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Case Study on Correlation between California Bearing Ratio (CBR) and Dynamic Cone Penetration Test (DCPT)

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1. INTRODUCTION

For the design of flexible pavement, the sub-grade soil strength is estimated with California Bearing Ratio test IS 2720part (IRC-37-2001). In 1929, this test was developed by California Division of Highway and is used to evaluate the suitability of sub grade and the materials used in sub base and base course. This test can be done in the laboratory as well as in the field. But this conventional CBR testing has low repeatability. It is an expensive and time consuming test. Moreover, it is very difficult to mould the sample at desired insitu density in the laboratory. Therefore, to overcome these problems, the other method (Dynamic Cone Penetrometer) is used in this study. This is an instrument used to evaluate insitu strength of pavement base , sub base and sub grade materials. The CBR values are obtained by conventional method and with the help of Dynamic Cone Penetrometer (DCP) and both the values are correlated to find the conventional CBR value by using DCP in the field. So, with the help of this relationship, it will be easy to get information about the strength of sub grade over the length of road.

2. NEED OF THE PRESENT STUDY

IRC•37-2001, the Indian Roads Congress standard deals with the design of flexible pavements and recommends the California Bearing Ratio (CBR) as an indicator of subgrade soil strength. The subbase/base thickness of pavement is governed by the CBR value of the subgrade soil along with some other parameters such as traffic intensity, climatic conditions, etc. The conventional CBR testing method is expensive, time consuming and its repeatability is low. Additionally, it is very difficult to mould the sample at the desired in-situ density in the laboratory CBR test. Values of in• situ density are underestimated due to local dampness of surface water percolation and stress release while taking out the sample. Dynamic cone penetration test (DCPT) value conducted in the field can be used to estimate the CBR value provided a suitable relationship exists between CBR and DCPT value. In the present study an attempt has been made to establish a relationship between the DCPT value and the CBR.

3. SUMMARY OF LITERATURE REVIEW

1. There exist a correlation between CBR Value and DCPT value.

2. The correlation between CBR values have mostly been determined under soaked conditions.

3. Experimental results shows direct linear relationship exist between initial state factor and the soil strength

3. Coefficient of this linear relationship is depend on plastic index and clay content of soil

4. The present investigation were limited to fine ground soils.

5. IRC 37 – 2012 have given a single relationship.

Log10 CBR = 2.465-1.12Log10 N

4. GAPS IN LITERATURE REVIEW

Though there exist a correlation between CBR Value and the DCPT value, which is established beyond doubt , the correlation is cannot a fixed generalised equation . There may be variation w.r.t. soil type , soil condition and moisture content. Such factors need further investigations and therefore more studies are required. The following are major gaps :

1. Correlation have been derived mostly for only few soil types (Laterite, Lacustrine soil).

2. IRC -37: 2012 has given a single correlation between DCPT and CBR Value. It is unlikely that a single correlation can hold good and give precise derivation of CBR value for different soil types. It is required to verify the correlation by carrying out a series of tests on different types of soils.

5. OBJECTIVES OF STUDY

The objectives of this thesis are listed below:

1. To determine the correlation between CBR (California bearing ratio) and DCPT (Dynamic cone penetration test) for different soils e.g Clayey, silt and Sandy Soil

2. To ascertain the effect of moisture on correlation between CBR and DCPT value

3. To ascertain the effect of compaction on correlation between CBR and DCPT value

4. To compare the results with the correlation given in IRC 37 : 2012.

Log10 CBR = 2.465-1.12Log10 N

6. RESEARCH METHODOLOGY

The following gives the step by step process of the things that are held in the laboratory.

1. Various types of Soil sample is to be taken from the vicinity of Chandigarh / Mohali
2. All the tests for research work of project shall be performed at Civil Engineering Department, NITTTR Chandigarh.
3. The CBR /DCPT test is to be performed on the various soil samples at different moisture content for clay it ma be 8,11,14,17 percent for silt at 6,8,10,12,14 percent and for sand 4,5,6,7,8 percent.
4. Liquid limit and plastic limit test shall be conducted for classification of soil.
5. This shall lead to campaction of soil at different densities.

7. LABORATORY TESTS

Following laboratory tests shall be carried out as per IS: 2720. The tests were carried out both on clayey soil , silty soil and sandy soil.

- Compaction properties (Optimum Moisture content and Maximum dry density)
- California bearing ratio test
- DCP test

8. EXPECTED OUTCOME

As we are expecting that the equation which is given in IRC-37-2012 for finding insuit CBR is not suitable for every type of soil and moisture content. As CBR value may changes with the variation in moisture content and types of soils.

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