

Experimental Analysis on Stabilization of Black Cotton Soil Using Bagasse Ash, Lime & Quarry Dust, A Review

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Abstract- Soil stabilization deals with physical, physio-chemical and chemical methods to ensure that the stabilized soil services its intended purpose as pavement component material. This recommended practice describes a method of stabilization of soils by utilizing Bagasse ash with lime & quarry dust to proved a base/ sub base course in the design of road pavement. Bagasse ash is a waste product available from burning of bagasse. The basic principles of soil stabilization include evaluating the properties of given soil and assessing the deficient property due to which the soil is considered weak. It also decides the appropriate method of supplementing the deficient property by the economical and effective methods of stabilization.

Bagasse ash can be advantageously used not only in the pavement construction work, but provides an useful and economic avenue for disposal of bagasse ash. The research investigated the properties of black cotton soil when stabilized by lime, bagasse ash and combination of lime, ash and quarry dust. The experiment covered grading test, Plasticity index (Atterberg) and California bearing ratio (CBR).

Keywords- Bagasse ash, lime, quarry dust, atterberg, CBR

I. INTRODUCTION

Soil stabilization means the improvement of the stability or bearing capacity of the soil by the use of controlled compaction, proportioning and the addition of suitable admixture or stabilizers. Due to lack of suitable soil at many places it need for soil stabilization. The common soil stabilized methods are lime stabilization and cement stabilization, which many be replaced by bagasse ash for economy. This reduces its disposal volume. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and air field pavements.

Methods of stabilization may be grouped under two main types.

- a. Modification or improvement of a soil property of the existing soil without any admixture.
- b. Modification of the properties with the help of admixtures. Compaction and drainage are the examples of first type, which improve the inherent shear strength of soil. Examples of second type are mechanical stabilization, stabilization with cement, lime, bitumen and chemical etc.

In the present study an attempt has been made to improve the properties of Black cotton soil subgrade by stabilization method using bagasse ash, lime & quarry dust. In this investigation laboratory studies were carried to know the effect of bagasse ash, lime & quarry dust when mixed separately and in combination with Black cotton soil by conducting various tests such as plastic limit and CBR tests.

1.1 Objectives

1. To determine optimum percentage of bagasse ash, lime & quarry dust by conducting tests such as liquid limit, plastic limit and plasticity index by varying the percentage of bagasse ash and lime.
2. To study the behavior of different soil using bagasse ash, lime & quarry dust.
3. To determine the optimum moisture content and maximum dry density by conducting the proctor compaction test.
4. To determine the CBR value of BC soil mixed with different percentages of bagasse ash and lime.
5. To reduce the cost of construction of the pavement over black cotton soil by soil stabilization technique with the help of soil stabilizing agent.
6. To utilize the waste materials available in the agro-industries.

1.2 Methodology

- To Determine the Liquid Limit, Plastic limit, Maximum Dry Density (M.D.D), Optimum Moisture Content (O.M.C) & C.B.R value of the Raw Soil.
- Sieve the soil by 20mm & 4.75mm (IS Sieve) to obtain the quantity of 5 kg.
- Mixed the soil by water up to (O.M.C).
- Take the quantity of Jute Fibre by Dry weight of the Soil by following percentage.
- Mix the Jute Fibre layer-by-layer into the soil.
- Test the Doped Soil in C.B.R apparatus to obtain the value of following percentage.

Necessity of Soil Stabilization:-

- Stabilized soil functions as a working platform for the project.
- Stabilization waterproofs the soil.
- Stabilization improves soil strength.
- Stabilization helps reduce soil volume change due to temperature or moisture.
- Stabilization improves soil workability.
- Stabilization reduces dust in work environment.
- Stabilization improves marginal materials.
- Stabilization improves durability.
- Stabilization dries wet soil.
- Stabilization conserves aggregate materials.
- Stabilization reduces cost.

Stabilization conserves energy.

II. MATERIALS USED

1. BAGGASE ASH :- The burning of bagasse which a waste of sugarcane produces bagasse ash. Presently in sugar factories bagasse is burnt as a fuel so as to run their boilers. This bagasse ash is generally spread over farms and dump in ash pond which causes environmental problems also research states that Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis, more specifically referred to as bagassosis. So there is great need for its reuse, also it is found that bagasse ash is high in silica and is found to have pozzolanic property so it can be used as substitute to construction material.

2. QUARRY DUST :- Crushed quarry dust was obtained from the local crusher plants. Quarry dust is a waste product produced during the crushing process which is used to extract stone. It is rock particles. When huge rocks brake in too small parts for the construction in quarries. It is like sand but mostly grey in colour.

3. Lime :- Lime production begins by extracting limestone from quarries and mines. Pure calcium oxide is fused with coke in order to render the highest yield in the manufacture of acetylene. The quality of the resultant carbide lime is a direct result of the excellent quality raw materials. Carbide lime is finer in particle size, and physically, having a very finely divided particlesize makes carbide lime better. A finer particle size means faster and more reactivity.

PRACTICAL UTILITY OF WORK

Our project will help in reduction the cost of construction for the road work. The materials which we are using in our project are natural wastes and these are not harmful to nature and human beings. Use of bagasse ash in soil stabilization can solve the disposal problem; can reduce cost and produce a 'greener' Ecofriendly environment for construction. This study helps in converting the non-valuable bagasse ash into soil stabilization and makes it valuable.

The safe reuse of the bagasse ash can be done, which otherwise is very harmful for the environment and can pollute the air and water, if incineration is not properly done.

So at last our project can be proved as an acid for the eco-friendly environment and many other concerns.

III. ENGINEERING PROPERTIES OF SOIL

1. Permeability: It is defined as the property of the soil which allows the passage or seepage of water through its interconnecting voids.
2. Plasticity: It is defined as the property of soil which allows it to deform rapidly without any volume change and without elastic rebound.
3. Compaction: It is a artificial process by which soil particles are rearranged and packed together into a closer state of contact by mechanical means to increase its dry density and decrease its porosity.
4. Compressibility: The property of the soil to reduce in volume under pressure is called compressibility.
5. Shear Resistance: It is the resistance to deformation by continuous shear displacement of soil particles.

IV. EXPERIMENTAL INVESTIGATION

Determination of liquid limit of soil: Moisture content of the soil which is expressed by the percentage of weight of oven dried soil in between plastic and liquid states of consistency.

Determination of plastic limit of soil: Moisture content of the soil which is expressed by the percentage of weight of oven dried soil in between plastic and semi solid states of consistency.

Plasticity index : Plasticity index of soil is the difference between its moisture content of liquid limit and plastic limit.

CBR test: California bearing ratio is the ratio of force per unit area required to penetrate in to a soil mass with a circular plunger of 50mm diameter at the rate of 1.25mm/min

V. EXPECTED OUTCOME

- California Bearing Ratio of the soil may increased.
- Reduction in cost of construction of the pavement.
- Scope for utilizing the agricultural solid waste that are energy-efficient and sustainable.
- Recycling of wastes by incorporating them into soil stabilization for practical solution to the pollution problem.

REFERENCES

- [1] Amruta P. Kulkarni, Mithun. K. Sawant, Vaishnavi V. Battul, Mahesh S. Shindepatil, Aavani P. BLACK COTTON SOIL STABILIZATION USING BAGASSE ASH AND LIME , Volume 7, Issue 6, November-December 2016, pp. 460–471, Article ID: IJCIET_07_06_051 ISSN Print: 0976-6308 and ISSN Online: 0976-6316
- [2] Patrick Khaoya Barasa , Dr. Too , Kiptanui Jonah , S. M. Mulei Stabilization of Expansive Clay Using Lime and Sugarcane Bagasse Ash, Volume 4 Issue 4, April 2015 International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064
- [3] Bilba, K., Arsene, M.A and Ouensanga, O. (2003), “Sugar cane bagasse fibre reinforced cement composites part I, Influence of the botanical components of bagasse on the setting of bagasse /cement composite.” Cement and Concrete Composites. Vol. 25, No. 1, pp. 91-96.
- [4] Ken C. Onyelowe, “Cement Stabilized Akwete Lateritic Soil and the Use of Bagasse Ash”, IJSEI, Vol. 1, Issue 2, March 2012, pp. 16-20.
- [5] Dilip shrivastava et.al, “Effect Of Lime And Rice Husk Ash On Engineering Properties Of Black Cotton Soil “,IJERST, Vol. 3, No. 2, May 2014, pp. 291-297.
- [6] Kiran, R.G. & Kiran, L. (2013). Analysis of strength characteristics of Black cotton soil using Bagasse ash and additives as stabilizer, IJERT, issue 7. Laboratory Study, Unpublished MSc. Thesis, Virginia: Virginia Polytechnic Institute and State University.
- [7] Chusilp, N., Likhitsripaiboon, N., & Jaturapitakkul, C. (2009). Development of bagasse ash as a pozzolanic material in concrete. Asian Journal on Energy and Environment, 10(3).
- [8] IS Code (IS: 2027 (Part 5) 1985).
- [9] IS Code (IS: 2027 (Part 7) 1980).
- [10] IS Code (IS: 2027 (Part 16) 1987).
- [11] Bilba, K., Arsene, M.A & Ouensanga, O. (2003). Sugar cane bagasse fibre reinforced cement composites part I, Influence of the botanical components of bagasse on the setting of bagasse /cement composite, Cement and Concrete Composites. 25(1), 91-96.
- [12] Alavéz-Ramírez, R., Montes-García, P., Martínez-Reyes, J., Altamirano-Juárez, D. C., & Gochi-Ponce, Y. (2012). The use of sugarcane bagasse ash and lime to improve the durability and mechanical properties of compacted soil blocks. Construction and Building Materials, 34, 296-305