Study on Brick By Using Black Cotton Soil As A Construction Material

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Abstract- *This paper deals with the design and preparation of brick using the black cotton soil as a construction material This technology has been developed by the central building research institute (CBRI), Roorkie, India. Ingredients used in preparation of brick by using black clay, cow dung cake, coal ash, lumps of soil stages of preparation of brick by using black cotton soil. Digging of clay, settling tank, mixing of clay, molding, drying, and firing. This paper we are preparing a brick by using black cotton soil which is eco friendly to the environment. The preparation of brick by using black cotton soil is cheap. It has more resistance compared to normal brick.*

Keywords- Adhesive material, brick, black cotton soil, rice husk, salt.

I. INTRODUCTION

Building bricks are a mixture of clay and sand which is mixed with water to create the correct consistency. Sometimes the bricks also have added lime, ash or organic matter which speeds up the burning of the brick. The clay mixture is then formed in moulds to the desired specification ready to be dried then burnt in the kiln. Clay: The properties and quality of bricks depend on the type of clay used. The most common form of clay used for everyday bricks, is that with a sandy consistency, silicate or alumina, which usually contains small quantities of lime or iron oxide. Silica, when added to pure clay in the form of sand, prevents cracking, shrinking and warping. If there is a large proportion of sand used in the mixture the brick will be more textured and shapely. An excess of sand, however, renders the bricks too brittle and destroys cohesion. 25% of silica is said to be advantageous. Iron oxide in the clay enables the silica and alumina to fuse and adds considerably to the hardness and strength of the bricks. The iron content of the brick is evident in the colour of the brick and can be used to add the colour red into the bricks.

However a clay which burns to a red colour will provide a stronger brick than clay which burns to a white or yellow brick. The lime content in a brick has two different effects. It stops the raw brick from shrinking and drying out, and it also acts as a flux during burning which causes the silica to melt and creates the bond which binds all the components of the brick together. However, too much lime can cause the brick to melt and loose shape. Any amount of quicklime within a brick is detrimental to its quality and can cause the brick to split into pieces. For the best qualities of pressed brick the clay is carefully selected both colour and composition. Clay from different sources is also often mixed together to create the desired mixture.

II. LITERATURE REVIEW

Sarangapani et al [2002]125 compared the characterization and properties of local low modulus bricks, table moulded bricks and wire cut bricks, mortars and masonry. Leaner mortars such as 1:6:9 cement – soil mortar showed very ductile behaviour which was indicated as the stress-strain curve becoming horizontal after reaching a peak strain value. This indicated that the 9 presence of a significant amount of soil gave rise to ductility with low strength mortars. Stress-strain characteristics of masonry were examined through prism tests. The modulus of elasticity of brick masonry was found as 265MPa. Simple analysis was carried out to understand the nature of stresses developed in the mortar joint and brick in the masonry. The results revealed that the bricks made around Bangalore had low moduli compared to the cement mortar. This led the masonry where mortar joints developed lateral tension while brick developed lateral compression

KavesTaner et al (2006) determined the usability of clay and finewaste of boron from the concentrator plant in Kirkar (Turkey) as a fluxing agent in the production of red mud brick. Scale tests for production of bricks were carried out. Clay and fine wastes have similar chemical composition but include different types and amounts of oxides. They were added in amounts of 5%, 10% and 15% of weight to red mud bricks. Those consist of high amounts of Fe_2O_3, SiO_2, and alkalies. Six different sets of samples have been produced and fixed at 700°C, 800°C and 900°C dry shrinkage of green body, bending and compressive strength, drying shrinkage, water absorption, frost resistance and harmful magnesia and line tests on heat –treated bodies.

IsmailDemir (2006) investigated the utilization potential of processed waste tea in clay brick. The effects of processed waste tea material addition on the durability and mechanical properties of the bricks were investigated. Due to the organic nature of processed waste tea, pore –forming and binding ability in clay body were also investigated. Based on the experimental investigation, the concluded that processed waste tea addition increased the required water content for plasticity. It is easily burnt out and ithas a wide range of burning from the clay body during fixing. No black coring and bloating were observed after fixing.

NunoAlmedia et al (2007) developed a method to evaluate the mechanical behavior of concrete mixtures containing stone slurry. The results showed that the substitution of 5% of the sand content by stone slurry induced higher compressive strength, higher splitting tensile strength and higher modulus of elasticity. They concluded that natural stone slurry could be consumed by several industrial activities as to byproducts and the same could specifically be used as a fine aggregate and/or micro filler in concrete mixtures, inducing benefits on its mechanical properties. .

Obada Kayali (2005) investigated the high performance of bricks from flyash. He concluded that the flyash brick had 24 % better compressive strength and 44% higher bond strength than the good quality clay brick. Also, he reported that the tensile strength of the flyash brick was three times greater than the value for standard clay bricks. The World Bank has cautioned India that by 2015, land disposal of coal ash would require about 1000 km2 of land. To overcome this problem and to encourage the utilization of flyash, Government of India in 2003 made it mandatory to use atleast 25% flyash with soils on weight to weight basis for manufacture of bricks within a radius of 100 km from coal or lignite based thermal power plants. In the last several decades, attempts have been made to find a suitable method for the disposal and proper utilization of fly ash

Ahmadi et al (2001) reported the results of an investigation on the utilization of paper waste sludge obtained from a paper manufacturing industry, as a replacement to the mineral filler material in various concrete mixes. The physical and chemical properties of the waste material were studied. The test results revealed that as the content of the waste increased the water to cement ratio for the mix also increased, since the waste has a high degree of water absorption Therefore, an additional amount of water was required for cement hydration. The results obtained showed that as the amount of the waste increased, the basic strengths, such as compressive strength, decreased. A maximum of 5% content of the waste as a replacement to the fine sand in concrete mix can be used successfully as construction materials, such as in concrete masonry construction with a compressive strength of 8 MPa, splitting strength of 1.3 MPa, and water absorption of 11.9% with a density of 20 kN/m3.

Peraetal (2003) pinpointed the properties of calcined paper sludge and inferred that when the paper is calcined at 650°C it can be mixed with metakaoline and calcite. This can consume hydroxide more rapidly than pure metakaoline. It can replace 20% of ordinary Portland cement with beneficial effects on compressive strength and the size of pores. When calcined at 800°C, paper sludge becomes a mixture of calcite, quick lime and metakaoline. It presents both hydraulic and pozzolanic properties. To be used in concrete, this ash needs to be slaked. The experts suggested that paper sludge could replace 20% cement without affecting the strength but it was less pozzolanic than the sludge calcined as 650°C.

Tarun R. Naik et al (2004) derived experimental results on concrete containing pulp and paper mill residuals. They concluded that the dosage of high range of water reducing agent was proportional to the amount of wood fibers in concrete. Paper Mill residuals do not affect the strength development of concrete. At a small lower compressive strength, concrete containing residuals showed equal length change (drying shrinkage) compared with the reference concrete made without residuals. Using the data from their experimental studies, Frias et al (2004) formulated that the highly pozzolanic materials were obtained by calcining paper sludges. At this juncture, it is important to remember that the calcining conditions (temperature and time in furnace) play an important role in their activation. The pozzolanic activity of calcined sludge decreased with theincreasing calcining temperature and time in furnace. According to the aforesaid experimental work, they declared that the best conditions for the pozzolanic activation of paper sludge occurred at 2.5 hours at 700°C. In this condition, the pozzolanic activity of calcined sludge was similar to that obtained from commercial metakaolin. Tonks et al (2004) conducted an experiment on buildings constructed by utilizing discarded telephone books. The researchers believed that these are viable and in fact this method conformed to the requirements of the Newzeland Building Act. They also suggested that the construction process is labour-intensive, rather than skill-based, but care is needed when selecting the volumes and placing them into position. Services, power and communication can be accommodated within the walls, while it is preferable to run wet services within the slab. This construction method is analogous to both earth and straw buildings and in a similar manner is suited to the “do it yourself” building owner / constructor.

Dunster Andrew et al (2007) concluded from their research work that the addition of 20% calcined paper sludge with cement paste modified initial setting-time by accelerating the process in 60 minutes. Workability was reduced when using calcined paper-sludge. The incorporation of 10% and 20% thermally activated paper-sludge leads to an increase in the drying shrinkage of mortar 2 and 2.5 times more than that shown by the ordinaryportland cement used as control.

MihaTomazevic (2000) correlated the experimental results with the observed effects of earthquakes on masonry buildings. They indicated reliable information as regards the global seismic behaviour and failure mechanism obtained by testing small-scale models of buildings subject to earthquake. To do this simulators are used to create seismic ground motion upon proto type buildings. The limitations in the capacity of the actuator and resonant frequency of the testing facility are of great importance when deciding upon the size and structural configuration of the models.

Murthy et al (2000) presented experimental results on cyclic tests of R. C. frames with masonry infills. It is seen that the masonry infills contribute significantly to lateral stiffness, strength, overall ductility and energy dissipation capacity. With suitable arrangements to provide.

III. METHODOLOGY

3.1.PREPARATION OF NORMAL BRICK:

RAW MATERALS

Natural clay minerals, including kaolin and shale, make up the main body of brick. Small amounts of manganese, barium, and other additives are blended with the clay to produce different shades, and barium carbonate is used to improve brick's chemical resistance to the elements. Many other additives have been used in brick, including byproducts from papermaking, ammonium compounds, wetting agents,flocculents (which cause particles to form loose clusters) and deflocculents (which disperse such clusters). Some clays require the addition of sand or *grog* (pre-ground, pre-fired material such as scrap brick).

A wide variety of coating materials and methods are used to produce brick of a certain color or surface texture. To create a typical coating, sand (the main component) is mechanically mixed with some type of colorant. Sometimes *a flux* or *frit* (a glass containing colorants) is added to produce surface textures. The flux lowers the melting temperature of the sand so it can bond to the brick surface. Other materials including graded fired and unfired brick, nepheline syenite, and graded aggregate can be used as well.

The initial step in producing brick is crushing and grinding the raw materials in a separator and a jaw crusher. Next, the blend of ingredients desired for each particular batch is selected and filtered before being sent on to one of three brick shaping processes—extrusion, molding, or pressing, the first of which is the most adaptable and thus the most common. Once the bricks are formed and any subsequent procedures performed, they are dried to remove excess moisture that might otherwise cause cracking during the ensuing firing process. Next, they are fired in ovens and then cooled. Finally, they are dehacked—automatically stacked, wrapped with steel bands, and padded with plastic corner protectors.

3.2. PREPARATION OF BRICK BY USING BLACK COTTON SOIL:

This technology has been developed by the Central Building Research Institute (CBRI), Roorkee, India.

Manufacture of bricks from black cotton soils presents many difficulties because of its highly shrinkable nature and presence of lime nodules. Coal ash is, therefore, used as an opening material. However, the quality of brick made is far from satisfactory as it has high water absorption and only 30 to 60 kg/sq cm compressive strength. The Central Building Research Institute (CBRI), Roorkee, India, has developed an alternative process which consists of the use of calcined clay as the opening material and burning of bricks in a Bull's kiln to produce bricks of compressive strength of up to 130 kg/sq cm and water absorption about 15 per cent. The process is expected to create good interest in the brick industry in the black cotton soil regions.

Calcined clay is prepared in circular clamps of about 6 m diameter. First, a layer (about 25 cm thick) of cow-dung cakes is spread at the bottom of the clamp. A coal-ash layer 15 cm thick in the outer part of the clamp gradually reducing to 2.5 cm at the centre is then spread over the cow dung cakes. Lumps of soil of 8 to 20 cm diameter are loosely arranged in a layer of about 0.5 metre thickness. Layers of coal-ash and soil lumps are then alternatively placed up to a total height of 2.5 metres. Coal-ash in the upper region of the clamp is kept about 10 cm in the outer part and 2.5 cm in the centre. The fire is started through a number of openings arranged diagonally in the clamp. A temporary brick wall is constructed all round the clamp to prevent heat loss. The disintegrator is fixed over a collecting pit (6 m x 6 m x 1.5m) for receiving the pulverized material. The big lumps are broken by a hammer, fed into the disintegrator and ground to pass a 2 mm sieve.

Raw clay is washed in a tank of the required capacity. The tank is dug to a depth of about 0.75m and soil is filled with water up to a height of 25 to 30 cm. The tank is then filled with water up to a height of about 0.45m. The soil is thoroughly mixed with water and brought into suspension. Lime nodules are allowed to settle. Some depressions are made at the bottom of the tank, and these work as storing spaces for the lime nodules that separate out of the raw clay. From these depressions lime nodules are removed with the help of baskets. The suspension is then transferred to the settling tanks through the drains made for the purpose.

In order to separate further lime nodules, depressions are made in the connecting channels and settling tanks also. The calcined clay is mixed with soil in the settling tanks. The slurry is allowed to stand in the settling tank for about 72 hours. When the clay has settled down the supernatant water is syphoned off and salt is mixed to the soil along with calcined clay after water from the settling tank is drained off. All the materials are thoroughly mixed.

The well-mixed slurry is transferred to the drying tanks with the help of buckets. In order to avoid mixing of soil slurry with the soil at the bottom of the drying tanks, a layer of calcined clay or coal-ash is spread on the bottom of the drying tanks before transferring the wet soil slurry to them. The prepared soil is then dried to a consistency suitable for moulding bricks. It is cut with a spade, kneaded and stacked into heaps and covered with wet jute bags to prevent further loss of moisture.

The bricks are moulded in iron moulds and are carried to the properly levelled drying ground. When the bricks are dried to a leather hard stage they are stacked for further drying until they are ready for firing. The firing is done by traditional method in a Bull's kiln. The process does not require any foreign imported material at any stage.

IV. CONCLUSIONS

By preparing a brick by using black cotton soil is ecofriendly to the environment. The brick surface is smooth. It will get maximum compressive strength. The manufacturing process of making brick with the black cotton soil is simple And Eco Friendly.

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