Stabilization of Black Cotton Soil Using Bagasse Ash& Lime

Dalwala Nehul[1], Verma Maulik [2], Patel Yash[3], Patil Akash[4], Prajapati Krunal[5], Naik sagar[6]
[1,2,3,4,5] *Student, Bhagwan Mahavir College of Engineering & Technology*
[6]*Assistant Professor, Bhagwan Mahavir College of Engineering & Technology*

***Abstract*- Black cotton soil is expansive soil that is prone to large volume changes (swelling and shrinkage) that are directly related to changes in water content. Soil with a high content of expansive minerals can form a deep crack in drier season. By laboratory test and adding stabilizer eventually the durability of soil increases and the occurrence of swelling and shrinkage reduces. Using locally available materials for enhancing soil behaviour is advantageous in terms of Sustainable and economic. It increases bearing capacity of expansive soil so that provide more stability to earthen embankment and slopes. It increases durability. Here we are going to perform Index properties, Compaction, UCS, CBR and Durability tests and analysis of different industrial slags in consideration of cost and strength. We used Bagasse Ash and Lime .This are sustainable alternatives rather than use of common stabilizers which are harmful and Costly. In this project we carry forward project. We used mix proportioning found by them.**

***Index terms*- waste materials, bagasse ash , lime**

I.INTRODUCTION

Soil which are expansive in nature give rise to various problems and Difficulties for Construction. such as unacceptable Settlement and instability of slope. Due to Wetting and Drying, soil undergoes large volume changes can lead to Cracking and seepage problems. Most common cause for Failure is loss of Shear strength due to wetness. As the soil is less Durable, to increase durability and bearing capacity of soil certain waste materials can be utilize efficiently. Without the stabilization, the structure will experience severe distress, which results in poor performance. Soil stabilization involves the use of stabilizing agents in comparatively weak soils to improve its geotechnical properties such as compressibility, strength, swelling- shrinkage and durability. We used Bagasse Ash and Lime. This are sustainable alternatives rather than use of common stabilizers which are harmful and Costly.

II. EXPERIMENTAL MATERIAL

A. Black cotton soil

Black cotton soil (BC soil) is a highly clayey soil. The black colour in Black cotton soil (BC soil) is due to the presence of titanium oxide in small concentration. The Black cotton soil (BC soil) has a high percentage of clay, which is predominantly montmorillonite in structure and black or blackish grey in colour. Expansive soils are the soils which expand when the moisture content of the soils is increased. The clay mineral montmorillonite is mainly responsible for expansive characteristics of the soil. The expansive soils are also called swelling soils or black cotton soils. The structures on Black cotton soil (BC soil) bases develop undulations at the road surface due to loss of strength of the sub-grade through softening during monsoon. The physical properties of Black cotton soil (BC soil) vary from place to place 40 % to 60 % of the Black cotton soil (BC soil) has a size less than 0.001 mm. At the liquid limit, the volume change is of the order of 200 % to 300% and results in swelling pressure as high as 8 kg/cm2/ to 10 kg/cm2. As such Black cotton soil (BC soil) has very low bearing capacity and high swelling and shrinkage characteristics. Due to its peculiar characteristics, it forms a very poor foundation material for road construction. Soaked laboratory CBR values of Black Cotton soils are generally found in the range of 2 to 4%. Due to very low CBR values of Black cotton soil (BC soil) excessive pavement thickness is required for designing for flexible pavement. Research & Development (R&D) efforts have been made to improve the strength characteristics of Black cotton soil (BC soil) with

new technologies. The construction of foundation for structure on black cotton soils poses challenge to civil engineers.

B. Water

Water used for mixing and curing shall be clean and free from injurious amounts of oils, salts, acids, alkalis, sugar, organic materials or other deleterious materials. The pH value of water shall be not less than 6. Potable water is generally considered satisfactory for mixing concrete. In case of any doubt regarding development of strength, the suitability of water for mixing concrete shall be checked by the compressive strength and initial setting time tests.

C. Bagasse Ash

Bagasse is the fibrous matter that remains after sugarcane is crushed to extract their juice. It is dry pulpy residue left after the extraction of juice from sugar cane. Bagasse is utilized as a bio fuel and in the manufacture of pulp and building materials. Bagasse is an extremely inhomogeneous material comprising around 30-40% of "pith" fiber, which is derived from the core of the plant and is mainly parenchyma material, and "bast", "rind", or "stem" fiber, which comprises the balance and is largely derived from sclerenchyma material. The burning of bagasse which is 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 pozzolonic property so it can be used as substitute. Bagasse ash is a pozzolanic material which is very rich in the oxides of silica and aluminium, and sometimes calcium to combine with calcium hydroxide to form stable calcium silicate, which has cementitious properties.

D. Lime

Lime is a calcium-containing inorganic material in which carbonates, oxides and hydroxides predominate. Strictly speaking, lime is calcium oxide or calcium hydroxide. The word "lime" originates with its earliest use as building mortar and has the sense of "sticking or adhering."

III. METHOD ADOPTED

The bagasse ash which is passing through 4.75mm sieve was collected and mixed with the expansive soil passing through 4.75mm.we use 9 different proportion of bagasse ash and lime for finding the Atterberg's limits, Differential Free Swell Index, the compaction parameters (OMC&MDD), Unconfined Compressive strength, we conducted on the prepared samples as per the relevant Indian Standard (IS) Codes. We use bagasse ash and lime proportion of 5:1,5:2,5:3,10:1,10:2,10:3 & 15:1,15:2,15:3 respectively.

Tests Conducted on Soil Sample

1. Atterberg's limits
2. Standard proctor test
3. California bearing ratio
4. Unconfined compression test

IV. RESULT ANALYSIS

On the basis of experiments conducted on the black cotton soil mixed with bagasse ash and lime in different proportions, the following conclusions can be made.

1. The Shrinkage limit and swell index of soil observed as 20% and 90% respectively which indicates high swelling properties of soil.
2. The LL decreased from 54.8% to 48.12%, the PL decreased from 26.54% to 22.14% and the PI also decreased from 28.26% to 25.98% at 05% BA + 95% BCS.
3. The standard proctor test with addition of bagasse ash and lime results 1.50gm/cc, 1.70gm/cc, 1.49gm/cc and 1.44gm/cc of MDD and correspondingly obtained the results of OMC are 20.55%, 17.25%, 24.45% and 23.10%. From the results, it can be concluded that there is up to 5% of BA, the value of MDD was increased and then it decreased. The maximum dry density obtained is 1.70 gm/cc from 1.50 gm/cc and the moisture content decreased from 20.44% to 17.18% at 05% BA + 95% BCS.
4. After equal amount of addition of bagasse ash and lime, it is concluded that up to 05% amount

of bagasse ash, the CBR value is increased from 11.55% to 17.55%.

5. UCS values increased from 0.317 N/mm2 to 0.456 N/mm2 at 9% of bagasse ash content. Further addition of bagasse ash reduces the UCS value.

V. CONCLUSION

Soil stabilization method by applying waste product bagasse ash is successfully improve the existing poor and expansive sub grade soil. Bagasse ash is free of cost and available locally, hence it proved economical also. Bagasse ash effectively dries wet soils and provides an initial rapid strength gain, which is useful during construction in wet, unstable ground conditions. Bagasse ash also decreases swell potential of expansive soils by replacing some of the volume previously held by expansive clay minerals and by cementing the soil particles together. This method will be applicable to this region in future, unless there is extensive change in geological formation of the strata.

REFERENCES

[1] Abhinav Rawat, Anupam Mital "Improvement of Clayey Soil Stabilized with Bagasse Ash" International journal of research review in Engineering science and technology (APRIL 2015)

[2] Amit S. Kharade, Vishal V. Suryavanshi, Bhikaji S. Gujar, Rohankit R. Deshmukh " Stabilization of black cottom soil using bagasse ash " IJEST (MARCH 2014)

[3] Amruta P. Kulkarni, Mithun. K. Sawant, Vaishnavi V. Battul, Mahesh S. Shindepatil, Aavani P. "Black cotton soil stabilized using bagasse ash and lime" International journal of civil engineering and technology, Vol. 7 pp. 460-471 (DEC-2016)

[4] Ashish Chhachhia, Anupam Mital "Stabilization of clay soil using bagasse ash" IJCIET vol. 8 (APRIL 2015)

[5] Sabat, A.K., "Utilization of Bagasse Ash and Lime Sludge for Construction of flexible Pavements in Expansive Soil Areas", Electronic Journal of Geotechnical Engineering, (EJGE), Vol. 17, 2012.

[6] Hailu, B., "Bagasse ash as cement replacing material", MSc Thesis, Addis Ababa University, Addis Ababa, 2011.

[7] B. AHMED, A. RAHMAN, J. DAS " Improvement of subgrade CBR value by using bagasse ash and Eggshell powder" International journal of advance structure and geotechnical engineering, vol. 4 (April 015)

[8] Dr. K.R.Arora "Soil Mechanics and Foundation Engineering"

[9] https://www.ijraset.com

[10] jrpublisher.com