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UTILIZATION OF BLACK COTTON SOIL IN THE MANUFACTURE OF BRICKS

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ABSTRACT–

Over a past few decades, there are wide ranges of alternatives available in the field of construction with the changing in the raw material for the particulars. As concern with the brick there are some invention like fly ash brick, concrete blocks and brick. Here we are using black cotton soil as a raw material for the bricks and also using some admixture to alter the properties of the black cotton soil. Test results obtained indicate that it is possible to manufacture good quality bricks using locally available black soil by adding, suitable admixtures. The bricks manufactured using this method have good quality with acceptable strength and further, they can be manufactured in a cost effective manner.

1. INTRODUCTION:

A Brick is a type of block used to build walls, pavements and other elements in masonry construction. Properly, the term brick denotes a block composed of dried clay, but is now also used informally to denote other chemically cured construction blocks. Bricks can be joined together using mortar, adhesives or by interlocking them. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities.

The Process of manufacturing of bricks from clay involves preparation of clay, molding and then drying and burning of bricks. The bricks are building materials which are generally available as rectangular blocks. The bricks do not require any dressing and brick laying is very simple compared to stone masonry.'

Brick is most artifact thing required to build walls, pavements and parts of masonry construction. Usually brick are unit stacked along or set as brick work along with mortar to build a permanent structure. Within the world Asia produces eighty seven of the overall production of the brick. Brick are the unit generally made in common or normal size in bulk quantities they need to be considered one in all the longest enduring and strongest artifact employed in twentieth century.

A Brick is a construction material used in the construction of structure. The Bricks and Mortar are stacked tighter and make the wall and any type of the structure. The Standard size of bricks is (19cm X 9cm X 9cm). The Nominal size of bricks is (20cm X 10cm X 10cm). The Standard size of bricks and specification of bricks is given in the IS: 2212 (1991). In the bricks various material are used like clay, Silica, Alumina, etc. Normally bricks are made from the clay material.

2. MATERIALS USED

2.1 BLACK COTTON SOIL:

Black cotton soil is a clayey type of soil also known as "Expansive soil". It has very low bearing capacity, high swelling and shrinkage characteristics. Hence stabilization is needed for this soil before subjecting it to any construction purpose.

FIG 2.1 BLACK COTTON SOIL

2.2 RICE HUSK POWDER:

Rice husk is the hard protecting coverings of grains of rice. In addition to protecting rice during the growing season, rice husk can be put to use as an insulation material, fertilizer or fuel etc. It is used in its powder form

FIG 2.2 RICE HUSK POWDER

2.3 COAL POWDER:

This is the powdered form of coal, which is created by crushing of coal. This is product obtained during mining. Coal powder is used in concrete. This is used to give stability to soil in brick manufacture.

FIG 2.3 COAL POWDER

2.4 LIME POWDER:

Lime powder is obtained by calcification of limestone. It has cementing capability. It can be used in concrete as cementitious material. Lime is used in manufacture of cement. Lime powder enhances the strength of the black cotton soil.

FIG 2.4 LIME POWDER

3. PROCEDURE FOR MANUFACTURING OF BRICKS:

- CLAY PREPARATIONS
- MIXING
- MOULDING
- DRYING
- FIRING

3.1 CLAY PREPARATIONS:

For the preparation of ordinary black cotton soil was taken from local area of the black cotton soil region. The debris and unnecessary particles removed from the soil. Tempering is adding water to the soil in order to make it more workable which takes 5 to 7 days in the case of black cotton soil. An alternative to tempering is disintegration or weathering, which involves allowing clay to dry in the sun and accept moisture from rain and dew. The repeated drying and moistening of clay will bring clay to a plasticity and workability a proper Crushing will make the mixture more homogeneous

3.2 MIXING:

Mixing is done to make the clay soil homogeneous and smooth. There are different techniques that can be used for mixing, including using animal power or letting humans mix the clay with their feet. Different admixtures such as coal or sawdust were added to the clay reasons:

for two beneficial

a) Reduce cracking during drying.

b) Reduce fuel usage during firing.

In addition the rice husk, salt and lime was also added separately as well as combination of any rice husk-lime, salt-lime and salt-rice husk weight of the soil.up to 5% of total

FIG 3.2 MIXING

3.3 MOULDING:

The size of a mould for brick making was selected such that considered shrinkage effect of soil take in mind. Bricks will shrink when drying, so the mould size chose larger than the intended finished brick. The slop moulding technique was adopted for the preparation of the mould. In slop moulding, a wet clay mixture is used- the mix is put into a rectangular form without a top or bottom. The mould was selected in size of 200mm x 100mm x 100mm height with a frog 10 to 20 mm deep on one of its flat side. The limitation with this technique is that because the mix is so wet, the brick may deform under its own weight and the surface can be marked easily. Moulded bricks can be imprinted with the brick manufacturer's name, called a "frog," on the flat side of the brick. This advertising. helps the brick dry and fire better, and is a good form of advertising.

FIG 3.3 MOULDING

3.4 DRYING:

Water was added during clay preparation to increase workability of the mixture, but in drying it is removed for several reasons. First, there will be less cracking in fired bricks with less water content. Second, additional fuel is needed, beyond what is used for firing, to dry the bricks in the kiln. Proper drying of bricks will involve rotating the bricks for different exposures to ensure even drying rates. For best results, drying should be done slowly. This will help with more even drying. Also, the best drying technique may change from location to location, so the brick makers must gain experience to determine the best way to dry bricks for each production process. We dry the bricks under the normal atmospheric temperature (25˚C).

FIG 3.4 DRYING

3.5 FIRING:

A clamp is a field kiln built from the green bricks that will be fired. Clamps vary with size and shape and must be oriented with respect to wind direction. Once a clamp is laid scout and constructed, it must be insulated.

Finally, the process of firing the clamp will take place in several steps. First, pre- heating, or water-smoking, will remove the water leftover from the drying process. This process is still physical. The second stage is firing, where the clay bricks will vitrify through a chemical process. The temperature must remain constant at this stage for complete verifications. Finally, for the cooling stage, the temperature must be slow and steady. A clamp may take two weeks to cool.

FIG 3.5 FIRING OF BRICKS

4 TESTS CONDUCTED ON BLACK COTTON SOIL

- Specific gravity test
- Liquid limit test
- Plastic limit test
- Standard proctor compaction test
- Compression strength test

4.1 SPECIFIC GRAVITY TEST:

Specific gravity of soil is defined as the weight of soil to weight of equal volume of water. It tells how much heavier or lighter the material is than the water. This test covers the determination of specific gravity of soil.

The standard value is 2.65.

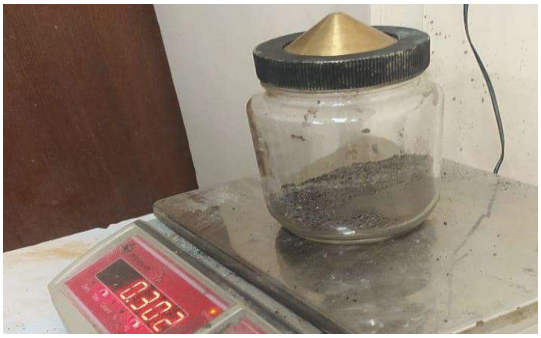


FIG 4.1 SOIL IN PYCNOMETER

DETERMINATION	TRIAL 1	TRIAL 2
Weightof pycnometer (W1)g	648	648
Weightof pycnometer + dry soil (W2)g	848	847
Weightof pycnometer + soil + water (W3)g	1600	1659
Veight of pycnometer + water (W4)g	1471	1489
Specific gravity	2.81	2.31
Average Specific Gravity	2.56	

4.2 LIQUID LIMIT TEST

The liquid limit is the moisture content at which the soil passes from the plastic state to the liquid state as determined by the liquid limit test.

FIG 4.2 LIQUID LIMIT TEST

TRIAL	1	2	3	4	5
% Water added	20%	25%	30%	35%	40%
No of blows	34	30	25	22	18
Empty weight of container (W1)	33	31	32	36	30
Weight of wet soil + container (W2)	37.6	33.7	34.38	37.69	33.16
Weight of oven soil + container (W3)	39.6	34.8	35.2	38.2	34.3
Weight of wet soil	4.6	2.7	2.3	1.6	3.1
Weight of dry soil	6.6	3.8	3.2	2.2	4.3
Water content	69.76	70.94	73	74.12	75.5

Average water content of soil 72.68

4.3 PLASTIC LIMIT TEST

The plastic limit is the moisture content that defines where the soil changes from a semi-solid state to the plastic state.

It may also defined as that water content at which soil starts crumbling when rolled into threads of 3mm dia .

FIG 4.3 PLASTIC LIMIT TEST

DETERMINATION NUMBERS	1
Container number	28
Weight of the container W1(g)	30
Weight of the soil + wet soil (W2)g	34.5
Weight of container + oven dry + soil (W3)	33
Weight of Wet soil	1.5
Weight of dry soil	3
Water content	50

4.4 STANDARD PROCTOR COMPACTION TEST

Compaction is the application of mechanical energy to a soil so as to rearrange its particles and reduce the void ratio. it is applied to improve the properties of an existing soil or in the process of placing fill such as in the construction of embankments, road bases runways, earth dams

DETERMINATION	1	2	3
Mass of mold + compacted soil(g)	6938	7053	7208
Mass of mold	4554	4554	4554
Mass of compacted soil (g)	2384	2509	2654
Bulk Density g/cm3	2.52	2.65	2.81
Dry density g/cm3	2.14	2.16	2.18

WATER CONTENT

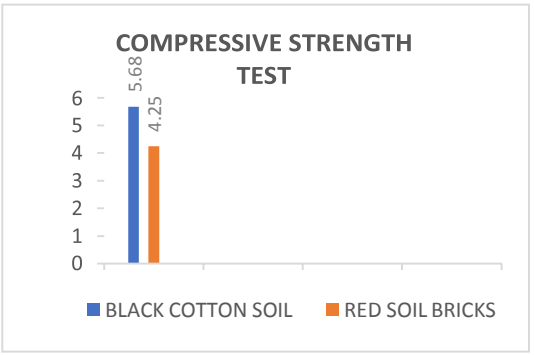
Container no 34		22	21
Mass of container(W1)	30	32	29
Mass of container + wet soil (W2)	42.2	41.7	38.4
Mass of Container + dry soil (W3)	40.9	39.5	37.5
Water Content	11.9	19.6	10.5

4.5 COMPRESSION STRENGTH TEST

The average compressive strength of brick made from black cotton soil is 5.68 N/mm2.

The compressive strength of brick made from red soil is 4.25 N/mm2

COMPRESSION STRENGTH CHART:



5. RESULT AND DISCUSSION:

The specific gravity test for the black cotton soil is conducted according to IS-2720, the standard value for black soil lies between 2.57 to 2.35 respectively, in practical laboratory test we obtained the value of 2.56, hence the results are within the limits and the soil can be used for manufacturing of bricks.

In standard proctor compaction test as per IS-2720, for different percentage of moisture content and corresponding values of dry density of soil are observed.

The maximum dry density obtained is 2.16 gm/cc at optimum moisture content of black cotton soil at 21%of water. This results shows that soil gives better strength at the water content of 21%.

Values of liquid limit and plastic limit used to classify fine grained soil. It gives us information regarding the state of consistency of soil. The values obtained for liquid limit is 72.68% and plastic limit is 50% for the soil sample.

As per IS code provisions the standard dimensions of first class brick is 19cm x 9cm x 9cm. In the laboratory test the dimensions of black cotton soil bricks are 22cm x 11cm x 8cm .

In the laboratory test as we performed the maximum compressive strength of brick using black cotton soil obtained is 5.68 N/ mm2. But the red soil brick compressive strength is 4.25 N/mm2. Hence the compressive strength of black cotton soil is more than red soil brick, so we can use this bricks in construction works.

6. CONCLUSION

Bricks are normally prepared from red soil or cementitious materials such as fly ash, GGBS etc.

The researches on the production of bricks using black cotton soil is done very rarely.

The bricks made from black cotton soil are highly effective compared to normal bricks.

Black cotton is a type of soil which is having high bonding strength when it is mixed with admixtures.

It has more adhesive property compared to red soil.

The strength of bricks is expected more compared to normal bricks.

Since, the bricks are more economical, soil is easily available in local areas and it is stronger.

It is a good idea to use black cotton soil in the manufacture of bricks in places where black cotton soil is highly available.

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