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Research Paper

PREDICTING THE CBR VALUE OF DIFFERENT SOILS WITH THE HELP OF INDEX PROPERTIES

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Subgrade strength is an important soil parameter in the design of flexible pavements. CBR value is indicative of the strength of the subgrade. The CBR test is a time consuming test and laborious. Hence here a method is proposed to predict the CBR value of a soil based on its index properties like LL, PL and PI. In the present study eight number of soil samples (having different index properties) were collected from different parts of Jabalpur district (MP). Liquid limit, plastic limit, plasticity index were found out and the CBR value was predicted based on the index properties. The method uses single variable and multiple variable regression analysis of Microsoft excel.

Keywords: California bearing ratio, Coefficient of correlation (R^2), MLRA, Regression, SLRA

INTRODUCTION

There are various methods of design of flexible pavement, the most common being the California bearing method (CBR) which is an empirical method. It was developed by the California division of highways in USA in 1928. The CBR is basically a penetration test which can be performed either in the field or in the laboratory.

To obtain soaked CBR value of a soil sample, it takes about a week, making CBR test expensive, time consuming and laborious. As a result, only a limited number of CBR test could be performed per kilometer length of the proposed road or any such construction. Such limited number of CBR test results may not generally reveal the variation in the CBR values over the length of the road to enable rational, economic and safe construction. This could be avoided only if a large number of soil sample are taken. But such a procedure will increase the project cost and time. Previously Mukesh and H S Patel established a correlation between physical properties and CBR value both in soaked and unsoaked condition. Naveen and Santosh (2014) established relation between CBR value and physical properties of the soil. Also Ramasubbarao and Shiva Shankar predicted the CBR value of fine grained soil using index and compaction characteristics. Rakaraddi and Gomarsi (2015) established relation between CBR value and different soil properties.

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Therefore to overcome the above mentioned difficulties it is aimed here to predict the soaked CBR value of the soil using index properties of the soil that is liquid and plastic limit and plasticity index.

EXPERIMENTAL WORK

For the purpose of this study eight numbers of samples of different types of soil were collected from different regions of Jabalpur district (MP) India. These samples were initially classified according to Unified Soil Classification System. For this purpose the samples were individually washed and passed through 75µ IS sieve and the mass retained was dried and weighted. Further the liquid and plastic limit of each of these eight samples was calculated. Also the OMC and MDD were determined and hence the CBR value of different samples was calculated. The results obtained are tabulated as below.

RESULTS AND DISCUSSION

Table 1 gives us the information about the classification of the soil sample and its CBR value. The further calculations are done using regression analysis tool from data analysis tool pack of Microsoft excel. The following graphs were observed.

Table 1: Results from Laboratory Tests

Sample	% Finer	LL	PL	PI	Classification	CBR
1	49.6	34.5	18.1	16.4	SC	3.38
2	99.2	73.0	32.0	41.0	CH	1.71
3	97.9	54.0	28.1	25.9	CH	2.35
4	96.4	44.1	24.0	20.1	CI	2.42
5	93.5	58.2	23.8	34.4	CH	2.11
6	98.5	56.4	21.2	35.2	CH	2.01
7	64.8	33.2	25.6	7.6	ML	2.95
8	71.1	28.9	22.7	6.2	ML	3.06

Figure 1: Variation of CBR with PI

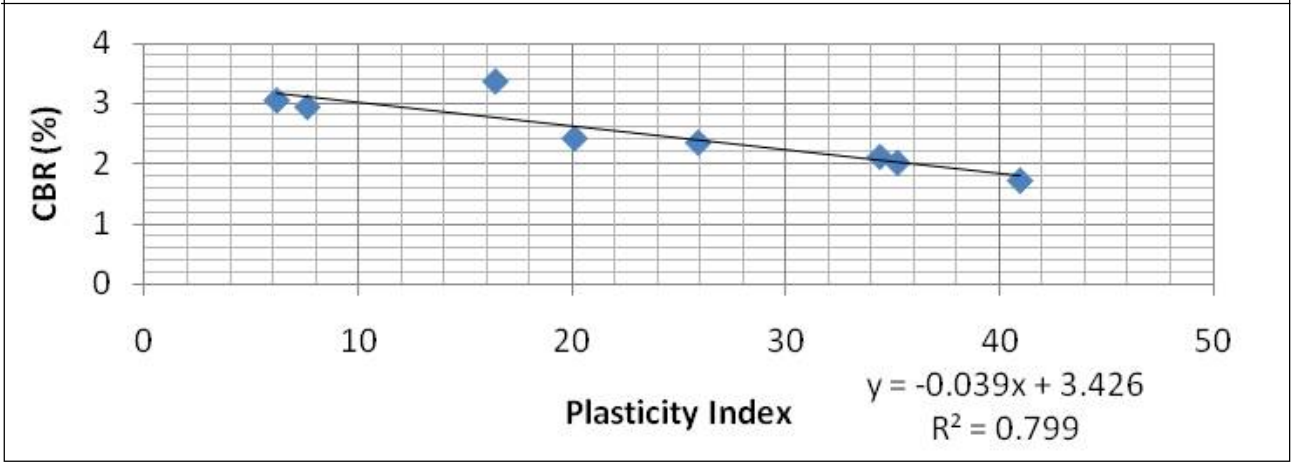
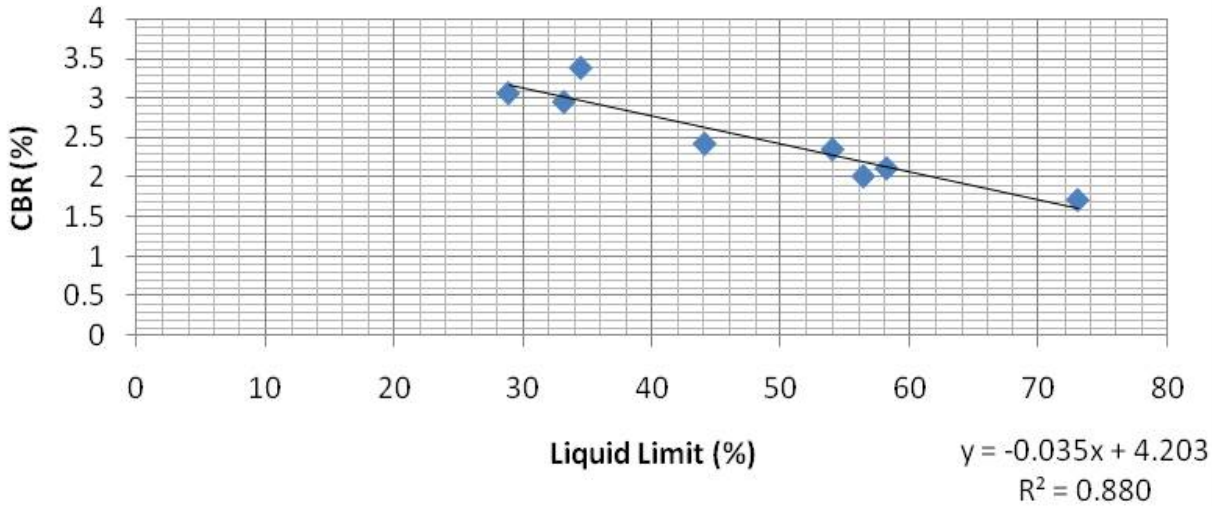


Figure 2: Variation of CBR with LL



From the above graph it is clear that there exists a good relation between the plasticity index and the CBR value of the soil, and also between CBR and liquid limit of soil, as it has a coefficient of correlation (R^2) value of 0.799 and 0.880 respectively. This shows that the index properties of the soil may be used in the prediction of the CBR value of the soil. From the correlation analysis the predicted CBR value has a correlation coefficient of 0.836 which is quiet good. The equation is:

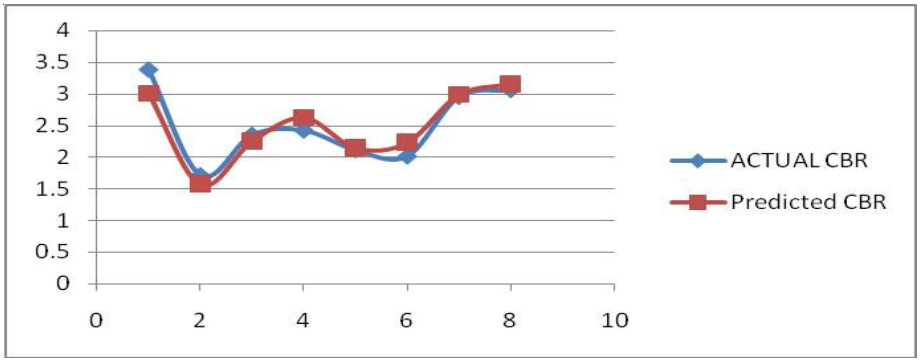
CBR = 4.3408 – (0.0427*LL) + (0.0085*PI)

The laboratory CBR and actual CBR is shown in Table 2.

Table 2: Actual and Predicted CBR

No. Of Samples	Actual CBR	Predicted CBR
1	3.38	3.00
2	1.71	1.57
3	2.35	2.25
4	2.42	2.62
5	2.11	2.14
6	2.01	2.23
7	2.95	2.98
8	3.06	3.15

Figure 3: Variation in Actual and Predicted CBR



CONCLUSION

- CBR value of soil decreases with increase in PI and LL.
- The coefficient of correlation is observed as 0.799 and 0.880, hence there exists a good correlation between the CBR and the plasticity index and also between LL
- The predicted values of the soil are close to the laboratory obtained CBR, hence the proposed model works properly.
- The coefficient of correlation for the CBR value found from regression analysis is found to be 0.836.

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