

MANAGEMENT ASPECTS OF BUILDING CONSTRUCTION USING R.B.C.

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Abstract

This is an account of the work done pertaining to the use of clay as major material of construction in different forms along with its origin, types, composition, most common properties and the state-of-the-art regarding use of clay for low-cost housing. The experimental work done by the authors during past 10 years by using clay as chief material of construction is also high-lighted. This makes use of pre-perforated post-reinforced baked clay panels of structural members. Purportedly these would be factory made panels manufactured on mass scale. From literature survey it has been observed that low-cost housing particularly implies to housing in rural areas using materials like clay together with straw, jute, sun-dried and baked clay bricks etc. However no attempt has so far been done to devise a parallel system to RCC by using reinforced baked-clay structural panels for construction of multi-storey buildings. Since the processes involved in this type of construction are different from those of concrete, the management aspects will also be substantially different, the proper assessment of which is imperative. An attempt has therefore been made to identify these aspects in this paper.

Key words: R.B.C., R.C.C., Low Cost Housing, Pre-cast panels, Multi-storey Buildings, Managerial aspects.

1. INTRODUCTION.

The earth was created some 5000 million years ago, according to scientific theory. The crust of earth feels very secure to us, but it is only about 40 km thick, floating on a 3000 km deep layer of molten materials. Slow currents in this molten sea cause whole continents to move at speeds of up to 2cm per year. Where continents grind against each other, earthquakes and volcanoes occur. During the last 200 million years the Indian plate moved north, and when it collided with the Asian continent the highest mountains on earth- the Himalayas- were formed [1].

Natural, non-toxic, healing, easily available, recyclable, low embodied energy, a pleasure to work with, soft & soothing, limitless creative possibilities- are some of the properties of clay; although some people may describe it primitive, inferior and dirty. Depending on the content of the soil, clay can appear in various colours, from a dull gray to a deep orange-red.

The formation of clay from rock is a most common event, taking place daily everywhere in the world. Clay consists of soil particles the diameters of which are less than 0.005 mm, also a rock that is composed essentially of clay particles. Rock in this sense includes soils, ceramic clays, clay shales, mudstones, glacial clays (including great volumes of detrital and transported clays) and deep sea clay (red clay, blue clay and blue mud). These are all characterized by the presence of one or more clay minerals, together with varying amounts of organic and detrital materials, among which quartz is predominant [2].

Clay is the most beneficial material to serve humanity in every walk of life. Clay is a fine-grained, natural firm earthy material that is plastic when wet at appropriate water contents, hardens when dry and gains strength like a permanent solid when heated intensely, consisting of hydrated silicates of aluminum.

2. LITERATURE REVIEW REGARDING USE OF CLAY

In most countries of the world, it is possible to mould earth with sophisticated or primitive tools to construct buildings. The range of the technical, constructional and architectural possibilities of earth is extremely wide. This wide constructional potential has enabled the construction of modest shelters, village houses, urban blocks and religious edifices, as well as palaces and entire cities.

In countries with no industrialized means, in a wide range of latitudes throughout the world, earth remains the main building material. Processed materials are costly both in foreign currencies and imported energy. Communities remain dependent on the use of locally available solutions, materials and knowledge. These materials and techniques are generally very well used and can ensure true architectural quality which makes the most of the human and material resources available[3].

All this is intended for houses in rural areas where the concept of multistory building is not prevalent, which is difficult to under-take without RCC. However, it is being attempted by the authors to produce reinforced pre-cast panels of baked clay as an alternative of reinforced cement concrete structural members.

As building material clay is used in the form of brick, either sun-dried (adobe) or fired, as well as roof, wall and pavement tiles. Clay is used for making china and earthenware, utensils, crockery, water storage vessels, drainage pipes, toys, buckets, barrels and even musical instruments. Clays are also of great industrial importance, e.g. ceramics, porcelain. Highly absorbent, bentonite is much used in foundry work for facing moulds and preparing the moulding sands for metals. The less absorbent bentonites are used chiefly in the oil industry, e.g., as filtering and deodorizing agent of petroleum and mixed with other materials, as drilling muds to protect the cutting bit while drilling. Other uses are making of fillers, sizings and dressing in construction, in clarifying water and wine, in purifying sewage, and in ceramics, plastic and rubber industries. Clay is also termed as mineral[3].

Clay is also being used for the construction of strawbale walls. It has great benefits to our health and the environment [4].

Bricks, cooking pots, art objects, dishware, spark plug bodies, and even musical instruments such as the ocarina are made with clay. Clay is also used in many industrial processes, such as paper making, concrete production and chemical filtering [5].

In Tanzania Iron smelters use highly refractory clay for their furnaces, and in Nepal the brass makers use a local fire clay for their casting moulds. A good potter's clay will often be covered by several meters of overburden [1].

3. CLAY AS REPLACEMENT OF RCC.

Clay has remained in use for erecting the most beautiful and durable structures even better than RCC even thousands of years ago. They were considered as the Wonders of the world. The Ziggurats of Mesopotamia and the Hanging Garden of Babylon are the evidence. One third of humanity of the world even today has made use of clay as the major material of construction. However, no systematic research has been carried out to make use of this material as a parallel to concrete. For the first time the authors undertook this task. For ten years we wallowed in the wildness of clay and developed an idea to use pre-cast panels pre-perforated, baked, post-reinforced and grouted which could be factory made on mass scale and used for multistory buildings as a replacement of RCC [6-12], which has been named as R.B.C.

The authors on their part have reached a stage where compressive strength resembling to that of concrete has been achieved. The material constants like Poisson's ratio and modulus of elasticity are well within the range of RCC. The flexural and shear behaviour is also satisfactory.

More research is required which is being carried out presently [13] and remains unpublished so far. Future buildings as per the vision of this project shall be of baked clay, particularly in the fertile plains where this material is abundantly available.

4. MANAGEMENT ASPECTS OF MULTISTOREY BUILDINGS USING CLAY.

This shall follow a separate routine regarding the use of clay with prudence for optimization when pre-cast panels which are factory made on order and put into use. This needs proper planning and before hand, ordering of what is needed in terms of pre-cast panels which would be used for erection of a building in due course of time.

Management leads to optimization in terms of materials, labour and consequently the cost without affecting the over all performance of the project and the very purpose which it is aimed to serve.

The world is cognizant of the fact that even people 4000 thousand years ago were so much careful that king of Babylonia the old empire, in his first law code of world mentioned as under:

1. The builder if he builds a house that falls and the owner dies, the builder shall be killed.
2. If a builder builds a house, that falls and the son of the owner dies, the sun of the builder shall be killed.
3. If a builder builds a house and it falls a slave dies, he shall purchase a slave as replacement of the slave of the owner.

This was aimed at building the houses soundly which could be accomplished though proper planning and management.

Man is aware of the fact that the proper management of house building is quite imperative which other wise would be vulnerable and shall lead to destruction. Economy of construction could also be achieved through proper management. Modern techniques such as CPM, PERT and the software like Primavera, MS project and such other well known packages are an added advantage.

The operations involved in the construction of houses using pre-perforated post-reinforced baked clay panels can be identified as follows.

1. Procurement of clay and pit sand
2. drying these materials at 105 degrees C.
3. pulverizing the clay
4. Mixing of materials (clay and pit sand) in proper proportions together with water.
5. Casting the panels
6. Compaction of panels
7. Drying of panels
8. Baking of panels
9. Reinforcing the panels
10. Creation of bond through grouting by using cement slurry

11. Curing
12. Transportation of the panels to the site.
13. Erection, which needs proper joint detailing.
14. Curing of the joints.

The total requirement of panels for all the structural members must be assessed first precisely and order must be placed before hand allowing ample time to manufacture these panels. Pre-requisites must be identified and completed in the mean time.

Proper sequential order of the types and sizes of the panels must be prepared and the supply of their quantity to be consumed every day must be ensured. Day to day labour requirements must also be estimated.

6. CONCLUSIONS.

1. Major managerial aspects of R.B.C. construction have been identified, which need more elaboration. The managerial skills together with optimization could bring the cost of construction further down when R.B.C. is used.
2. The State-of-the-Art regarding use of clay as chief material of construction has been high-lighted.
3. The latest developments that have occurred due to the endeavour of the authors have been presented.
4. R.B.C. holds promise as a future material of construction in parallel with RCC at relatively lower cost.

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