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# UTILIZATION OF SUGARCANE BAGASSE ASH IN IMPROVING PROPERTIES OF BLACK COTTON SOIL

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**Abstract -** *Soil Stabilisation manages physical, physio-concoction and compound strategies to guarantee that the settled soil benefits its expected reason as asphalt part material. This suggested practice depicts a strategy for adjustment of soils by using Bagasse debris with lime and quarry residue to demonstrated a base/sub base course in the plan of street asphalt. Bagasse debris is a waste item accessible from consuming of bagasse. The fundamental standards of soil adjustment incorporate assessing the properties of given soil and evaluating the lacking property because of which the dirt is viewed as powerless. It additionally chooses the suitable technique for enhancing the insufficient property by the affordable and compelling strategies for Stabilisation.*

*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).*

***Key Words*: *Bagasse ash, atterberg, CBR, Stabilisation***

## 1. INTRODUCTION

Soil adjustment implies the improvement of the solidness or bearing limit of the dirt by the utilization of controlled compaction, proportioning and the expansion of appropriate admixture or stabilizers. Because of absence of appropriate soil at numerous spots it requirement for soil adjustment. The regular soil settled strategies are lime adjustment and concrete adjustment, which many be substituted by bagasse debris for economy. This decreases its removal volume. Adjustment is being utilized for an assortment of building works, the most well-known application being in the development of street and landing strip asphalts.

Methods of stabilization may be grouped under two main types.

a. Modification or improvement of a dirt property of the current soil with no admixture.

b. Modification of the properties with the assistance of admixtures. Compaction and seepage are the instances of first sort, which improve the innate shear quality of soil. Models of second sort are, mechanical adjustment, adjustment with concrete, lime, bitumen and synthetic and so on.

c. In the current examination an endeavor has been made to improve the properties of Black cotton soil subgrade by adjustment strategy utilizing bagasse debris, lime and quarry dust. In this examination research facility contemplates were conveyed to know the impact of bagasse debris, lime and quarry dust when blended independently and in mix with Black cotton soil by directing different tests, for example, plastic cutoff and CBR tests.

### 1.1 Objectives

1. To decide ideal level of bagasse debris, lime and quarry dust by directing tests, for example, fluid breaking point, plastic cutoff and pliancy list by differing the level of bagasse debris and lime.

2. To examination the conduct of various soil utilizing bagasse debris, lime and quarry dust.

3. To decide the ideal dampness substance and most extreme dry thickness by leading the delegate compaction test.

4. To decide the CBR estimation of BC soil blended in with various rates of bagasse debris and lime.

5. To lessen the expense of development of the asphalt over dark cotton soil by soil adjustment strategy with the assistance of soil settling specialist.

6. To use the waste materials accessible in the agro-ventures.

### 1.2 Methodology

- To Determine the Liquid Limit, Plastic cutoff, Maximum Dry Density (M.D.D), Optimum Moisture Content (O.M.C) and C.B.R estimation of the Raw Soil.

- Sieve the dirt by 20mm and 4.75mm (IS Sieve) to acquire the amount of 5 kg.

- Mixed the dirt by water up to (O.M.C).

- Take the amount of Jute Fiber by Dry load of the Soil by following rate.

- Mix the Jute Fiber layer-by-layer into the dirt.

- Test the Doped Soil in C.B.R mechanical assembly to acquire the benefit of following rate.

## 2. Materials Used

1. **BAGGASE ASH** :- The consuming of bagasse which a misuse of sugarcane produces bagasse debris. Directly in sugar industrial facilities bagasse is singed as a fuel to run their boilers. This bagasse debris is commonly spread over homesteads and dump in debris lake which causes natural issues likewise research expresses that Workplace introduction to cleans from the handling of bagasse can cause the ceaseless lung condition aspiratory fibrosis, all the more explicitly alluded to as bagassosis. So there is incredible requirement for its reuse, additionally it is discovered that bagasse debris is high in silica and is found to have pozollinic property so it tends to be utilized as substitute to development material. The bagasse ash used in the study was brought from Sugar Mil. The ash was obtained from this mill at a boiler temperature of 750-800°C. The bagasse ash produced at the plant was about 2-2.5 % of the bagasse used in boiler.

TABLE-1 PRODUCTION OF BAGASSE ASH

| S.No. | Country | Annual ash production, MT | Ash utilization % |
|---|---|---|---|
| 1 | India | 112 | 38 |
| 2 | China | 100 | 45 |
| 3 | USA | 75 | 65 |
| 4 | Germany | 40 | 85 |
| 5 | UK | 15 | 50 |
| 6 | Australia | 10 | 85 |
| 7 | Canada | 6 | 75 |
| 8 | France | 3 | 85 |
| 9 | Italy | 2 | 100 |

2. QUARRY DUST :- Crushed quarry dust was acquired from the neighborhood smasher plants. Quarry dust is a waste item created during the devastating cycle which is utilized to remove stone. It is rock particles. At the point when tremendous rocks brake in too little parts for the development in quarries. It resembles sand yet generally dim in shading.

3. Lime: - Lime creation starts by removing limestone from quarries and mines. Pure calcium oxide is intertwined with coke so as to deliver the best return in the assembling of acetylene. The nature of the resultant carbide lime is an immediate aftereffect of the fantastic quality crude materials. Carbide lime is better in molecule size, and truly, having a finely separated particlesize makes carbide lime better. A better molecule size methods quicker and greater reactivity.

## 3. ENGINEERING PROPERTIES OF SOIL

1. Permeability: It is characterized as the property of the dirt which permits the entry or leakage of water through its interconnecting voids.

2. Plasticity: It is characterized as the property of soil which permits it to distort quickly with no volume change and without flexible bounce back.

3. Compaction: It is a fake cycle by which soil particles are revised and pressed together into a closer condition of contact by mechanical intends to expand its dry thickness and diminishing its porosity.

4. Compressibility: The property of the dirt to decrease in volume under tension is called compressibility.

5. Shear Resistance: It is the protection from twisting by persistent shear removal of soil particles.

## 4. Experimental Investigation

Assurance of fluid restriction of soil: Moisture substance of the dirt which is communicated by the level of weight of broiler dried soil in the middle of plastic and fluid conditions of consistency.

Assurance of plastic constraint of soil: Moisture substance of the dirt which is communicated by the level of weight of broiler dried soil in the middle of plastic and semi strong conditions of consistency.

Versatility list: Plasticity record of soil is the distinction between its dampness substance of fluid cutoff and plastic breaking point.

CBR test: California bearing proportion is the proportion of power per unit territory needed to infiltrate in to a dirt mass with a roundabout unclogger of 50mm width at the pace of 1.25mm/min.

## 5. Composition Taken

| S. No. | Bagasse Ash (%) | Lime (%) | Quarry dust (%) |
|---|---|---|---|
| 1 | 0 | 4 | 0 |
| 2 | 0 | 5 | 0 |
| 3 | 0 | 6 | 0 |
| 4 | 4 | 0 | 0 |
| 5 | 5 | 0 | 0 |
| 6 | 6 | 0 | 0 |
| 7 | 1 | 4 | 1 |
| 8 | 2 | 3 | 1 |
| 9 | 3 | 2 | 1 |
| 10 | 4 | 1 | 1 |

## 6. Results

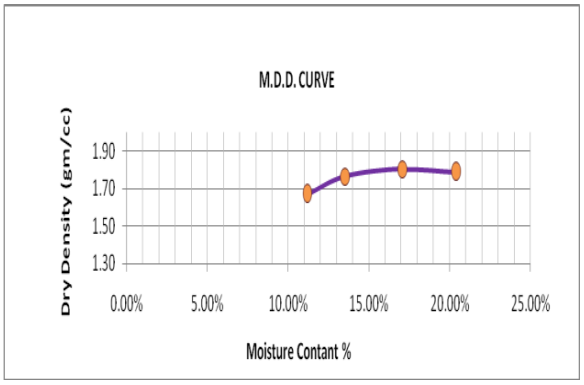
### *Observations & Calculations of Density Test:-*

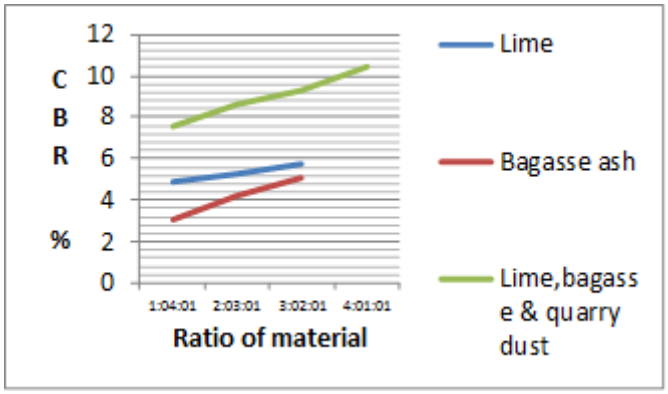
Weight of mould=4.120 kg Volume of mould =1000CC Diameter of mould =10 cm Height of mould =12.8 cm Weight of rammer =4.5 kg

| DETERMINATION NO | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Weight of Water Added, Ww (gm) | 400 gm | 550 gm | 700 gm | 850 gm |
| Weight Of Mould + Compacted Soil, (gm) | 5.850 | 5.960 | 6.170 | 6.210 |
| Weight of Compacted Soil, W (gm) | 1.730 | 1.840 | 2.050 | 2.090 |
| Bulk Density(gm/cc) = W/(Mould Volume) | 1.73 | 1.84 | 2.05 | 2.09 |
| Dry Density (gm/cc) = Bulk density/ (1+w). | 1.67 | 1.77 | 1.81 | 1.79 |
| Container No. | 1 | 2 | 3 | 4 |
| Wt. of container (gm) = W1 | 23.12 | 22.36 | 23.93 | 22.28 |
| Wt. of container + wet soil (gm) = W2 | 35.05 | 42.99 | 39.35 | 42.44 |
| Wt. of container + dry soil (gm) = W3 | 33.85 | 40.53 | 37.10 | 39.51 |
| Moisture % | 11.18 | 13.54 | 17.08 | 20.43 |

OMC=17.08%

M.D.D= 1.81 gm/cc.




### *Atterberg Limits*

| Black Cotton Soil | LIME (%) | | |
|---|---|---|---|
| | 4 | 5 | 6 |
| Liquid Limit (%) | 44.56 | 42.32 | 41 .02 |
| Plastic Limit (%) | 27.80 | 25.82 | 23.24 |
| Plasticity Index | 16.76 | 16.5 | 17.78 |

| Black Cotton Soil | Bagasse Ash | | |
|---|---|---|---|
| | 4 % | 5 % | 6 % |
| Liquid Limit (%) | 67.02 | 63.91 | 58.07 |
| Plastic Limit (%) | 29.89 | 28.01 | 26.23 |
| Plasticity Index | 37.13 | 35.9 | 31.84 |

| Black Cotton Soil | Lime, Bagasse Ash & Quarry Dust | | | |
|---|---|---|---|---|
| | 1:4:1 | 2:3:1 | 3:2:1 | 4:1:1 |
| Liquid Limit (%) | 59.06 | 56.25 | 53.89 | 45.73 |
| Plastic Limit (%) | 36.00 | 33.29 | 32.86 | 29.11 |
| Plasticity Index | 23.06 | 22.96 | 21.03 | 16.62 |

| Black Cotton Soil | LIME | | |
|---|---|---|---|
| | 4 % | 5 % | 6 % |
| CBR (%) | 4.93 | 5.27 | 5.76 |

| Black Cotton Soil | BAGASSE ASH | | |
|---|---|---|---|
| | 4 % | 5% | 6 % |
| CBR (%) | 3.029 | 4.18 | 5.089 |

| Black Cotton Soil | LIME, BAGASSE ASH & QUARRY DUST | | | |
|---|---|---|---|---|
| | 1:4:1 | 2:3:1 | 3:2:1 | 4:1:1 |
| CBR (%) | 7.59 | 8.63 | 9.27 | 10.41 |

## 7. CONCLUSIONS

- Soil stabilization method by applying waste product bagasse ash is successfully improve the existing poor and expansive sub grade soil.
- The plasticity index reduced with increased in content of bagasse ash and lime.
- The addition of lime and lime in combination with bagasse ash improved the CBR of the soil. The combination bagasse ash, lime & quarry dust can strongly improve the strength of the expansive 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.
- It can be seen that addition of bagasse ash, lime & quarry dust can be consider as an suitable and stabilizing agent.

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