

# CBR Test on Clay Soil Stabilized with Admixture (Waste Tiles Particles)

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**ABSTRACT:** For any pavement, the subgrade layer is very important and it must be strong to support the entire wheel load. To work on soils, we need to have proper knowledge about their properties and factors which affect their behavior. Swelling of expansive soils causes serious problems. This study is kept to observed the effects of utilization of clayey soils to evaluate the engineering properties of clayey soil mixed with the tiles particles with the different percentage viz. 0.05%, 0.075%, 0.25%, 0.50%, 0.75% and 1.0% by weight of admixture. Performance of different tests as standard proctor compaction tests and California bearing ratio tests are done.

**KEYWORDS:** Clay Soil, Waste Tiles Particles, California Bearing Ratio tests, Standard Proctor Compaction tests.

## I. INTRODUCTION

Clay soil stabilization is the process of improving the engineering properties of the clay soil and thus making it more stable. It is required when the soil is not suitable for the intended purpose. In its broadest sense stabilization includes compaction, reconsolidation, drainage and many other such processes.

Soil stabilization is widely used in connection with road, pavement and in construction of foundation. The engineering properties of the soil which can be improved by the stabilization are:

1. Strength: to increase the strength and bearing capacity.
2. Durability: to increase the resistance to erosion, weathering or traffic loading.
3. Volume stability: to control the swell shrink characteristics caused by moisture changes.

Various stabilization techniques are Mechanical Stabilization, Chemical Stabilization, Cement Stabilization, Lime Stabilization, Bitumen Stabilization, Electrical Stabilization, Fly Ash Stabilization, Geotextile Stabilization, Grouting Stabilization and Thermal Stabilization.

## II. MATERIALS USED FOR STUDY

### 2.1 CLAY SOILS

Clay is a finely-grained natural rock and soil materials that combines one or more clay minerals with possible traces of quartz ( $\text{SiO}_2$ ), metal oxide ( $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$  etc) and organic matter. Clay soils feel very sticky and roll like plasticine when wet. They can hold more total water than most other soil types and, although only about half of this is available to plants, crops seldom suffer from drought. They swell when wetted and shrink when dried, so a certain amount of restructuring can take place in these soils depending on weather conditions. The size of clay soil is smaller than  $2\mu\text{m}$ . Locally available clayey soil was collected from the fields of village Bhadrarjun about 48 Km. north east of Jalore town.

### 2.2 WASTE TILES PARTICLES

A lot of ceramic tiles wastage is produced during formation, transportation and placing of ceramic tiles. This wastage or scrap material is inorganic material and hazardous. Hence its disposal is a problem which can be removed with the

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idea of utilizing it as an admixture to stabilize dune sand, so that the mix prove to be very economical and can be used as subgrade in low traffic roads or village roads.

Tiles waste was collected from a local shop of tiles. Ceramic tile waste is cheap and non-reusable material, it is shown in all construction area and easy to collect. By the using of ceramic tile waste to reduce the waste materials in earth and economical.

### III. EXPERIMENTAL PROGRAMME

The following testswere conducted:

1. Standard Proctor Compaction test to determine the different dry densities of clay soils and maximum dry density at the optimum moisture content.
2. California Bearing Ratio test to determine the % CBR values for clay soils mixed with different mix composition of admixture (waste tiles particles) in unsoakedconditions.

### IV. TEST RESULTS

#### 4.1 STANDARD PROCTOR TEST

The maximum dry density (MDD) of the clay soils without any admixture mixedis obtained as 1.67 gm/cc at theoptimum moisture content (OMC)equal to 18%. The dry density variation with water content for bentonite is tabulated below in Table 1 and graphically shown below in Figure 1:

Table 1: Dry density variation with water content for bentonite

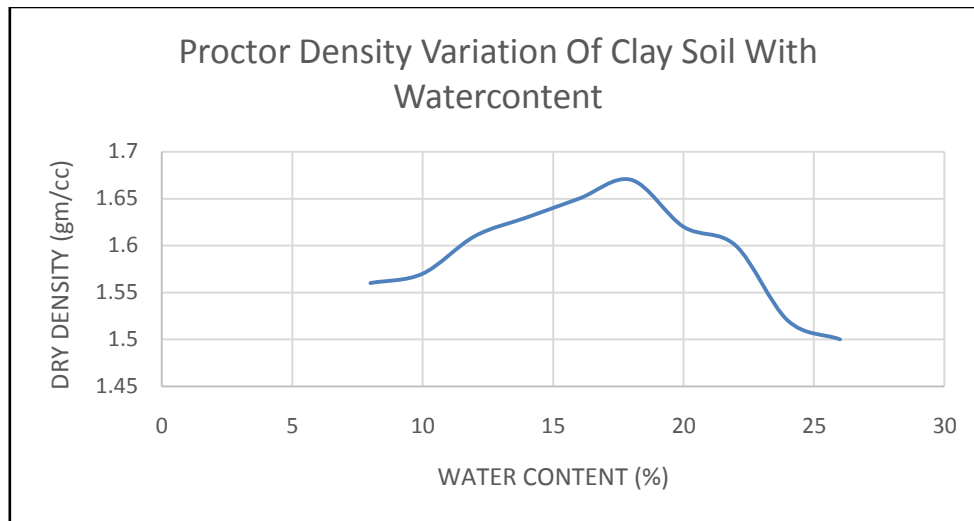
| S. No. | % WATER ADDED (BY WEIGHT) | DRY DENSITY (gm/cc) |
|--------|---------------------------|---------------------|
| 1      | 8                         | 1.56                |
| 2      | 10                        | 1.57                |
| 3      | 12                        | 1.61                |
| 4      | 14                        | 1.63                |
| 5      | 16                        | 1.65                |
| 6      | 18                        | 1.67                |
| 7      | 20                        | 1.62                |
| 8      | 22                        | 1.6                 |
| 9      | 24                        | 1.52                |
| 10     | 26                        | 1.5                 |

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**Figure 1: Dry density variation of clay soil with water content**

### 4.2 CALIFORNIA BEARING RATIO TEST

The results of the unsoaked CBR tests conducted at MDD of 1.67 gm/cc, 1.61 gm/cc and 1.52 gm/cc are tabulated below:

**TABLE 2: Mix Compositions, Symbols for Unsoaked CBR Test at MDD 1.67 gm/cc and % CBR Value of Clay soil with Each Mix Composition**

| MIX NO. | MIX COMPOSITION               | SYMBOL | % CBR VALUE |
|---------|-------------------------------|--------|-------------|
| 1       | 0.05% Tiles Particles + Clay  | CA1    | 5.723       |
| 2       | 0.075% Tiles Particles + Clay | CA2    | 5.961       |
| 3       | 0.25% Tiles Particles + Clay  | CA3    | 7.392       |
| 4       | 0.50% Tiles Particles + Clay  | CA4    | 5.246       |
| 5       | 0.75% Tiles Particles + Clay  | CA5    | 4.768       |
| 6       | 1.0% Tiles Particles + Clay   | CA6    | 4.530       |

**TABLE 3: Mix Compositions, Symbols for Unsoaked CBR Test at MDD 1.61 gm/cc and % CBR Value of Clay soil with Each Mix Composition**

| MIX NO. | MIX COMPOSITION               | SYMBOL | % CBR VALUE |
|---------|-------------------------------|--------|-------------|
| 1       | 0.05% Tiles Particles + Clay  | CA7    | 5.007       |
| 2       | 0.075% Tiles Particles + Clay | CA8    | 5.484       |
| 3       | 0.25% Tiles Particles + Clay  | CA9    | 6.199       |
| 4       | 0.50% Tiles Particles + Clay  | CA10   | 5.007       |
| 5       | 0.75% Tiles Particles + Clay  | CA11   | 4.530       |
| 6       | 1.0% Tiles Particles + Clay   | CA12   | 4.530       |

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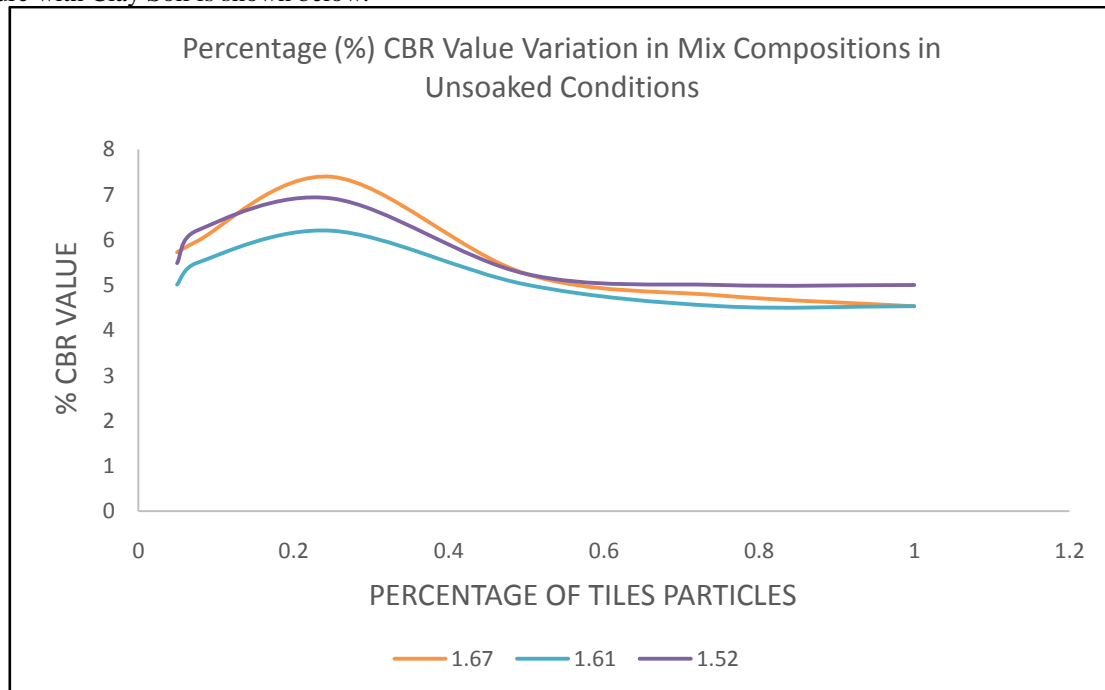
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**TABLE 4: Mix Compositions, Symbols for Unsoaked CBR Test at MDD 1.52 gm/cc and % CBR Value of Clay soil with Each Mix Composition**

| MIX NO. | MIX COMPOSITION               | SYMBOL | % CBR VALUE |
|---------|-------------------------------|--------|-------------|
| 1       | 0.05% Tiles Particles + Clay  | CA13   | 5.484       |
| 2       | 0.075% Tiles Particles + Clay | CA14   | 6.199       |
| 3       | 0.25% Tiles Particles + Clay  | CA15   | 6.914       |
| 4       | 0.50% Tiles Particles + Clay  | CA16   | 5.245       |
| 5       | 0.75% Tiles Particles + Clay  | CA17   | 5.000       |
| 6       | 1.0% Tiles Particles + Clay   | CA18   | 5.000       |

The graphical variation of the percentage CBR values in unsoaked conditions for different mix compositions of admixture with Clay Soil is shown below.



**Figure 2: Variation of % CBR values in unsoaked conditions for different mix compositions of admixture with Clay Soil of dry density 1.67 gm/cc, 1.61 gm/cc and 1.52 gm/cc**

From the above graph it is clear that among the three samples taken for the study, the maximum CBR value is obtained for dry density of Clay Soil of 1.67 gm/cc. It is also stated here that the maximum CBR value is obtained when the percentage by weight of admixture (Waste Tiles Particles) mixed with the Clay Soil is 0.25%.

### V. CONCLUSIONS

The following conclusions can be made from the above study:

- 1) It is observed that the CBR values first increases when the percentage by weight of admixture (Waste Tiles Particles) mixed with the clay soil increases upto 0.25% and then with the increase in percentage by weight of admixture the CBR values decreases.

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- 2) The above observation is same for all the three samples and thus it is concluded that the variation of CBR values with the percentage by weight of admixture is independent of the dry density of the clay soil.
- 3) It is also seen here that the maximum CBR value is obtained when the percentage by weight of admixture mixed with the clay soil is 0.25% irrespective of the dry density of the clay soil.
- 4) It is clear that among the three samples taken for the study, the maximum CBR value is obtained for dry density of bentonite equal to 1.67 gm/cc.
- 5) Waste Tiles Particles can be used as admixture and thus its recycling helps in reducing environmental problem related to its dumping and/or disposal.

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