Analysis Of Sugarcane Bagasse Ash For The Improvement In The Properties Of Black Cotton Soil

Sonu Chauhan, Stuti Verma, Sumit Kumar, Vaibhav Kumar
Student of Department of Civil Engineering
Mr. Mohit Choubey
Assistant Professor Department of Civil Engineering,
Babu Banarasi Das Instituteof Technology and management ,Lucknow ,India

Abstract: The purpose of this research is to lookinto the feasibility of using sugarcane bagasse ashtoimprovethegeotechnicalpropertiesofsoil.Clayey soilismixedwithvaryingamountsofbagasse ash (0%, 5%, 10%, 15%, 20%, 25% and30%). Several tests (Atterberg's limits, StandardProctor Test, and CBR Test) were conducted to determine its effect on strength parameters .Standard Proctor Tes tresults showthat the Optimum Moisture Content increases as the percentage of sugarcane bagasse ash increases ,while the Maximum Dry Density decreases as the percentage of sugarcane bagasse ash increases .California According to the Bearing Ratio results, the CBR value increases up to a 20% replacement of sugarcane bagasse ash. With an increase in the proportion of sugarcane bagasse ash. According to the California Bearing Ratio results, the CBR value increases upto a 20% replacement of sugarcane bagasse ash. The CBR value decreases as the percentage of sugarcane bagasse ash increases. These findings indicate that sugarcane bagasse ash, at its optimum percentage of 20%,can be used as a stabilizer to increase the CBR values of sub grade soil.

Keywords: SugarCane Bagasse ash (SCBA),Maximum DryDensity(MDD), OptimumMoistureContent(OMC),CaliforniaBearingRatio(CBR).

INTRODUCTION

According to the California Bearing Ratio results, the CBR value increases by up to 20%when sugarcane bagasse ash is replaced. As the percentage of sugarcane bagasse ash increases, so does the CBR value. These findings suggest that sugarcane bagasse ash can be used as a stabilizer to increase the CBR values of sub grade soil at its optimum percentage of 20%.Tomake them useful and meet the requirements of geotechnical engineering design, researchers have focused more on the use of low-cost materials derived locally from industrial and agricultural wastes in order to improve the properties of deficient soils while also lowering construction costs. The large production of agricultural wastes has the potential to harm the environment by causing air pollution water Pollution, and ultimately affecting local ecosystems. The study's main goal is to look

Into the use of rice husk ash and sugarcane bagasse ash, both of which are agricultural waste, to stabilize the weak sub grade soil. This has previously hampered the poor and under developed nations of the world from providing accessible roads to the rural in habitants, who make up the majority of the ir population and are primarily agriculturally dependent. Thus, by utilizing agricultural waste, construction costs will be significantly reduced while also reducing environmental hazards. It has been discovered that Portland cement, due to its chemistry, emits a large amount of CO2per ton of finished product.

LITERATUREREVIEW

Many ancient societies, including the Chinese, Romans, and Indians, used various tactics to increase soil suitability, some of which were so effective that many of the buildings and streets they built still exist and are in use today. Separately, the Mesopotamians and Romans realized that by mixing poor soils with a stabilizing material such as pulverized limestone or calcium, they could improve the ability of routes to transport traffic. This was the first time that weak soils were chemically stabilized in order to improve their load carrying capacity

KiranR.G.KiranL.(2017)conducted research on' The investigation of strength properties of Black Cotton soil utilizing Bagasse ash and additions as stabilizer'? The black cotton soil used in this study was collected at Harihara ,Davanagere district, Karnataka. In this study, laboratory experiments are conducted out for various percentages of Bagasse ash (5%,10%,and15%) and additive mix proportions.The strength metrics, such as CBR, are determined by danditis It was discovered that the blend results of Bagasse ash with varying percentages of cement for black cotton soil generated a change in density and CBR value. When 8% Bagasse ash was added to 8% cement, the density values increased from 15.16kN per m2 to16.5kN per m2,and the CBR values increased from2.12 to 5.43. The addition of 4% Bagasse ash with 8% cement enhanced the tensile strength to174.91kN/m2 from 84.92kN/m2 with the addition of 8% Bagasse ash with 8% cement. The MDD value increases up to 8% replacement and the CBR value increases up to 8% above which it declines.

Sumair Razvi, Syed(2018) the CBR of the lime treated black cotton soil increased when compared to the untreated black cottons oil ,according to the research report "soil stabilizing by lime. "For black cotton soil, CBR value improves with lime content ranging from 2% to 3% .Soil stabilization is the process of increasing the various engineering qualities of black cotton soil and resulting in stables oil**.**

Gupta Chayan(2016) the author wrote the study article "The black cotton soil modification by application of waste materials,"andthe conclusion is as follows:

The standard compaction criterion, maximum dry density of black cotton soil, increases from1.53g/cm3 to 1.76g/cm3 for the final optimum composite, whereas the optimum water content of black cotton soil drops from 22.8% to 19%.The results of the UCS test demonstrate that after soil stabilization, the unconfined compressive strength values of black cotton soil increase from 138.01kPa to286.13kPa, a107.32% increase.

K. Shreyas (2017) the author's study article is titled "stabilization of black cotton soil by admixtures," and the conclusion is as follows: By replacing some of the cement with fly ash, the engineering qualities of black cotton soil improve, as does its stability. The conduct of CBR tests by adjusting the quantity of additives such as cement, M-Sand, and fly ash in the soil mix results in an increase in CBR values when the percentage of stabilizer is increased.

MATERIALANDMETHODS

Black Cotton Soil

Black Cotton soil as the name speaks for itself looks Gray to black in color. This type of soil has excessive expansive and sink age characteristics which make it undesirable for use as sub grade in highway construction .Normally, it has very high dry strength and very low wet strength .so it is important to improve the geotechnical properties of the black cotton soil before using it sub grade. Soil sample for this study was available locally. Bank of GOMTI **RIVER, LUCKNOW, UTTAR PRADESH**

Various test were conducted and results are summarized in the following table:

Table1: Properties of Soil Sample

Specific Gravity	2.2
Maximum Dry Density	1.53g/cc
Water Content	26.8%
California Bearing Ratio	1.9%
Liquid Limit	30%
Plastic Limit	22%
Plasticity Index	8%
Color	Grayish Black

Bagasse Ash

The fibrous residue that remains after the sugar juice is extracted from cane mills is known as bagasse. The byproduct of burning bagasse is known as bagasse ash. This substance typically causes sugar factories disposal issues. For both financial and environmental concerns, research has been focused on using waste materials from industry and agriculture to build road ways. Bagasse ash was purchased from **RAUZAGAON CHINI MILL, AYODHYA , UTTAR PRADESH**

The following table summarizes the findings of lab studies undertaken to determine the engineering qualities of bagasse ash:

Table2: Properties of bagasse Ash Sample

Specific Gravity	1.40
Maximum Dry Density	1.2gm/cc
Optimum Moisture Content	30
Color	Black

BagasseAshStabilization

In this study, numerous features of the soil and bagasse ash mixture (0% to 14%) were investigated for evaluation, including:

A. Maximum Dry Density(MDD)

B. Optimum Moisture Content(OMC)

C. California Bearing Ratio (CBR)

RESULTSANDDISCUSSIONS

I n the appropriate table, the result of the MDD, OMC and CBR are summarized. These data have been analyzed under the constructions category.

1. Maximum Dry Density

Proportion of Bagasse ash (%)	MDD(g/cc)
0	1.71
5	1.66
10	1.60
15	1.39
20	1.53
25	1.46
30	1.43

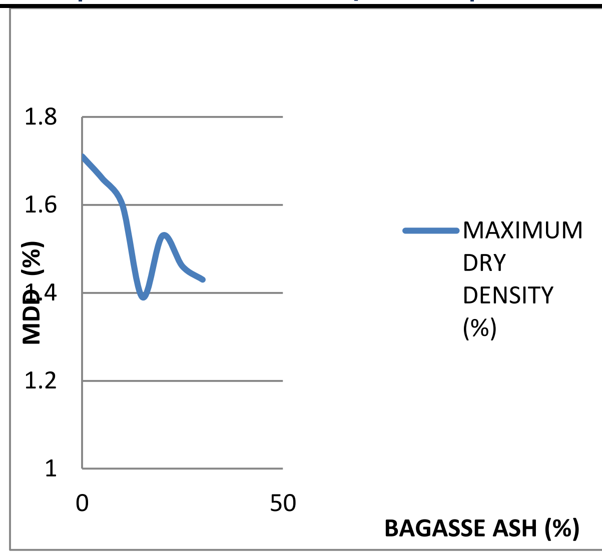


Figure 1: Maximum Dry Density vs. SCBA (%)

1. Optimum Moisture Content

Proportion of Bagasse Ash (%)	**OMC (%)**
0	22.50
5	24.10
10	24.54
15	22.48
20	26.50
25	27.88
30	18.79

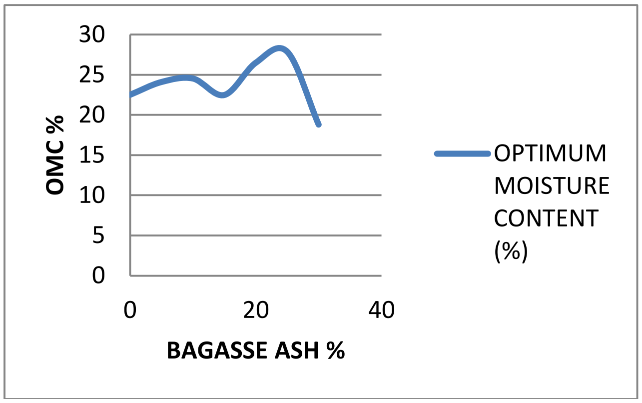


Figure 2: Optimum Moisture Content vs SCBA (%)

3. California Bearing Ratio

Proportion of Bagasse Ash(%)	CBR(%)
0	2.55
5	3.51
10	4.78
15	5.42
20	9.25
25	7.98
30	6.70

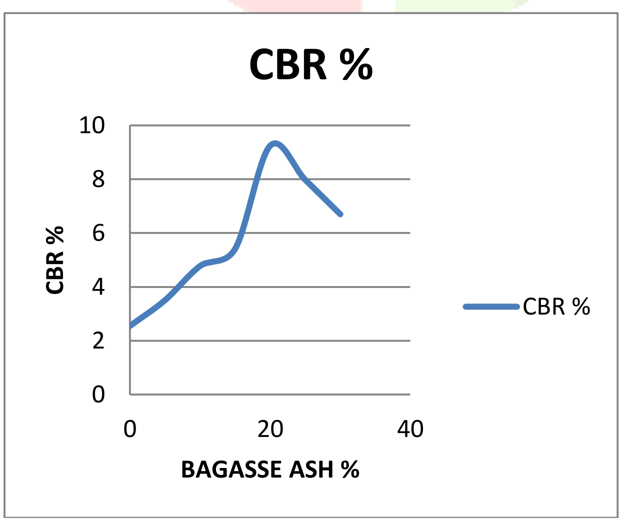


Figure 3: CBR vs SCBA (%)

CONCLUSIONS

According to the results of the laboratory examination conducted for this study, the following conclusion has been reached:

1. The optimal moisture content (OMC) and maximum dry density (MDD) of the black cotton soil increase to the maximum value and then decline.

2. The project's outcome and conclusion will be determined by the final findings from the experiment that must be conducted using admixtures ,along with an analysis of the readings that are collected.

3. CBR values have also demonstrated a comparable character. When ash was added to the mixture, these values rose up to 8% before falling if the ash percentage was raised further.

4. This mix's CBR values are attribute able to the cementitious nature of bagasse ash, which allows ash particles to become stronger when exposed to moisture.

SCOPE FOR FUTURE INVESTIGATION

Flexible Pavement Design for without Stabilization of Black Cotton Soil.

Number of commercial vehicles per day.=400

CBR applicable design curve = **D.**

Sub grade soil design CBR (wet) = 1.86%

.Hence, the pavement thickness is **600 mm**

(As per Pavement Thickness Design graph).

Flexible Pavement Design for stabilization of Black Cotton Soil

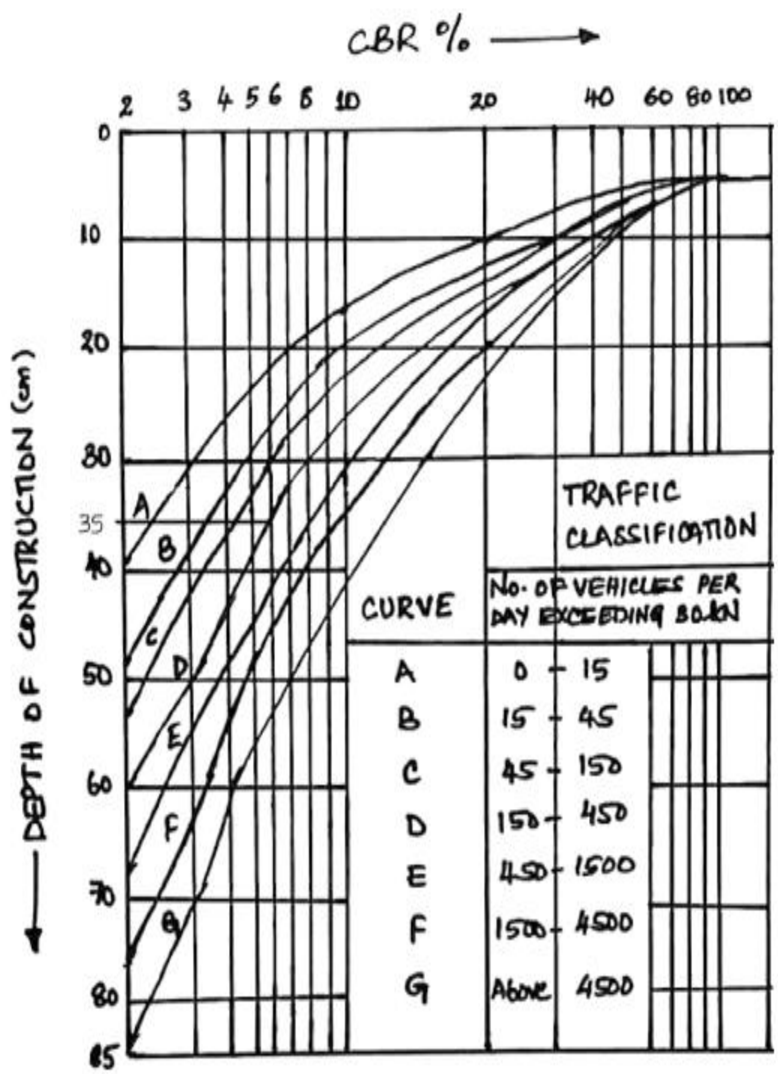
Number of commercial vehicles per day=**40**

Design curve for applicable of sub grade soil=11.46%.

CBR design curve=D.

Hence, the pavement thickness is 250 mm (as per Pavement Thickness Design graph). Total pavement thickness was reduced by **600- 250=350mm.**

Pavement thickness reductions as a percentage=**58.33%**



REFERENCES

[1] AmruthaP.Kulkarni,MuthuK.Sawant,VaishnaviV.Battle,MaheshS.Shindepatil,andAavaniP.," Black Cotton Soil Stabilization Using Bagasse Ash and Lime," IJCIET, Vol. 67, Issue 06, Nov. -Doc2016,pp.460-471.

[2] G.PaulPandi,S.Raghav,D.TamilSelvam,andK.UdhayaKumar,"UtilizationofPlasticWast einRoadConstruction,"IJESCVolume 7Issue No.3,2003.

[3] ArjitaBiswas,Amit Goel,SandeepPotnis,"PerformanceEvaluationofSustainablebituminous-PlasticroadsforIndianconditions",InternationalJournalofEngineeringandAdvancedTechnolo gy(IJEAT)ISSN:2249–8958,Volume-9Issue-1,October2019.

[4] H. P. Singh and M. Bagra (2012), "Improvement in the CBR Value of Soil Reinforced withConcrete,"JuteFiber,"InternationalJournalofEarthScienceandEngineering,October 2012,pp.1438-44-1442.

[5] "AnalysisofStrengthCharacteristicsofBlackCottonSoilUsing Bagasse,"KiranR.G.and Kiran L.IJERT,issue7,ashandadditionsasstabilisers(2013).

[6] M. Chittaranjanand A.V. Narasimha Rao "Agricultural and domestic waste applications""JournalofEnvironmentalResearchandDevelopment," January Vol.5,No.3(March),(2011)

[7]"Utilization of Plastic Waste in Road Construction," Vatsal Patel, Snehal Popli, and DrashtiBhatt,InternationalJournalofScientificResearch,Volume:3,Issue:4,April2014,ISSNN o2277-8179.

[8]K.S.Gandhi(2012),CivilEngineeringDepartment,SarvajanikCollegeofEngineeringan dTechnology,Surat,"ExpansiveSoilStabilizationUsingBagasseAsh."Vol.5 Issue5Pg 1-

[9] GuidelinesfortheUseofPlasticWasteinRoadConstruction(Provisiona l),RDSO/WKS/2019/1,May2019.

[10] IS2720(Part5)-1985,Determinationofliquidandplasticlimits,IndianStandardCode(secondrevision).

[11]IS1498-1970,Classificationandidentificationofsoilsfor generalengineeringuses.(Firstrevision).

[12]UtilizationofSolidWasteforSoilStabilization:AReview,PrasadP.Dahale,Dr.P.B.Nagarnaik,Dr.A.R.Gajbhi ye2012,Vol.17BundQ.