Variation of CBR Value With Bitumen Emulsion

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Abstract- *The california bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements. The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement. Increase in CB value of certain subgrade soil is an intimation of improved srenth.Several method are adopted to increase the CBR value of the soil. This study mainly focusing the effect of CBR value on the addition of bitumenemulsion*

Keywords- CBR value, bitumen, bitumen emulsion, subgrade

I. INTRODUCTION

In design and construction of any structure, the role of soil is very crucial. Since the soil is in direct contact with the structure, it acts as a medium of load transfer and hence for any analysis of forces acting on structure, one has to consider the aspect of stress distribution through soil, as stability of structure itself depends on soil properties. Geotechnical study of site is crucial at feasibility stage, taking place before the design begins (a critical design input) in order to understand the characteristics of subsoil upon which the structure will stand.

California bearing ratio (CBR) is an empirical test and widely applied in design of flexible pavement over the world. This method was developed during 1928-29 by the California Highway Department. Use of CBR test results for design of roads, introduced in USA during 2nd World War and subsequently adopted as a standard method of design in other parts of the world, is recently being discouraged in some advanced countries because of the imperialness of the method (Brown, 1996). The California bearing ratio (CBR) test is frequently used in the assessment of granular materials in base, subbase and subgrade layers of road and airfield pavements. The CBR test was originally developed by the California State Highway Department and was thereafter incorporated by the Army Corps of Engineers for the design of flexible pavements. It has become so globally popular that it is incorporated in many international standards ASTM 2000.(Joshi 2014)

Bitumen emulsions are a dispersion of bitumen in an aqueous continuous phase, stabilized by the addition of an emulsifier. They are prepared as emulsions at high temperatures, but applied as solid dispersions at ambient temperatures. Initially the properties of soil are determined by using conducting sieve analysis, plastic limit, liquid limit, specific gravity and shrinkage limit. Different percentage of bitumen emulsion was added and the obtained CBR value compared with the shear strength obtained for normal soil.

II. OBJECTIVES

Main objective of the work is to study the change in CBR value by the addition of bitumen emulsion

III. MATERIALS AND METHODOLOGY

Thes oil was collected from Muthuvara,Thrissur at an average depth of 1.5m. The undisturbed soil was cleared and large particles were removed. After the soil was air dried and stored in bags under room temperature. Bitumen emulsion was collected.

The tests were carried out on the collected soil without adding bitumen emulsion, such that the effect of the additive could easily be measured. Basic properties of the soil were determined.

Fig 3.1: CBR test

CBR value of the sample was find out.Adding various amount of bitumenemulsion the CB vale of the soil was found out.

IV. RESULT AND DISCUSSION

The basic properties of was determined. Properties of soil were tabulated in table 4.1.

Table-4.1:Properties of soil

Properties	Values
Specific gravity ,G	2.62
Liquid Limit ,WL (%)	41
Plastic Limit, WP(%)	23
Shrinkage Limit, WS (%)	14
Plasticity Index, I P	18
Soil type	MI
Optimum moisture content %	13.3
Maximum dry density (kN/m3)	19.4
Unconfined compressive strength (Kg/cm2)	0.832

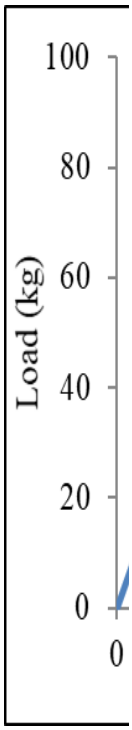

Fig.4.1: Variation of CBR value at 4% of bitumen emulsion

CBR of soil was determines by adding various percentage of bitumen emulsion. Bitumen emulsion was directly added to the soil and mixed well. After 1 minute soil was filled in CBR mould CBR value was determined by CBR test.

The figure 4.1 shows the variation of CBR value with 4% of bitumen emulsion at optimum water content (13.3%). Here the penetration increases with respect to the load, up to a certain point, then it became constant.

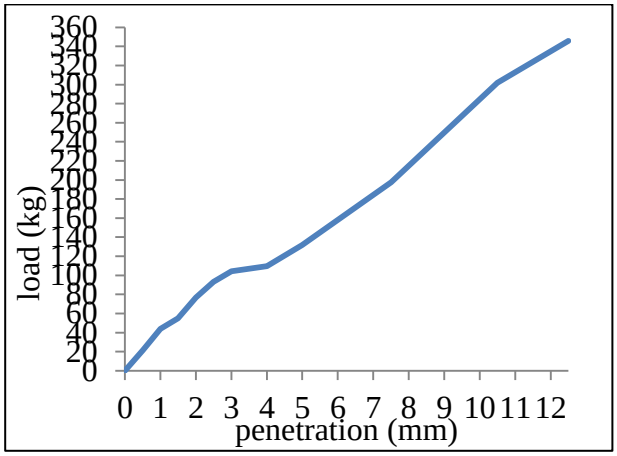

Fig 4.2: variation of CBR value at 8% of bitumen emulsion

The figure 4.2 shows the variation of CBR value with 8% of bitumen emulsion at optimum water content (13.3%). Here the penetration increases with respect to the load, upto a certain point, then it became constant.

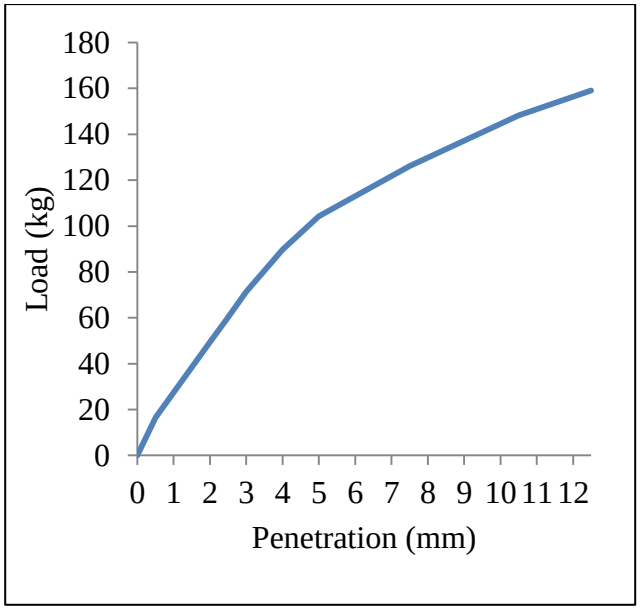

Fig 4.3: variation of CBR at 6% of bitumen emulsion

The figure 4.3 shows the variation of CBR value with 6% of bitumen emulsion at optimum water content. Here the penetration increases with respect to the load, upto a certain point, then it became constant.

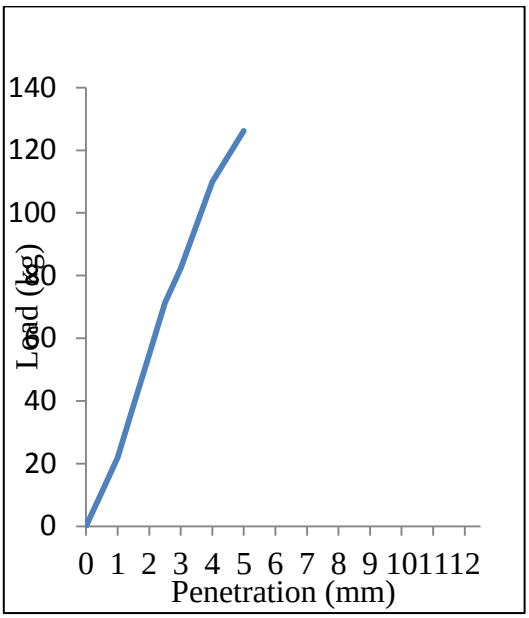

Fig.4.4: variation of CBR value at 12% of bitumen emulsion

The figure 4.4 shows the variation of CBR value with 12% of bitumen emulsion at optimum water content(13.3%). Here the penetration increases with respect to the load, up to a certain point, then it became constant

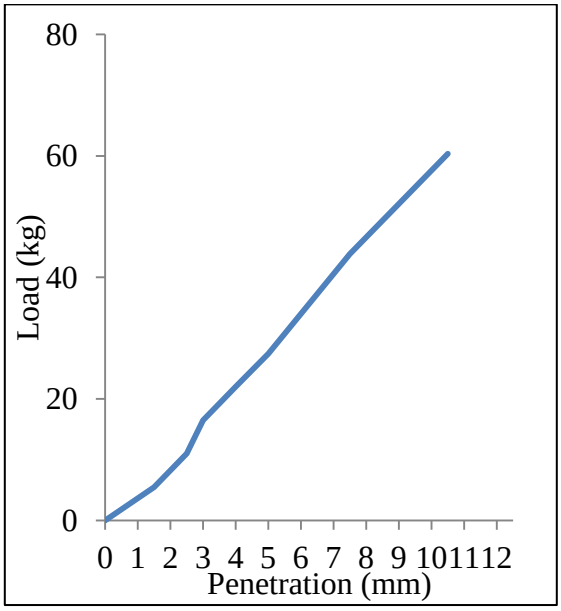

Fig.4.5: variation of CBR value at 16% of bitumen emulsion

The figure 4.5 shows the variation of CBR value with 16% of bitumen emulsion at optimum water content. Here the penetration increases with respect to the load, up to a certain point, then it decrease.

The figure 4.6 shows the variation of CBR value with 10% of bitumen emulsion at optimum water content. Here the penetration increases with respect to the load, up to a certain point, then it decrease.

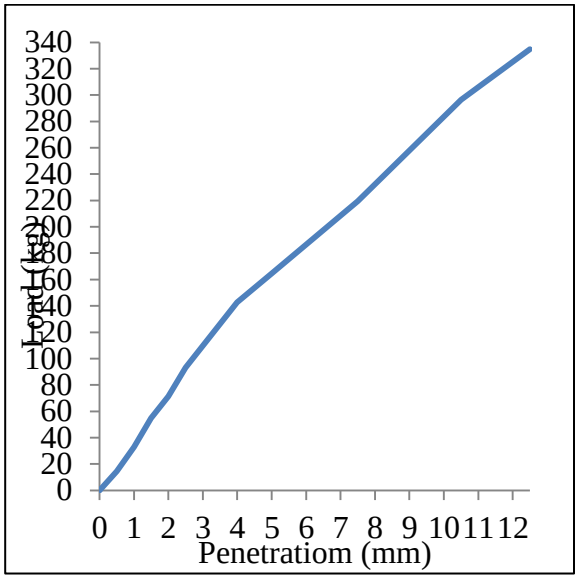

Fig.4.6: variation of CBR value at 10% of bitumen emulsion

The figure 4.7 shows the variation of compressive stress with 14% of bitumen emulsion at optimum water content. Here the compressive stress increases with respect to the axial strain, up to a certain point (0.272kg/cm2), then it decrease.

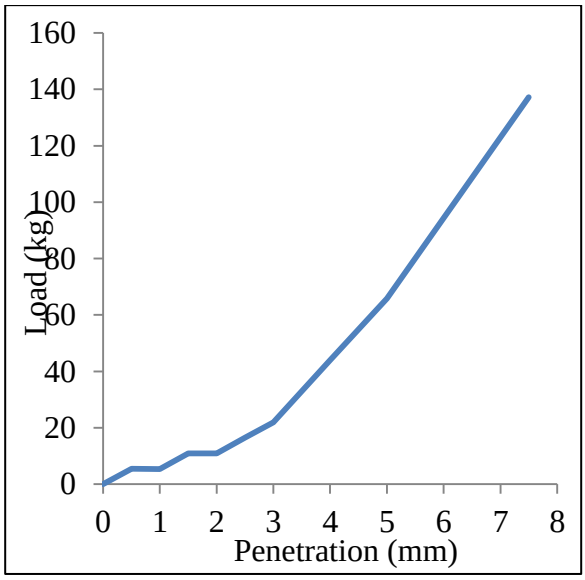

Fig.4.7: variation of compressive stress at 14% of bitumen emulsion

The figure 4.8 shows the variation of compressive stress with 9.5% of bitumen emulsion at optimum water content . Here the compressive stress increases with respect to

the axial strain, up to a certain point (0.810kg/cm2), then it decrease.

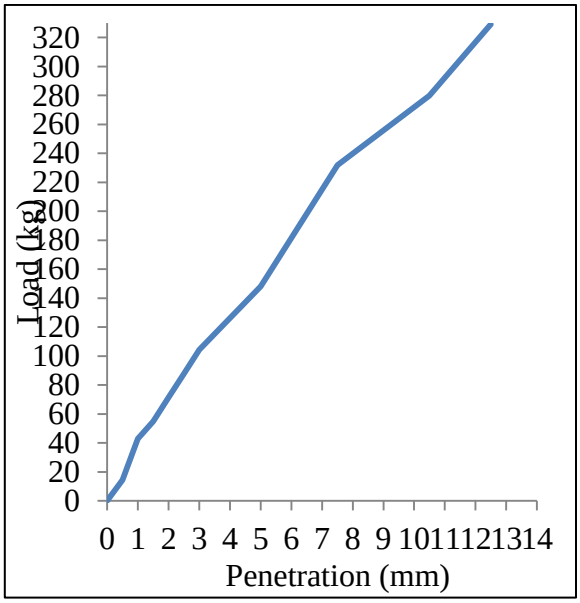

Fig.4.8: variation of CBR value at 9.5% of bitumen emulsion

The figure 4. shows the variation of compressive stress with 10.5% of bitumen emulsion at optimum water content . Here the compressive stress increases with respect to the axial strain, up to a certain point (1.015 kg/cm2), then it decreases.

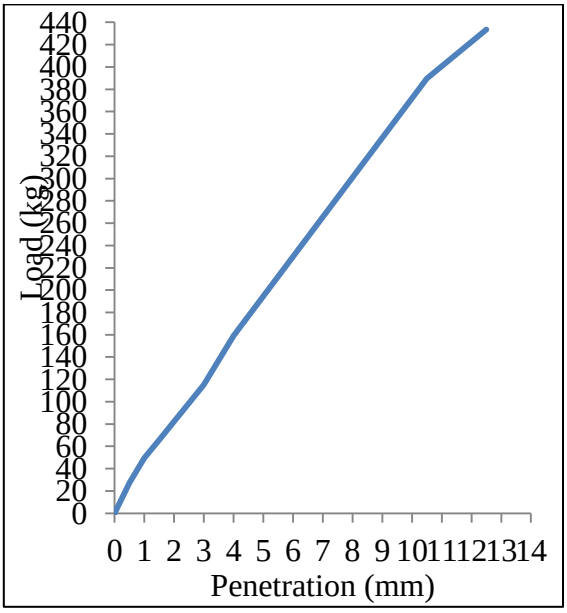

Fig.4.9: variation of CBR value at 10.5% of bitumen emulsion

The figure 4.10 shows the variation of compressive stress with 11% of bitumen emulsion at optimum water content . Here the compressive stress increases with respect to the axial strain, up to a certain point (0.509kg/cm2), then it became constant.

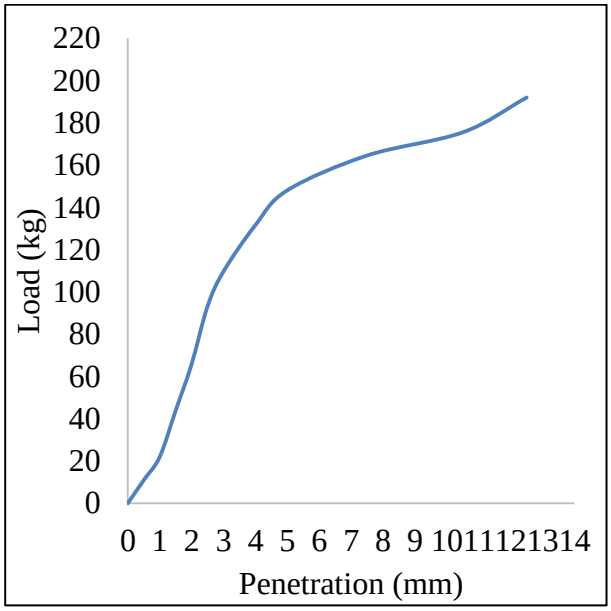

Fig.4.10: variation of CBR value at 11% of bitumen emulsion

The figure 4.11 shows the variation of compressive stress with 11.5% of bitumen emulsion at optimum water content Here the compressive stress increases with respect to the axial strain, up to a certain point (0.414kg/cm2), then it became constant.

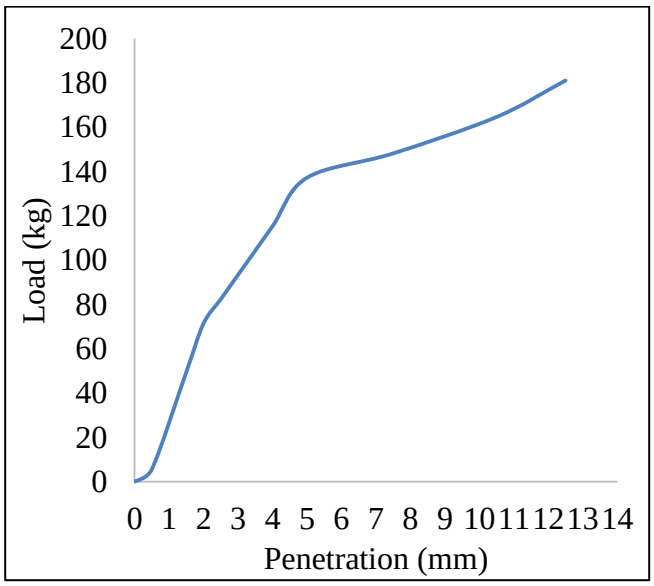

Fig.4.11: variation of CBR value at 11.5% of bitumen emulsion

V. CONCLUSIONS

- This study made a comprehensive examination of the effectiveness CBR value on the addition of bitumen emulsion.
- The strength of soil is good when 10.5% of bitumen emulsion added.
- The maximum CBR value and minimum permeability is obtained at 10.5% of bitumen emulsion added soil. So the soil is used for construction purposes.

REFERENCES

[1] V.S.Prasad, K.G.Pradeep, K.N.Vijay,and S.S.Asadi, "Study on Strength of Laterite Soil Using Bitumen Emulsion" ,in International Journal Of Current Engineering And Scientific Research,Vol.04, pp.49-54,2017.

[2] S.S.Batra ,andJ.S Arora,"Effect of Cationic Bitumen Emulsion on Shear Strength Parameters of Soil", in International Journal of Research in Engineering and Technology, Vol.05,pp.156-160,September 2016

[3] Badiger R, Bisanal G.M (July-2015) "Study on Stabilization of Soil Using Sea Shell and Bitumen Emulsion" "International Journal of Innovative Research in Science, Engineering And Technology", Volume: 04(Pg.No:5875-5882)

[4] Benbini M.A, Prof.R.K.Pandey (Dec-2016) "Study on Use of Bitumen Emulsion on Gravel Road Soil" "International Journal of Scientific Engineering and Technology Research", Volume: 05(Pg.No:10328-10334)