

A comparative performance of burnt clay bricks and Compressed stabilized earth bricks: Kigali city- Rwanda

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ABSTRACT

The prevailing shortage of many building materials based on natural resources has led to a considerable price escalation in recent times. This has created opportunities for developing many alternative masonry materials that can be used for wall construction. Compressed stabilized earth bricks, solid blocks and interlocking blocks are few such materials. To reduce the number of bricks used in given area, rat-trap bond is also gaining popularity. All these will create many challenges to the professionals involved in the building industry that have to be solved by providing data on strength and behavior characteristics. This research compares the strength, load deformation characteristics, maintenance, construction cost, durability (lifetime), water absorption procedure, environment sustainability, withering limit and application of English and rat-trap bond patterns in masonry construction. The findings are based on burnt clay bricks and compressed stabilized earth bricks and blocks in order to investigate comparable performance.

Keywords: Compressed Stabilized Earth Bricks (CSEB), Bond Patterns.

1 BACKGROUND

In construction industry, masonry construction is very common all over the world. Different masonry materials have been used in RWANDA housing sector giving more prominence to burnt clay bricks and cement sand blocks in the recent past. However, the shortage of raw materials available in KIGALI CITY-RWANDA led to the development of many alternatives that can be used as walling materials. Such alternatives have been further promoted with the introduction of sustainable construction concepts. This part covers two varieties of burnt clay bricks and different types of compressed earth blocks used as masonry units. In Kigali, Burnt clay bricks and natural materials (stones) are very commonly used. These BCB are very insufficient and also costly. Compressed stabilized earth bricks are not used as BCB even if both materials have the same role in construction industry.

The compressed stabilized earth bricks and interlocking blocks can be manufactured to the standard brick size of 215mm x105mm x 65mm. the blocks can be manufactured as solid or interlocking. The thickness of bricks or block can vary from 140mm to 240mm. when the burnt clay bricks are considered; the sizes and quality of bricks available in the markets vary to some extent. Thus the alternative masonry materials and manufacturing methods have introduced an added complexity to the use of masonry for house construction. These can give many variations that are generally not covered in BS5628: part 1 and 1992 part 2. thus for effective use of such masonry, it is very important to have data on the performance. To compare those two materials, better to know their characteristics.

Fired Clay Brick making in Rwanda as building materials is characterized by the following features:

Bricks making is a small scale, traditional industry all most brick kilns are located in rural and per-urban areas. It is common to find large brick making clusters located around towns and sites, which are the demand centers for bricks.

The brick production process is based on manual labor; the brick production is seasonal vocation as the brick kilns do not operate during the rainy season.

Bricks making is large of coal and has impact on environment; the quality of fired bricks depends both on the quality of green bricks as well as on the firing process.

The compressed earth block (CEB) and interlocking blocks as building materials is characterized by the following features:

Compressed earth blocks are small masonry elements, parallelepiped in shape, but the common dimensions of which differ from those of hand-molded earth blocks or of fired bricks and vary depending on the type of specially developed presses or moulds used. Two main criteria must however, be taken into account when determining a compressed earth block's dimensions, which should above all be suited to the great degree of flexibility in use which is the one of great qualities of this building materials.

These are:

On the one hand the weight of the block, bearing, in mind that they are solid blocks which are principally used

in masonry.

On the other hand the work (or nominal) dimensions of length (l) width (w) and height (h) which will determine bonding patterns. The CEB is very flexible in the way it can be used for many configurations of wall and roof building systems construction of arch, floors, vaults, domes and arched

openings.

This research project is to compare performance of burnt clay bricks and compressed stabilized earth bricks or interlocking blocks in Kigali City-Rwanda in order to reduce the insufficient building materials and access affordable buildings.

2. METHODS

This research was been successful in favor of sampling technique, bricks manufacturing, bond patterns, cost prices, environmental effects, population sampling. The main focuses of research select mainly to the Comparative Performance of Burnt Clay Bricks and Compressed Stabilized Earth Bricks thus the research design is the retrospective qualitative research. This research conducted in Kigali city, the area of the study was selected through using simple random sampling in Kigali city-RWANDA. The images below show wall constructed with BCB and another with CSEB taken on construction site during my research for purpose of comparing those two types of bricks.

BCB



CSEB



3. RESULTS

In this study, as the method was population sample, data collection instruments and techniques of data analysis; the researcher presents, analyzes, and interprets the data collected from sampling population using questionnaire and interview. Data from respondents are summarized and grouped in accordance with research questions and hypotheses; it also gives more information in details of the various views of operatives and site engineers on relationship between them with intention of improving method of construction of walls after doing comparative performance between two materials.

The following are the results regarding research's objectives after questioning Site Engineers and Masons.

. Fire clay bricks have weather resistance than compressed earth blocks

. Use of compressed Earth blocks reduces the cost of combustible materials (fire wood and charcoals). In other hand

. Compressed stabilized earth bricks or blocks are environmental friendly blocks over fire bricks.

. Burnt clay bricks are costly than compressed stabilized earth blocks wall. On a 1m² of BCB wall and CSEB wall compared, BCB wall costs 14,040Rwf and CSEB wall costs 10,550Rwf.

According to these result, both two building materials are needed on construction industry and can be used according to the choice of the builders or technicians.

4. DISCUSSION

In this project, the discussion was done on site questioning site engineers and masons different questions in order to see if CSEB can also be used as the same as BCB for purpose of increasing the construction materials. Here, CSEB was found

that is less costly than BCB (Means CSEB are affordable materials).

At the end of the discussion, it is noted that both two materials (BCB and CSEB) are useful in construction industry.

5. CONCLUSION

Based on the review of both experimental and filed investigation on clay bricks and stabilized compressed earth blocks, the following concluding remarks can be drawn: Major usage in the world for construction is clay bricks; many researchers are presently looking for newer options because they need low cost materials, which are also environmentally friendly. The process of manufacturing clay bricks also requires high

energy to burn due to the emission of CO₂ gas from this process.

Stabilized compressed earth blocks include; uniformed building component sizes, use of locally available materials and reduction of transportation. Uniformly, sized building components can result in less waste, faster construction and the possibility of using other pre-made components or modular manufactured building elements. Such

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modular elements as sheet metal roofing which can be easily integrated into a CEB structure.

less more costly than FCB.

The reduction of transportation time, cost and attendant pollution can also make CEB

6. LIST OF ABBREVIATIONS

BCB : Burnt Clay Bricks

CEB : Compressed Earth Bricks or blocks

CSEB : Compressed Stabilized Earth Bricks or blocks

CO² : Carbone dioxide

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