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# Improvement of Pavement Soil Subgrade by using Burnt Brick Dust

Neha Pundir[1], M. K Trivedi[2]
[1]P.G. Student, [2]Professor, Department of Civil Engineering
MITS Gwalior, Madhya Pradesh, India

***Abstract:*** ***To stabilize the clayey soil, an experiment is conducted to evaluate the properties of soil blending with different percentage of Burnt Brick Dust of 10%, 20%, 30%, 40% and 50% by weight and then the tests are performed. Tests conducted for clayey soil mixed with Burnt Brick Dust are Liquid Limit, Plastic Limit, Shrinkage Limit, Optimum Moisture Content and Maximum Dry Density, and California Bearing Ratio. A comparison between properties of clayey soil and clayey soil mixed with Burnt Brick Dust is performed. It is found that the properties of clayey soil mixed with Burnt Brick Dust are improved drastically.***
***Keywords: engineering properties, clayey soil, subgrades, burnt brick dust, California Bearing Ratio***

## I. INTRODUCTION

Clayey soil is composed of very small particles, and usually it contains silicates of aluminum and/or iron and magnesium. The flow of water impedes by clayey soil, means it slowly absorbs water and then retains it for a long time. Clayey soil swells in wet condition and shrinks in dry condition. The upper layer of soil can bake into hard concrete-like crust which cracks (C.J Bronick, R.lal, 2014)[1].

In geotechnical engineering, soil stabilization is the process to improve the one or more chemical and mechanical characteristics of soil which is used in engineering applications. In other words stabilization of soil is also defined as the technique in which the soil can be mixed with an appropriate amount of different stabilizers to eliminate the volume change and improve some physical and chemical characteristics of soil. Using of stabilizers to stabilize the soil is not a modern technique; actually there are varieties of additive materials which have been used in the past. Some of them are plant saps, animal dung, natural oils, lime(Khandaker and Hossain, 2011)[2].

## II. MATERIAL USED

The soil used in this experiment is taken from the Malanpur, Bhind District of Madhya Pradesh. The clayey soil sample were mixed with different percentages of burnt brick dust of 10%, 20% , 30% , 40% and 50% of dry soil mass.

TABLE 1. PROPERTIES OF SOIL

| Properties | Soil |
|---|---|
| Liquid limit (%) | 36 |
| Plastic limit (%) | 20 |
| Plasticity index (%) | 16 |
| Free swelling index (%) | 45 |
| Specific gravity | 2.66 |
| Natural moisture content (%) | 17.1 |
| Optimum moisture content (%) | 18.6 |
| Maximum dry density (%) | 17.66 |
| CBR value (%) | 2.88 |
| Grain size distribution | |
| Gravel (%) | 0 |
| Sand (%) | (11.6 +.8) =12.4 |
| Silt and Clay(%) | 87.6 |


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## III. LABORATORY INVESTIGATION AND RESULT

In this research work experiments to determine the physical and mechanical properties of soil were conducted. According to Indian Standard Classification System (ISCS) the soil is classified. Liquid limit, plastic limit, plasticity index, specific gravity, free swelling index, standard proctor compaction, California bearing ratio tests were conducted on soil sample. Tests on treated soil sample are conducted after seven days of curing.

### *A. Results of Soil Sample after Replacement with Burnt Brick Dust (BBD)*

Table III-A .1 Free swell index value for mix proportions of soil and burnt brick dust

| Free Swell Index | Mix proportions | Clayey soil | 10% BBD | 20% BBD | 30%BBD | 40%BBD | 50%BBD |
|---|---|---|---|---|---|---|---|
| 1 | Initial vol. | 10 ml | 10 ml | 10 ml | 10 ml | 10 ml | 10 ml |
| 2 | Final vol. | 14.5ml | 13.3ml | 12.4ml | 11.1ml | 10.6ml | 10ml |
| 3 | Free swell index | 45% | 33% | 24% | 11% | 6% | 0% |

Fig III-A .1 Chart showing the variation in Free Swell Index for mix proportions of soil and burnt brick dust (BBD)

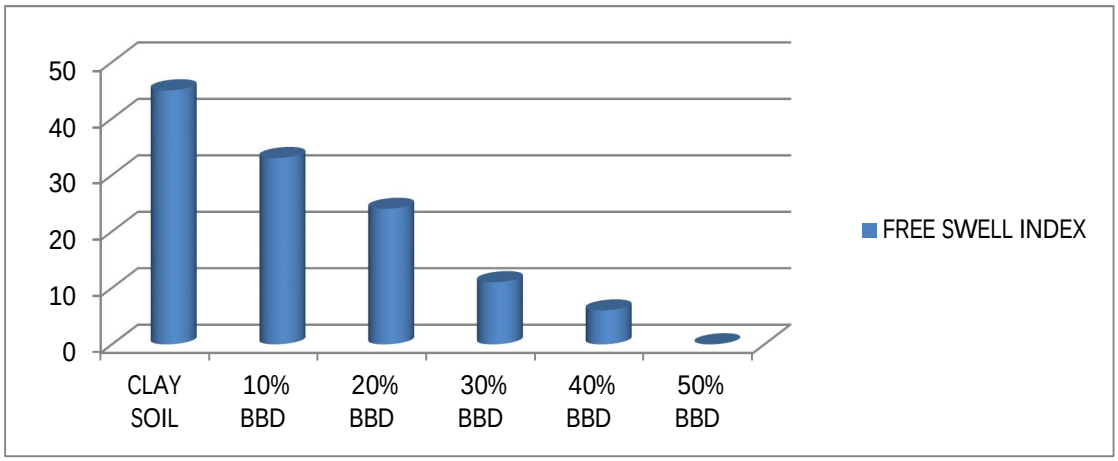
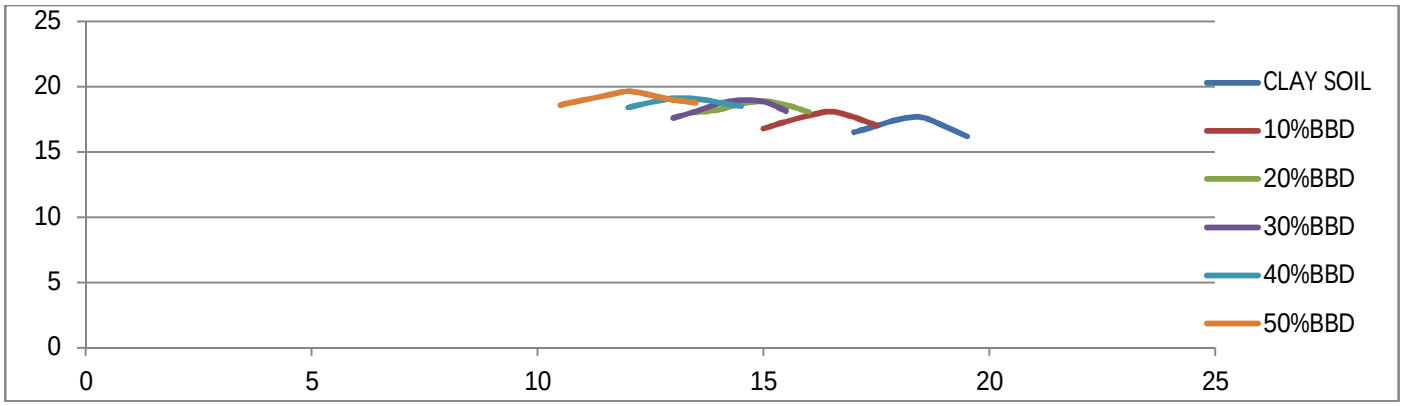



Table III-A .2 Compaction Test value for mix proportions of soil and burnt brick dust (BBD)

| Content | Clayey soil | 10% BBD | 20% BBD | 30% BBD | 40% BBD | 50% BBD |
|---|---|---|---|---|---|---|
| MDD(KN/m$^3$) | 17.66 | 18.09 | 18.89 | 18.97 | 19.11 | 19.64 |
| OMC (%) | 18.6 | 16.59 | 15.38 | 14.99 | 13.33 | 11.9 |

Fig III-A .2 Graph showing OMC and MDD of mix proportions of soil and burnt brick dust (BBD)





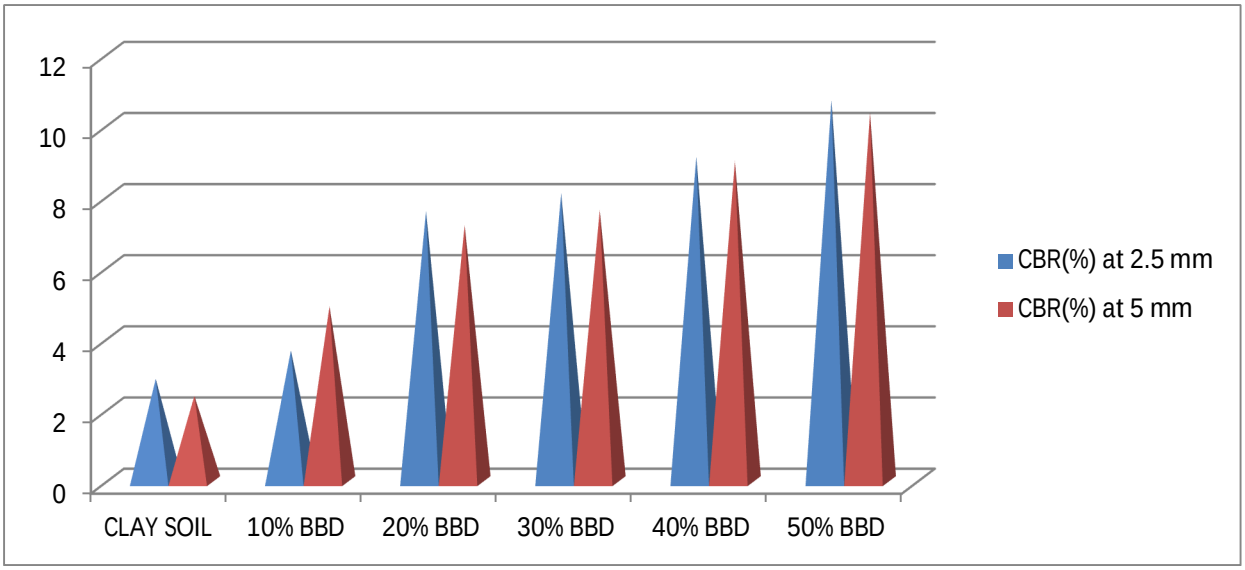
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Table III-A .3 CBR Value for mix proportions of soil and burnt brick dust (BBD)

| Percentages of BBD | CBR(%) at 2.5 mm | CBR(%) at 5 mm |
|---|---|---|
| Clayey soil | 2.88 | 2.40 |
| 10% BBD | 3.68 | 4.92 |
| 20% BBD | 7.6 | 7.2 |
| 30% BBD | 8.1 | 7.62 |
| 40% BBD | 9.13 | 9.003 |
| 50% BBD | 10.72 | 10.36 |

Fig III-A .3 Chart showing the variation of CBR Value for mix proportions of soil and burnt brick dust (BBD)




## IV. CONCLUSION

In this study, the soil is replaced with burnt brick dust of different percentages (10%, 20%, 30%, 40% and 50%) and tests are performed after seven days of curing. From free swelling index, optimum moisture content (OMC) and maximum dry density (MDD), CBR test results are conclude as:

*A.* This experimental study concludes that increase in the percentage of burnt brick dust in clayey soil decrease the swelling of soil. When the replacement of soil reached 50% (means 50% BBD and 50% soil) the swelling of soil becomes zero.

*B.* On increasing the percentage of burnt brick dust, the optimum moisture content (OMC) decreases and maximum dry density (MDD) increases. The optimum moisture content (OMC) and maximum dry density (MDD) at 50% replacement of soil with burnt brick dust is 11.9% and 19.64 KN/$m^3$.

*C.* On increasing the percentage of burnt brick dust CBR value also increases. At 50% replacement of soil the CBR value is 10.72 percent.

*D.* On increasing the percentage of burnt brick dust in soil above 50 percent, the soil becomes cohesionless.

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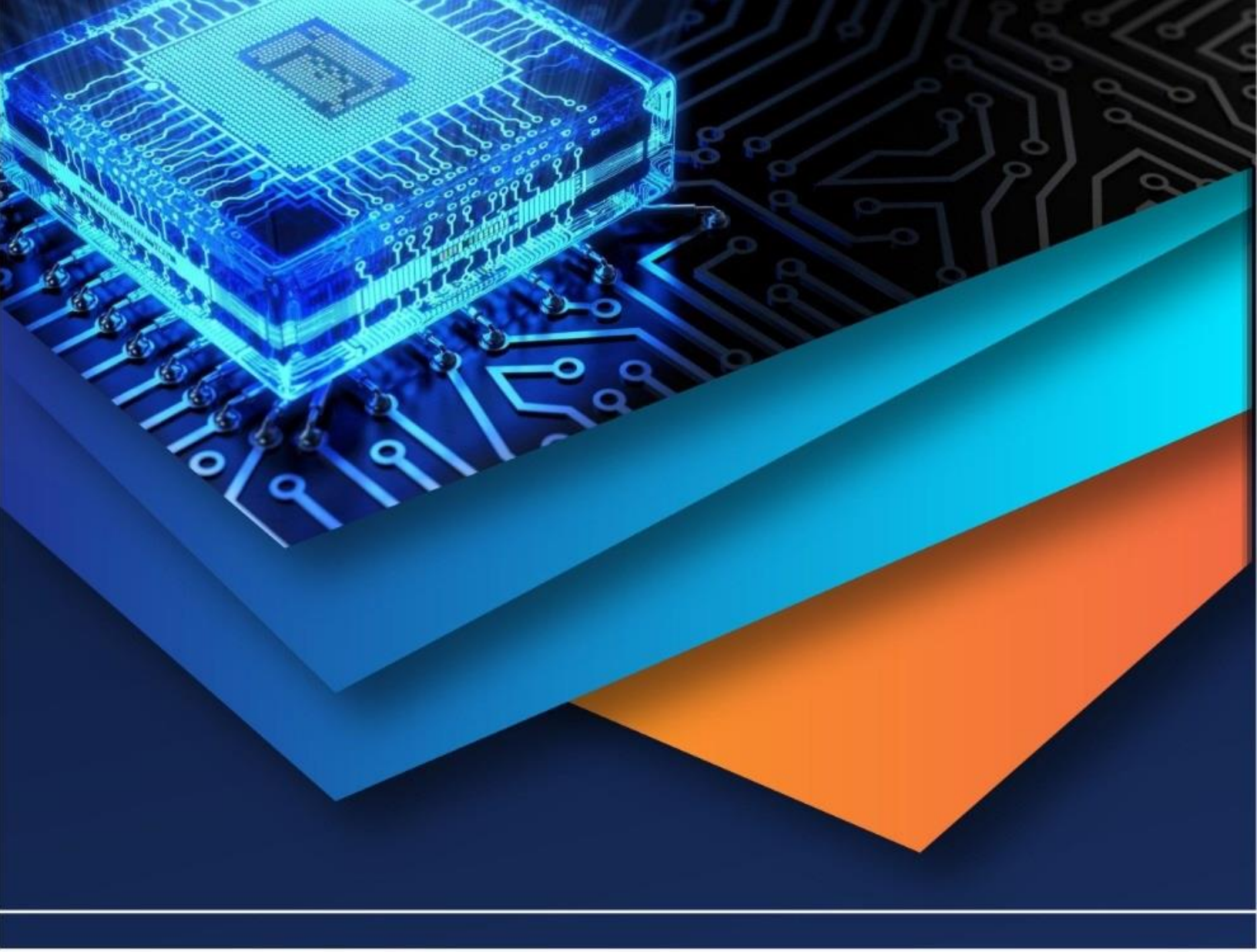
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