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MANUFACTURING OF STABILIZED BLOCKS USING SHEDI SOIL

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Abstract – In recent times the emission of carbon dioxide into the air is being increased day by day due to various reasons. This weakens the heat–trapping blanket that surrounds the planet, causing global warming. Various alternatives can be considered to protect the planet. The production of each ton of cement releases high amount of carbon dioxide to the atmosphere. The usage of cement can be reduced by using the other possible cementing materials without compromising the strength and durability. Lithomargic (Shedi) soil is most commonly available soil throughout west coast of India. The Lithomargic soil strata are existing at shallow depths below natural ground level and are whitish, yellowish or pinkish in color.

Key Words: Lithomargic soil, Physicochemical analysis, sodium hydroxide, Ground-granulated blast-furnace slag (GGBS or GGBFS)

1. INTRODUCTION

Infrastructure projects such as highways, railways, water reservoirs, reclamation etc. requires earth material in very large quantity. In urban areas, borrow earth is not easily available which has to be hauled from a long distance. More areas are covered with highly plastic and expansive soil, which is not suitable for such purpose. Extensive laboratory field trials have been carried out by various researchers and have shown promising results for application of such expansive soil after stabilization with additives such as sand, NaOH, cement, GGBS, etc. The most basic building material for construction of house is the usual burnt clay Blocks and concrete Blocks. A significant quantity of fuel is utilized in making the Blocks. Also, continuous removal of topsoil, in producing conventional Blocks creates environmental problems. Cement concrete Blocks need conventional cement and not a sustainable material.

1.1 OBJECTIVES

To study the performance of Shedi soil Block for strength and water absorption.

To obtain the optimum proportion of shedi soil, cement, GGBS and sodium hydroxide for strength and economy.

2. SCOPE OF STUDY

Shedi soil is relatively an economically available material. The research reported till date speaks about the random use of the material without any quantitively rational approach. The report on proportioning, strength development in shedi soil is very less. This forms the basis of Shedi soil Blocks. In this project the study of physical, chemical, setting characteristics and compressive strength of different proportions of Shedi soil with other materials like cement, cement, gypsum, GGBS at different ages are studied.

3. METHODOLOGY

3.1- MATERIALS

The following are the materials which were needed for our project. The material should be as per IS code recommendation. The materials should be stored in clean and dry room.

3.1.1- Shedi Soil

Lithomargic soil or shedi soil was collected from a depth of 1-1.50m below natural ground level near national high way side of Bhatkal, Karnataka, India. The soil was air dried for 6 days pulverized manually and sieved through 425 microns before used for experimental investigation. The physical & Index properties of soil are listed in Table 3.1

3.1.2- Cement

Cement is an important binding material in building construction. It is basically Calcium oxide (CaO) in natural association with magnesium oxide (MgO). The word 'Cement' refers to products derived from burnt (calcite) cement stone, such as quick cement and hydrated cement.

3.1.3- Sodium hydroxide

Sodium hydroxide is a highly caustic base and alkali that decomposes proteins at ordinary ambient temperatures and may cause severe chemical burns. It is highly soluble in water, and readily absorbs moisture and carbon dioxide from the air. It forms a series of hydrates NaOH. H2O. The monohydrate NaOH H2O. Crystallizes from water solutions between 12.3 and 61.8 °C. The commercially available "sodium hydroxide" is often this monohydrate, and published data may refer to it instead of the anhydrous compound.

3.1.4- GGBS

Ground-granulated blast-furnace slag (GGBS or GGBFS) is obtained by quenching molten iron slag (a by-product of iron and steel-making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder.

Two major uses of GGBS are in the production of quality-improved slag cement, namely Portland Blast furnace cement (PBFC) and high-slag blast-furnace cement (HSBFC), with GGBS content ranging typically from 30 to 70%; and in the production of ready-mixed or site-batched durable concrete.

3.2 Manufacturing Process

Process of manufacture of Shedi soil Blocks involves the following stages of operations.

- GGBS, Cement and Sodium salts with different combination and proportion was mixed along with major quantity of Lithomargic soil.
- Quantity of water for workability is used and maximum strength was arrived based on compression test conducted with varying percentage of water.
- The prepared mix was casted according to the standard procedure with various mix proportions arrived.
- The conventional Block moulds having standard size of 220mmX110mmX75 mm was used to cast the Blocks.
- Molded wet Blocks were cured for 7, 28 days.
- Compression test was carried out for each proportion on 7^{th}, 14th and 28^{th} day.
- Sorting, inspection and quality control tests prior to sale.

3.3- Proportions for shedi soil Blocks.

The row materials shedi soil, Cement, GGBS, Sodium Hydroxide, is used for the present study were taken in dry condition and mixed in the proportions with water as shown in the Table 3.4

The normal hand mould was used to cast the Blocks with the standard size of 220mmX110mmX75mm.They were cast according to the standard procedure with various mix proportions arrived.

The required quantity of Shedi soil, Cement, GGBS was calculated previously, according to that the materials mixed properly. Then required quantity of water was added and mixed thoroughly.

The prepared mix was poured into the mould and compacted. After some time the mould is removed. Then the wet Block was kept under air curing for a required period and was sprayed with water twice a day till testing

3.3.2-Compressive strength test

After curing for required period Blocks are kept for testing. To test the specimens the Blocks are placed in the calibrated Compression testing machine applying a load uniform at the rate of 2.9kN/min. The load at failure is the maximum load at which specimen fails to produce any further increase in the indicator reading on the testing machine. In that three numbers of Blocks were tested for each mix proportion. Each Block may give different strength. Hence, average of three Blocks was taken.

The standard procedure for testing of burnt Block IS: 3495 – P (1)-1992 was followed for compressive

3.3.4- Efflorescence test

The presence of alkalis in Blocks is harmful and they form a gray or white layer on Block surface by absorbing moisture. To find out the presence of alkalis in Blocks this test is performed. In this test a Blocks immersed in fresh water for 24 hours and then it's taken out from water and allowed to dry in shade.

If the whitish layer is not visible on surface it proofs that absence of alkalis in brick. If the whitish layer visible about 10% of Block surface then the presence of alkali is inacceptable range. If that is about 50% of surface then it is moderate. If the alkalis presence is over 50% then the Blocks severely affected by alkalis.

Size shape and color test

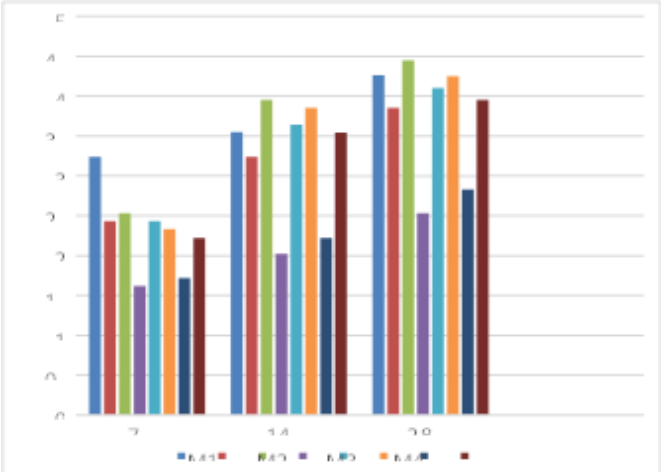
In this test randomly collected 20 Blocks are staked along lengthwise, widthwise and height wise and then those are measured to know the variation of sizes as per standard. Blocks are closely viewed to check if its edges are sharp and straight and uniform in shape. A good quality Block should have bright and uniform color throughout.

Soundness test

In this test two Blocks are held by both hands and struck with one another. If the Blocks give clear metallic ringing sound and don't break then those are good quality Blocks

RESULTS AND DISCUSSION

The compressive strength of the casted Blocks was tested after the curing period. The results of compressive strength test of Shedi soil Blocks for 7 & 28 days respectively are presented in the table. Based on the results graphs were plotted and results were discussed.



CONCLUSION

Maximum compressive strength achieved for the Blocks are M3 & M6 mixes. It contains 25% of GGBS, 4% of cement & negligible amount of NaoH for M3 mix and for M6 mix, it is 25% of GGBS, 3% of cement. Since higher compressive strength is for M3 mix, we can consider optimum strength is for M3 mix (SS- 77.51%, L- 3.1%, GGBS- 19.39%). Water absorption recorded for Blocks minimum for M1 mix (SS- 76.92%, L- 3.07%, GGBS- 19.23%, NaOH- 0.76%) Shedi soil Blocks can be conventionally prepared economically by using Shedi soil, cement, GGBS, NaOH. Due to lower water penetration, seepage of water through Blocks is considerably reduced.

In view of the above, it can be concluded that fly ash Blocks masonry units can effectively conventional masonry units. Due to uniform size of Blocks mortar required for joints & plaster reduces almost by 50%. Due to high strength, practically there will be no breakage during transport & use.

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