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INVESTIGATION OF STABILIZED MUD BLOCK BY USING CEMENT, FLY ASH AND ADMIXURE

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Abstract: Precast interlocking concrete paver blocks are used in immense extent and its demand is increasing day by day for creating the pavement or for exterior flooring.But largely paver blocks are cast using concrete, in which cement is the binder. But it is an energy absorbing product which consumes more energy during its all phases of production process and it gives out great volume of carbon di-oxide (CO2) to the outside environment causing serious threat on the atmosphere. Thus there is needful to minimize the usage of cement or to find the other possible binding agent which is eco friendly. In the other hand large quantity of wastes are getting accumulated which is simply burnt or dumped in a place as a result of which environmental problems are rising and the valuable lands are getting turned into dumping yards. Only little percentage of these wastes is being used for various purposes. The materials which can improve the performance of the building elements can be effectively used in the construction field, thus helping to overcome the complications of disposal issues. Hence in this study an effort is made to use locally available fly ash ,cement, soil to make paver blocks which is then stabilized using some percentage of cement. Hence in this study an effort is made to use locally available Gadhichi soil to make paver blocks which is then stabilized using some percentage of cement , Fly Ash , and Admixture. The pavers were cast and tested for compressive strength.The mixture of soil with 10% of Fly ash and 5% addition of cement by the weight of soil and with addition of 10gm APG Mix with or Without Coating showed satisfactory results .

Keywords :- ***Gadhi Soil , Fly Ash, Cement, Compressive Strength , APG Mix***

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INTRODUCTION

Gadhi soil has got many inherent benefits with excellent thermal insulation properties, better termite resistance and cohesive properties revealing fewer cracks during different weather changes. Minke (2006), Reddy (2004), Morel et al. (2001) and Goodhew and Griffiths (2005) described earth (soil) as an environment-friendly and sustainable building construction material. In order to have an insight into the reason for these advantageous properties of Gadhi soil, this report explores some of it's basic properties. The properties grain size analysis, liquid limit, plastic limit, specific gravity, Standard Proctor Compaction Test values, MDD and OMC were investigated experimentally. The mud paving block is a combination of admixures and soil mixed together with the addition of water. A series of test cubes were cast and tested with different ratios of soil & cement by controlling the water content.

Block paving is an attractive practice of building a pavement or hard standing. stabilized mud blocks are used for the purpose of exterior flooring. Stabilized mud blocks are used greatly in different countries over past two decadesin order to get control of the problems of providing paved path in areas where typical types of creating pavement is not workable or it is not reasonable and durabledue to road congestion, geological, functioning or environmental constraints. Stabilized mud block for paved path construction, interlocking patterns so that it canlock with the adjacent paving blocks.

A. LITERATURE REVIEW

Related to the project, the review presented here is mainly about paver blocks using soil ,fly ash cement etc. An attempt has been made out to briefly describe the salient features of the investigation that have been done by researchers.

Mishra et.al(2020) : Studied that using locally available laterite soil, rice husk ash and areca husk fiber to make paver blocks which is then stabilized using some percentage of cement could improve the performance of the building elements. Further its performance is enhanced by usage of SBR latex. The pavers were cast and tested for compressive strength, abrasion resistance and water absorption. The mixture of soil with 20% replacement of rice husk ash and 0.4% addition of areca husk fiber by the weight of soil and ash, with addition of 30% cement and constant 2% latex showed satisfactory results.

Modou and Jarju(2019) : Studied that Interlocking stabilised soil blocks (ISSB) would be an alternative sustainable construction material in the flood prone regions in the Gambia. They had analysed how ISSB has been used in other African countries and especially in regions, most susceptible natural disaster like in Malawi an Earthquake prone regions. ISSB is an exceptional high quality construction alternative with very low production and construction cost. It is as well environmentally friendly and can greatly influence the sanitary health of the people by the constructing water tanks.

J.S.Trivedia et.al(2013) : Studied variation in the values of CBR of the Sub-grade Soil with the addition of a specific percentage of Fly Ash. The input values for this study were those which directly affect the CBR values i.e., directly proportional to CBR. It includes Liquid Limit (LL), Plasticity Index (PI), Optimum Moisture Content (OMC) & Fraction of Fly Ash added (F.A in %).For analysis of stabilization of soil using fly ash, Evolver 5.7 an add-in software of excel is used. Properties used for analysis are Liquid Limit, Plastic Limit, Optimum Moisture Content and California Bearing Ratio

Karim et.al (2020) : Studied the optimum mix ratio of soil to fly ash to enhance the engineering properties of clayey sand that can potentially be used as a road subgrade. Grain size distribution and Atterberg limits tests were conducted to classify the soil and to study the effects of the fly ash on the soil plasticity. The Proctor test was conducted to determine the optimum moisture content and maximum dry density of soil--fly ash mixtures with arbitrarily selected 0%, 40%, 50%, and 60% fly ash content.

Somaiya et.al (2013) : Studied the improvements in the properties of expansive soil with fly ash in varying percentages. As the locally available borrow soil has generally high plasticity (LL > 50) it was difficult to construction on it. The inclusion of different percentage of fly ash in natural soil generally resulted in some increasing in unconfined compressive stress.

Pasupuleti et.al (2015) : Studied the effect of curing time on the strength characteristics of cement treated soil and also to show the engineering behavior in various properties which includes the compaction, compressibility and the shear strength parameters. To achieve this, laboratory tests had been conducted for various types of soils treated with different types of cements, varying the percentages were performed. The results showed that the curing time has a significant effect on the unconfined compressive strength and it is found that on the addition of cement content, the engineering properties are also affected.

B. METHODOLOGY

1. Materials Used:

Soil sample: The soil sample used in the project work for the experimental purpose is borrow from Nimba Bhatkuli. The collected soil sample is white in colour. Fig 3.1 shows a typical photograph of soil sample.

Figure 1 : Soil Sample

Fly ash: Fly ash is finely divided residue resulting from the combustion of powdered coal, transported by the fuel gases and collected by electrostatic precipitator. The fly ash used in this study has been collected from Ready Mix Concrete Plant, Amravati. Fig 3.2 shows a typical photograph of fly ash.

Figure 2 : Fly Ash

Cement: A cement is a binder, a chemical substance used for construction that sets, hardens, and adheres to other materials to bind them together. The cement used in this study is Portland Pozzolana Cement (fly ash based) and is used in optimum percent to bind materials which is used for manufacturing of stabilized paver blocks.

Figure 3: Cement

Admixture: APG MIX (Cement admixture): An admixture is a material other than water, aggregates, cementatious materials, and fiber reinforcement, used as an ingredient of a cementatious mixture to modify its freshly mixed, setting, or hardened properties and that is added to the batch before or during its mixing. APG mix uesd to prepare a stabilized paver blocks during mixing withthe proportion of 3gm per block, and the 3 blocks were prepared with the given combination.

Figure 4: APG Mix admixture

Ultima Protek Top Coat: It is a water based exterior paint that provides excellent sheen and dust resistance to the walls. It has anti-algal properties, high washability, cracks free,water proofing properties.

Figure 5: Ultima Protek Top Coat

2. Determination of Moisture Content

Oven drying method: Water content in soil by oven drying method as per IS: 2720 (part II)-1973. Water content or moisture content is defined as the ratio expressed as percentage of the mass of water in a given soil mass to the mass of soil solid particular under the specified testing condition. It is denoted as w in %. Fig shows a typical photograph of oven.

3. **Grains Size Analysis Test :** To classify the type of soil “grain size analysis test” is very necessary. The grain size analysis is the process of determining the proportion by weight of different sizesof particle present in given soil.

4. **Determination of Specific Gravity of Soil by Pycnometer:** Specific gravity is defined as the ratio of the unit weight (or density) of soil solids only to unit weight (or density) of water. The knowledge of specific gravity is needed in the calculation of soil properties, void ratio and degree saturation

5. **Determination of Liquid Limit:** Liquid limit of a soil sample is defined as the minimum water content at which the soil is in liquid state and has a small shearing strength against flowing. With reference to a standard mechanical device by Casagrande, it is defined as the minimum water content at which a groove of standard dimension cut in a soil pat flows together for a distance of 10-12mm at the bottom under an impact of 25 blows.

6. Plasticity index – Plasticity Index is defined as the numerical differencebetween the liquid limit & plastic limit of soil. $I_P = W_L - W_P$

Preparation of stabilized mud block:

Quantity of material required:

- Size of mould: (0.2x 0.1x 0.06)M
- Volume of mould: 0.2x 0.1x 0.06 = 0.0012M
- Material required for 1 mould:

1) Quantity of soil =Volume x Density
=0.0012 x 2400
=2.88kg
2) Cement(5%) =2880 x 5\100
=144gm
3) Fly ash(10%) =2880 x 10\100
=288gm

4)Admixture = 3gm/block

Steps to prepare mud blocks:

1) The moulds were made using plywood pieces with dimensions of (0.2 x 0.1 x0.06)m.

2) The materials were mixed manually using a trovel.

3) The mixing was carried out until the mixture obtained a uniform appearance.

4) The mould was greased properly and the mixture was filled in the block in threelayers by tamping each layer.

5) It was necessary to finish the surface with the help of a spatula to level the facesof the block.

6) After 24 hours of hardening the blocks were de-moulded.

7)

8) After de-moulding, the blocks were given spray curing for 3/7 days.

9) The Coat was applied on the stabilized block, and kept it dry for 24 hours.

Compaction test:

1) Compaction test was conducted on stabilized mud block, without and withcoating.

4) The universal testing machine(UTM) was uesd for the compactoin test.

5) And the failure load ware obtained.

- **Project group:**

RESULT AND DISCUSSION

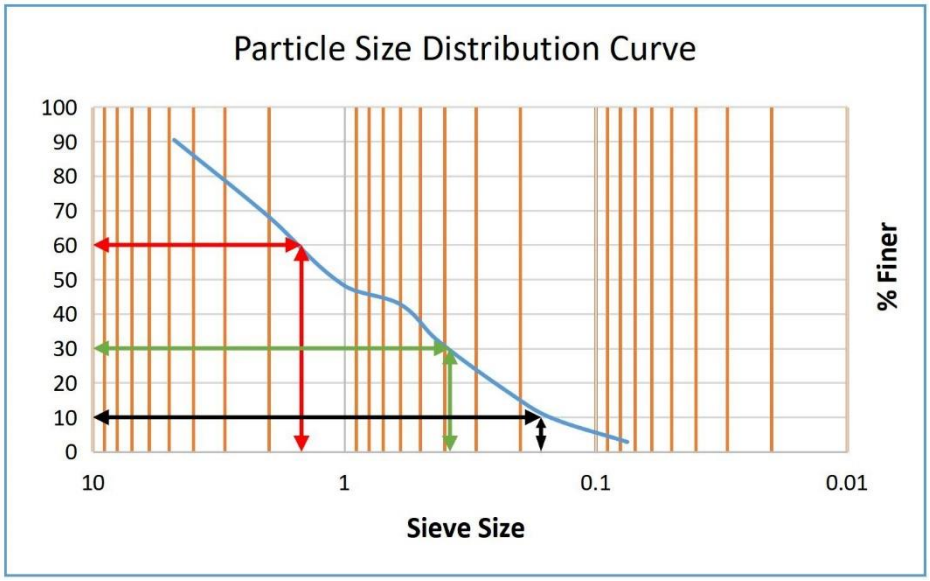


Figure 4.1 Relationship between particle size and % finer

Calculations:

Cu = D60/D10

Cu = 1.48/0.165

Cu = 8.96

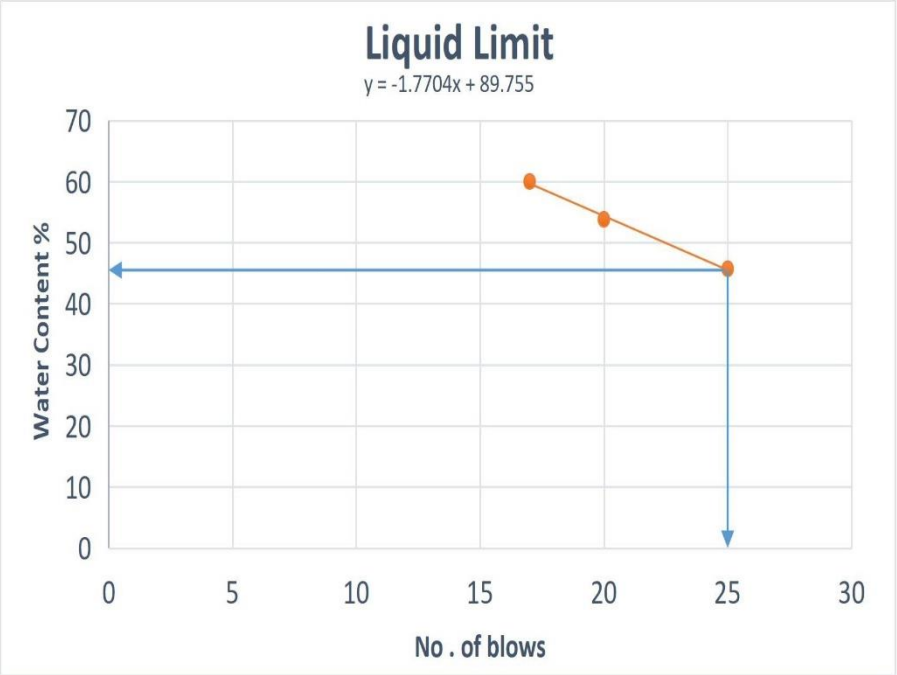
Cc = $(D30)^2$/D10*D60

Cc = (0.38)^2/0.165*1.48

Cc = 0.591

Result: The soil is found to be Poorly Graded Sand .

Figure 6 Relationships between No of Blows and Water Content



Result: The liquid limit of the sample was found to be 45.70%

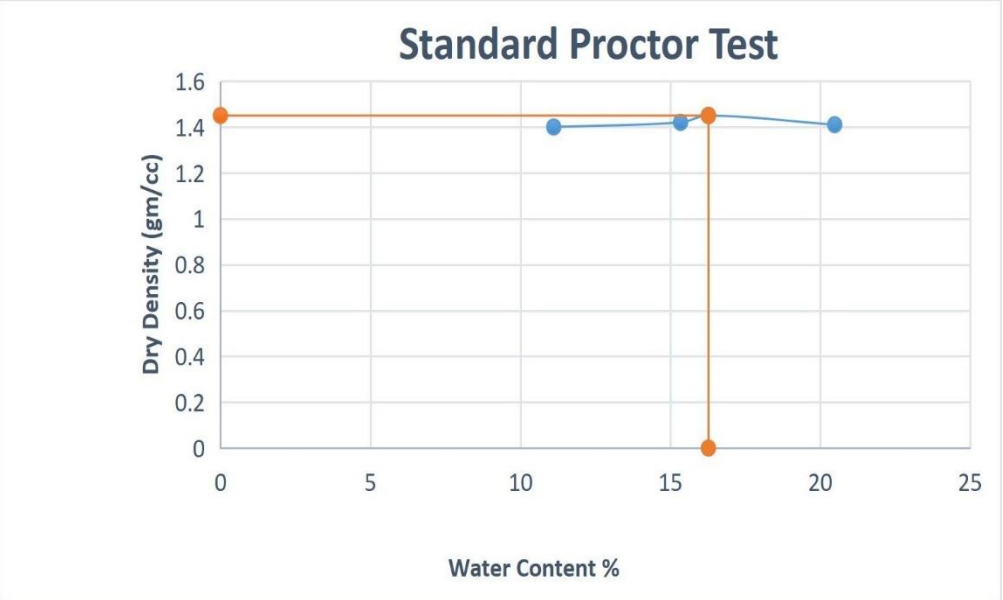


Figure 7 Relationship between moisture content and dry density

Result: The OMC and MDD of soil is found to be 16.27% and 1.45 gm/ccrespectively.

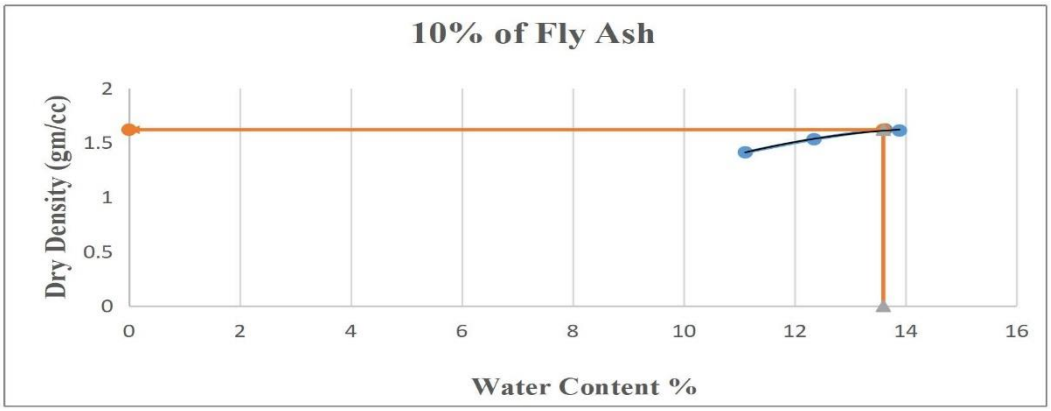


Figure 8 OMC and MDD for Gadhi soil +10% fly ash

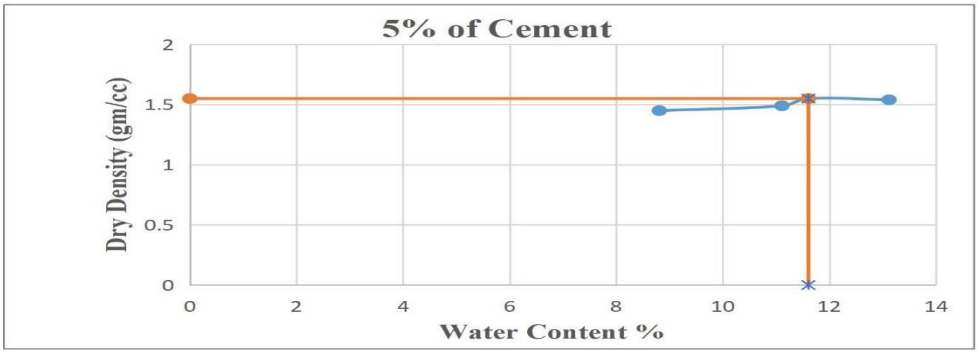


Figure 9 OMC and MDD for Gadhi soil +5% cement

Performance of Stabilized Mud Block

The performance of stabilized mud block was determined for three combinations as shown in table 4.9 the stabilized mud block was prepared for optimum percentage of cement(5%),fly ash(10%) and admixture. The failure load after 7days of curing curing was determined for blocks with coating and without coating, for coating of block Ultima Protek top coat was used

Table:1 Performance of Stabilised Mud Block Combinations

Sr. No	Stabilised Mud Block Combination	Failure Load (KN) After 7 Days Curing	
		Without Coating	With Coating
1	Soil Block	19.7	28.8
2	Soil + Cement +Fly ash	30.8	69.4
3	Soil + Cement + Fly ash +Admixture	53.4	69.3

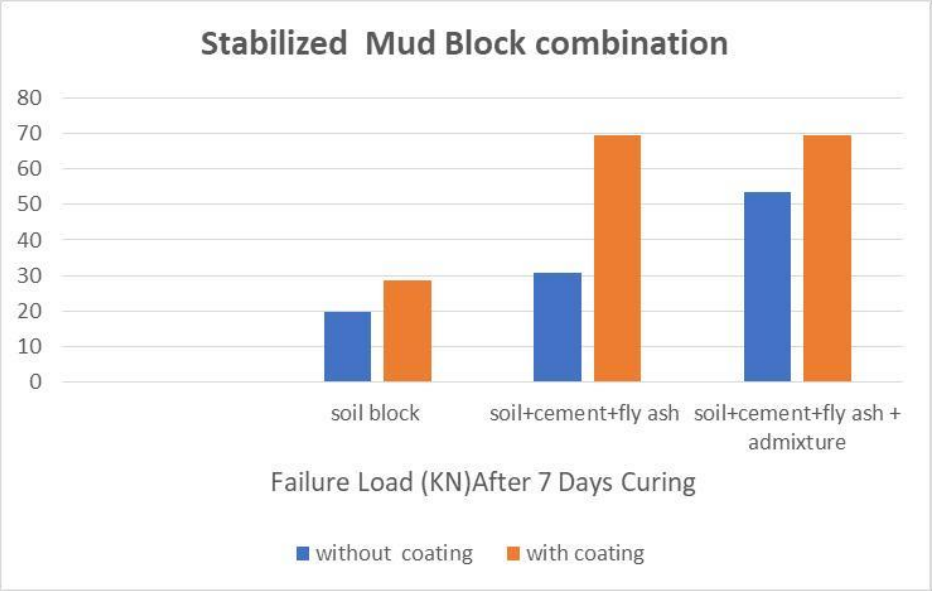


Figure 10 Combination of stabilized mud block

From the above graph it was observed that the failure load was increases after applying coat to the stabilized mud block, and when the cement and fly ash were added the failure load was increased, and when the cement, fly ash andadmixture were added it was again increased.

CONCLUSION

From the study following conclusions can be made :

1. The Gadhi soil used is Poorly Graded Sand with low plasticity.
2. The optimum percentage of cement and fly ash is found to be 5% and 10% respectively.
3. The failure load of soil block was increased by 271% and 241% with coating after adding optimum percentage of cement, fly ashand admixture.
4. The stabilized block after adding optimum percent of cement and fly ash increased by 140% with coating and increases by 55% without coating.
5. It was observed that the failure load of stabilized block after adding cement , fly ash and Admixture without coating increases by 75% than soil, cement, fly ash block, Where as with coating the failure load remains same.

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