction purposes. Soil-cement is a very old building material and finds its roots in the changes of an even older material, soil-ash. The addition of cement to the soil results in a material that does not undergo large volume variation by the absorption and
loss of humidity, does not completely deteriorate when submerged in water, and presents high compression strength and durability due to its lower permeability (Grande 2003). Soil-cement is obtained by mixing soil, pulverized and moistened at optimum moisture content, to 7–14 % Portland cement in relation to the volume of compacted soil (Vargas 1977). It is believed that British engineer H.E. Brook-Bradley, at the late nineteenth century, was the pioneer in using this mixture, initially for the treatment of road beds and tracks for horse-driven vehicles in Southern England. In Brazil, soil-cement was used in the production of road bases and studies were focused on this end. In 1948, however, the Brazilian Portland Cement Association—ABCP, suggesting another use for this material, published in its bulletin No. 54—houses were made with soil-cement walls—in which, motivated by the success achieved in some experiments, proposes to use this material for the construction of monolithic walls (Neves 1978). However, the first official record of its use in Brazil is in the building, completed in 1948, of the headquarters of the English Farm, in the city of Petrópolis —RJ (Conciani and Oliveira 2005). Soil-cement is a low-cost alternative material obtained by the mixture of soil, cement, and a little water in suitable proportions. At first, this mixture seems a wet mixture and, after compression and setting, it hardens and gains enough consistency and durability over time for many applications in rural and urban areas. Soil-cement is an evolution of past construction materials, like clay and mud. Natural adhesives of varying characteristics have been replaced by an industrial product of controlled quality: the cement. The use of soil-cement in Brazil has, since 1948, helped meeting these needs, being today already widespread.

Soil-cement has been used for decades, but its use is still very limited. As a result, entire forests are devastated to produce ceramic bricks that, after all, are more expensive. Despite these positive points, in Brazil, the interest by the soil-stabilizing method is more significant in paving works (about 90 % of the bases of our roads are made of compacted soil-cement), dams and retaining walls, with secondary application in civil construction due to the lack of technical knowledge of professionals involved in the various segments of society.

III. METHOD OF MANUFACTURING

The materials for manufacturing the interlocking brick consists of cement, laterite soil and sand with ratio of 1:1:6(cement: sand: soil) by volume. The use of volume rather than weight is due to simplicity of the manufacturing. The corresponding mixing mass ratio of the reference sample is27.6:4.0:4.2 kg. Soil, sand and cement were mixed together in the drum mixer. Water was gradually added into the mixer [1].

IV. PROCESS OF MANUFACTURING OF CEMENT SOIL BRICKS

Three distinct operations can be recognised in the process of soil-cement block production using manually operated machines. They are as follows

Soil preparation

Soil is sieved through 5mm sieve in order to remove bigger clay lumps, gravel etc. Sieved soil is spread into a thin layer on level ground and then the cement is spread on top and mixed thoroughly using a spade. Now water is sprinkled on the dry soil-cement mixture and mixed manually, such that the water gets dispersed uniformly. The wetted soil-cement mixture is pressed into a block using the machine. Soil preparation has to be carried out in batches such that the wetted soil-cement mixture should be converted into blocks within 40 minutes. This is mainly to avoid setting of the cement before pressing into a block. Generally, soil sufficient for 25 blocks is processed in each batch.

Block pressing

The processed soil is compacted into a block using a machine. "This operation consists of the following activities:

a. Feeding the processed soil into the mould,
b. Block compaction
c. Block ejection

Stacking and Curing

The blocks can be stacked one above the other upto 6 layers. Dose stacking without any gaps will be useful in preventing the drying of blocks while curing. The stack covered with straw on top has to be kept moist by sprinkling water for 3 to 4 times daily for 3 weeks.

V. MATERIALS SELECTION OF INGREDIENTS

Cement

Cement is building materials which act as a binding agent of material. It is used as a binding material in which binding together various building material such as soil, brick, and stone etc [1].

Soil

Soil shall be of the quality suitable for the production of stabilized soil blocks. Generally, soil contains clay minerals and inert particles such as silt and sand. The percentage and type of clay mineral controls the characteristics of soil.

Water

Water is an important ingredient of bricks as it actively participates in the chemical reaction with cement. Since it help to form the strength giving cement gel reinforcement and concrete inside the
centre hole of this brick and act as load bearing of column [1].

VI. TESTING OF CEMENT SOIL BRICKS

Absorption Test on Bricks
The soil-cement blocks were dried in an oven at 60°C and then allowed to cool down to ambient temperature. The dry weight of the block is measured before soaking it in water for 0.5, 1, 2, 5, 10, 15, 30, 120 and 140 minutes. Thereafter, the wet weight of the blocks were measured. Calculation of the percentage saturation is with respect to dry weight [10]. Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme conditions. In this test, sample dry bricks are taken and weighed. After weighing these bricks are placed in water with full immersing for a period of 24 hours. Then weigh the wet brick and note down its value. The difference between dry and wet brick weights will give the amount of water absorption. For a good quality brick the amount of water absorption should not exceed 20% of weight of dry brick.

Crushing Strength or Compressive Strength Test on Bricks
Crushing strength of bricks is determined by placing brick in compression testing machine. After placing the brick in compression testing machine, apply load on it until brick breaks. Note down the value of failure load and find out the crushing strength value of brick. Minimum crushing strength of brick is 3.50 N/mm²; if it is less than 3.50 N/mm², then it is not useful for construction purpose.

Hardness Test on Bricks
A good brick should resist scratches against sharp things. So, for this test a sharp tool or finger nail is used to make scratch on brick. If there is no scratch impression on brick then it is said to be hard brick.

Shape and Size Test on Bricks
Shape and size of bricks are very important consideration. All bricks used for construction should be of same size. The shape of bricks should be purely rectangular with sharp edges. Standard brick size consists length x breadth x height as 19cm x 9cm x 9cm. To perform this test, select 20 bricks randomly from brick group and stack them along its length, breadth and height and compare. So, if all bricks similar size then they are qualified for construction work.

Soundness Test of Bricks
Soundness test of bricks shows the nature of bricks against sudden impact. In this test, 2 bricks are chosen randomly and struck with one another. Then sound produced should be clear bell ringing sound and brick should not break. Then it is said to be good brick.

Structure of Bricks
To know the structure of brick, pick one brick randomly from the group and break it. Observe the inner portion of brick clearly. It should be free from lumps and homogeneous

Efflorescence Test on Bricks
A good quality brick should not contain any soluble salts in it. If soluble salts are there, then it will cause efflorescence on brick surfaces. To know the presence of soluble salts in a brick, placed it in a water bath for 24 hours and dry it in shade. After drying, observe the brick surface thoroughly. If there is any white or grey color deposits, then it contains soluble salts and not useful for construction

VII. ADVANTAGE OF CEMENT SOIL BRICKS

1. Soil-cement has been consecrated as an alternative technology for offering the main component of the mixture soil in abundance in nature and generally available on the construction site or close to it.
2. The constructive process of the soil-cement mixture is very simple and can be conducted by unskilled labor.
3. It offers good comfort conditions, comparable to brick and masonry buildings or ceramic blocks, offering no conditions for the proliferation of insects harmful to public health, meeting minimum living conditions.
4. This material has good resistance and perfect waterproofing features, resisting weathering and humidity, facilitating conservation.
5. The application of roughcast or plaster mortar is unnecessary due to the smooth finish of monolithic walls as a result of the perfection of pressed faces (walls) and material impermeability requiring only the application of a simple cement-based painting, further increasing its impermeability, as well as visual appearance, comfort, and hygiene.
6. Low aggression to the environment, since it eliminates the firing process.
7. Low transport costs when produced at the construction site.
8. Low cost compared to conventional masonry.

REFERENCE