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ROLE OF OPTIMUM MOISTURE CONTENT ON CALIFORNIA BEARING RATIO OF SUBGRADE SOIL

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ABSTRACT **:** *The California Bearing Ratio Test (CBR Test) is a test first developed by California State Highway Department (U.S.A.) for evaluating the bearing capacity of sub grade soil for design of flexible pavement. The CBR value of the sub grade soil is being used widely since a long time in design of pavement structure and is critical in deciding the overall thickness of the pavement. Additionally, for good drainage, a typical specification for the pavement foundation design requires the value of permeability coefficient of the sub grade material to be specified. Thus, permeability and CBR constitute two important parameters in the design and assessment of long-term performance of the pavement. In this project only strength aspects of pavement sub grade have been considered. In this study, laboratory investigations have been carried out on two number of soil samples procured from different roadwork sites. Preliminary tests, such as index tests and particle size distribution tests, used for soil classification, have been taken up followed by Proctor compaction and CBR tests. CBR tests have been conducted for same samples under conditions of soaking, with due emphasis on moisture content parameters in the soil sample. In this study for the purpose of comparison two different types of soils have been considered to study the variations.*

Key words: Liquid Limit, Plastic Limit, CBR, Pavement Sub grade.

1. INTRODUCTION

In India clay soil cover almost one fifth to one sixth of the total land area. The clay soil covers mostly on the Deccan plateau region majorly found over the states of Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Gujarat and Karnataka. The clay soil also found even at the river banks. Normally the clay soils possess low strength and undergo volume change in the presence of moisture, clay soil is a typical expensive soil which losses its strength in the presence of water resulting in swelling of the soil and in absence of water it shows multiple cracks due to shrinkage and this makes very difficult to use clayey soil to use in construction. Indian clay soils are rich in montmorillonate; it is a type of clay mineral. This mineral is responsible for swelling and shrinkage behavior of the soil. Structures on these soils experience large scale damage due to heavy accompanied by the loss of strength of these soils during rainy season and shrinkage during summer. Density of soil changes by varying the moisture content. Hence optimum moisture content is found out to achieve the maximum density. Since major area of land in India are covered by clay soil so we have taken two different soil samples which have high clay percent in the samples. Role of optimum moisture content in CBR values on these two soils are studied below. variation of OMC in preparation of CBR mould resulting in different results.CBR results indirectly affects pavement thickness. Therefore OMC and CBR results plays a major role in design of pavements

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2. BASIC TESTS

	Sample 1	Sample 2
Sieve Analysis	GM	SC
Liquid Limit	58.04%	45.04%
Plastic Limit	30%	23.24%
Specific gravity	2.205	2.18
Free swell index	35(water)	24(water)

3. STANDARD PROCTOR DENSITY

The Proctor compaction test is a laboratory geotechnical testing method used to determine the soil compaction properties, specifically, to determine the optimal water content at which soil can reach its maximum dry density The Proctor compaction test consists of compacting soil samples at a given water content in a standard mould with standard compaction energy. The standard Proctor test uses a 4-inch-diameter mould with the compaction of three separate layers of soil using 25 blows by a 5.5 lb hammer falling 12 inches. In the Proctor test, the soil is first air dried and and then separated into 4 to 6 samples. The water content of each sample is adjusted by adding water (2% - 10% increments or more depending on the type of the soil). The soil is then placed and compacted in the Proctor compaction mould in three different layers where each layer receives 25 blows of the standard hammer. Before placing each new layer, the surface of the previous layers is scratched in order to ensure a uniform distribution of the compaction effects. At the end of the test, after removing and drying of the sample, the dry density and the water content of the sample is determined for each Proctor compaction test. Based on the whole set of results, a curve is plotted for the dry unit weight (or density) as a function of the water content. From this curve, the optimum water content to reach the maximum dry density can be obtained.

4. CALIFORNIAN BEARING TEST

It is the ratio of force per unit area required to penetrate a soil mass with standard circular piston at the rate of 1.25 mm/min. to that required for the corresponding penetration of a standard material

PROCEDURE

- Normally 3 specimens each of about 7 kg must be compacted so that their compacted densities range from 95% to 100% generally with 10, 30 and 65 blows. Weigh of empty mould
- Add water to the first specimen (compact it in five layer by giving 10 (blows per layer) After compaction, remove the collar and level the surface.
- Take sample for determination of moisture content. Weight of mould + compacted specimen.
- Place the mold in the soaking tank for four days (ignore this step in case of unsoaked CBR.) Take other samples and apply different blows and repeat the whole process.
- After four days, measure the swell reading and find %age swell. Remove the mould from the tank and allow water to drain. Then place the specimen under the penetration piston and place surcharge load of 10lb. Apply the load and note the penetration load values.
- Draw the graphs between the penetration (in) and penetration load (in) and find the value of CBR. Draw the graph between the %age CBRand Dry Density, and find CBR at required degree of compaction.

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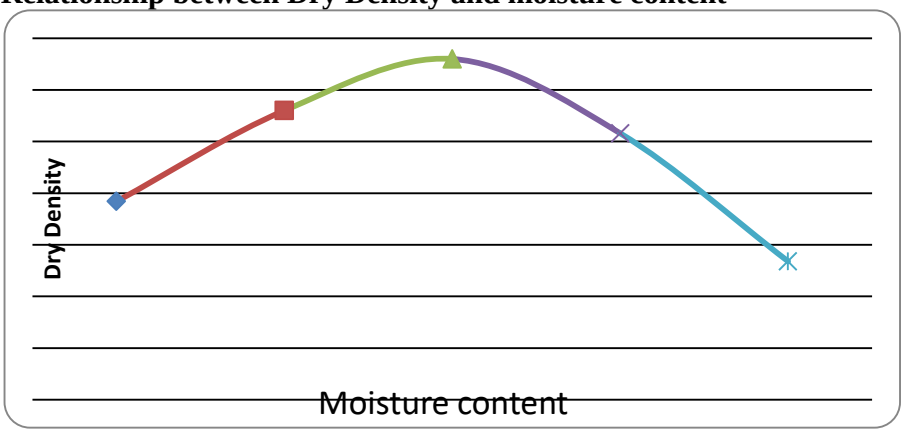
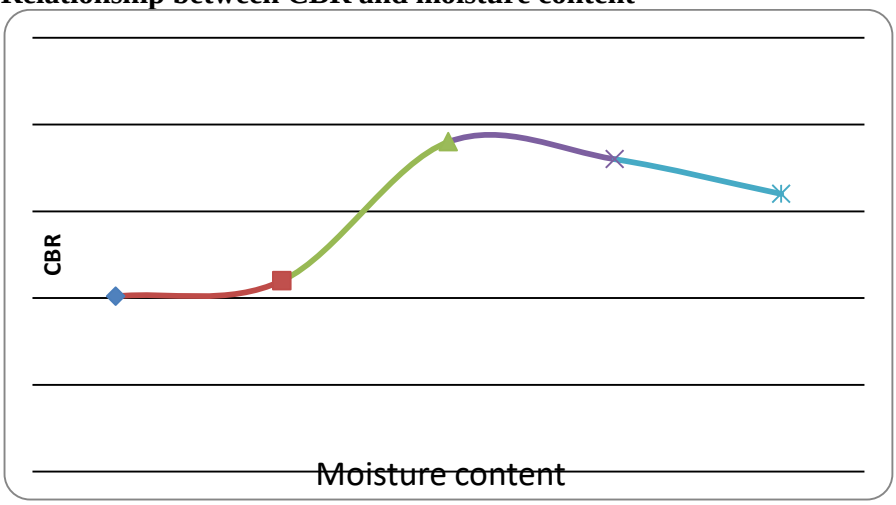
5. RESULTS

SAMPLE 1

Relationship between Dry Density and moisture content

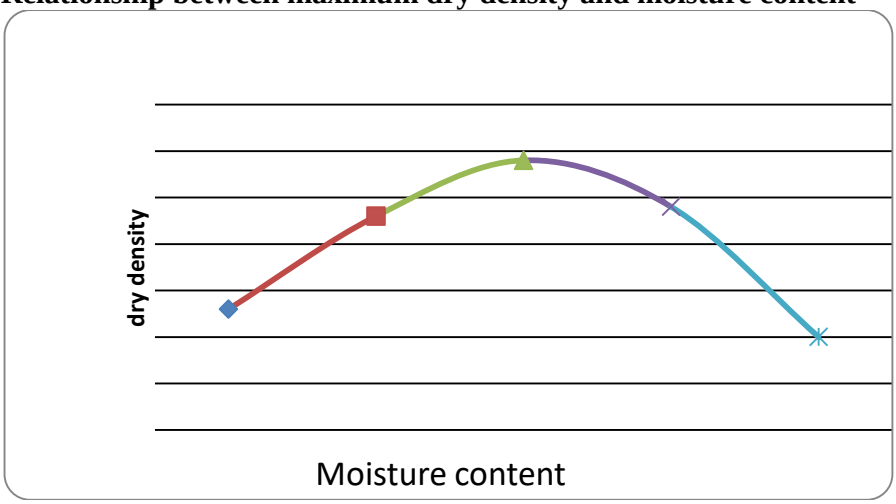


Relationship between CBR and moisture content



SAMPLE 2

Relationship between maximum dry density and moisture content



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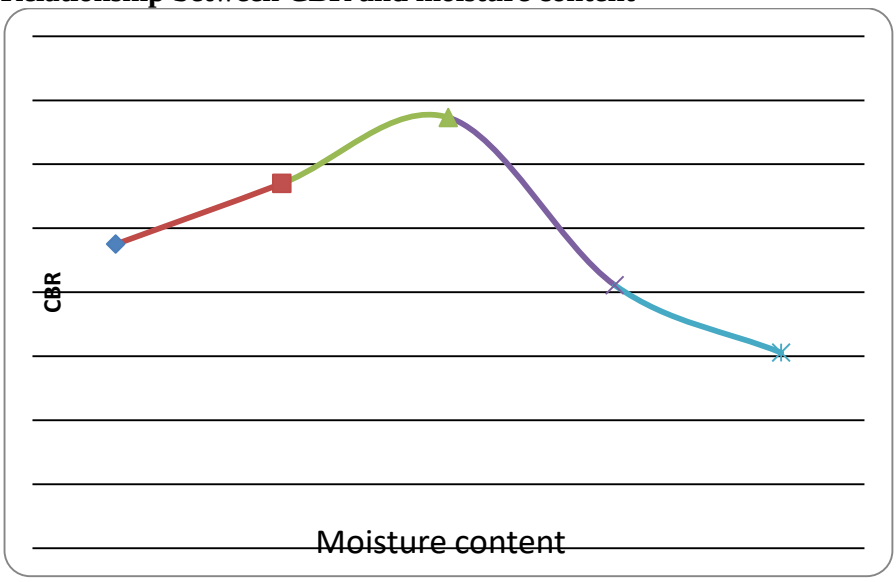
Relationship between CBR and moisture content



6. CONCLUSION

From the results and discussions of several tests conducted on only two types of soil samples as described before, it is concluded that the value of CBR for the given soil sample attains maximum value at OMC.

Sample 1: OMC: 6.12%, CBR: 1.9

Sample 2: OMC:6.22%, CBR: 13.46

If we maintain OMC and CBR values of sub grade soil load bearing capacity will be hiher and significantly thickness of pavements can be reduced. Further study can be done by preaparing the mould in unsoaked and 1,2,3 days soaking conditions, based on these conditions behavior of the soil can be tabulated by repeating the experiments which are mentioned before.

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