

AN EXPERIMENTAL STUDY ON CORRELATION BETWEEN CALIFORNIA BEARING RATIO (CBR) AND DYNAMIC CONE PENETRATION TEST(DCPT)

Er Younis Farooq M.E(Ctm)¹ , Prof Ajay K Duggal², Asif Farooq (B.Tech)³

^{1,2,3} *Civil Engineering Department, National Institute Of Technical Teachers' Training & Research, Sector 26, Chandigarh.*

Abstract- The paper is revealing the results of a laboratory study carried out to find the correlations between the Dynamic Cone Penetration test value and the unsoaked CBR value at different moisture content. A series of test was carried out different types of soil (sand,silt,clay) at different moisture content, for each soil sample to find out the correlation in CBR value. Samples were compacted manually (Standard proctor compaction) to obtain the pre-determined conditions.

The laboratory results indicated that there is variation in CBR values at same moisture content . The CBR variation of same water content goes higher to lower with the variation of water content.

Key word- CBR Test, DCP Test, Dry Density, Moisture content

I. INTRODUCTION

The Dynamic cone penetration (DCP) is an instrument that can be used to evaluate California Bearing Ratio (CBR) value of road pavement subgrade. The DCP has many advantages over the traditional CBR test. Its an in situ test, simple to use and inexpensive. Hence its possible to introduce this instrument to local road authorities that deal with rural road construction and maintenance work, with a limited budget. Its very rarely that a local authority values the subgrade in maintenance work or designing of overlay the subgrade in maintenance work or designing of overlay thickness. However the DCP, which can also be produced by local authorities for those themselves at low cost, can be introduced for those rural road projects as an effective road evaluation tool.

II. 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

$$\text{Log}_{10} \text{ CBR} = 2.465 - 1.12 \text{Log}_{10} \text{ N}$$

III. EXPERIMENTAL PROCEDURE

A series of tests were conducted in the laboratory under controlled conditions as required .Soil samples were prepared of clay ,sand,silty soil at different moisture content. The CBR test was conducted in a mould of diameter 150mm. The standard proctor compaction test was carried out for each soil sample to find out the dry density and MDD, then DCP test was carried out by varying the moisture content and the dry density. About five test were carried out for each soil sample. Sample were compacted manually and extreme case was taken to maintain the pre-determined conditions. This shows the effect of moisture content on CBR value.

IV. TEST RESULTS AND DATA ANALYSIS

The results of various tests conducted in the field and laboratory are given in table:

Clay soil (CL) MDD at 11%

Water content	Laboratory CBR %	DCPT INDEX%	Difference in CBR%
8%	58.33	58.2	.13
11%	21.89	25	3.11
14%	5	7.27	2.27
17%	1.57	2.15	.58

Silty Soil MDD at 6%

Water content	Laboratory CBR%	DCPT INDEX%	Difference in CBR%
6%	15.76	28	12.24
8%	27.15	25.27	1.88
10%	37.31	25	12
12%	7.35	16	8.65
14%	3.50	10	6.5

Sandy soil MDD at 5%

Water content	Laboratory CBR%	DCPT INDEX %	Difference in CBR
4%	42.3	35	7
5%	30.65	41.44	10.84
6%	52	40	12
7%	48	51	3
8%	36	34	2

V. CONCLUSION

Based on the study, following conclusions can be drawn:

1. The variations between laboratory CBR values by IS and DCP method are 1 to 12% for unsoaked condition. in respect to IS method.
2. For construction of new embankments or strengthening of existing pavements, DCPT will be a very useful tool for evaluating the strength of sub grade in terms of CBR value.
3. Once the correlation is established between CBR index for tests conducted under different conditions and compaction level. The unsoaked CBR value in the field can be determined very quickly by conducting the in-situ DCPT for existing conditions and using the CBRI value for that particular condition.
4. Data prove equation given in IRC -37-2012 is not suitable at different water content as it changes from 1-12% in CBR value

REFERANCES

- 1 K.S.Gill, J.N.Jha, A.K.Choudhary-“CBR Value Estimation Using Dynamic Cone Penetrometer”- India Geotechnical Conference- 2010, Geotrendz December 16-18 2010 IGS Mumbai Chapter & IIT Bombay
2. M. M. E. Zumrawi-“Prediction of In-situ CBR of Subgrade Cohesive Soils from Dynamic Cone Penetrometer and Soil Properties- *IACSIT International Journal of Engineering and Technology*, Vol. 6, No. 5, October 2014
3. K.A.K.Karunaprema and A.G.H.J.Edirisinghe- “A Laboratory Investigation on the Relationship between Dynamic Cone Penetrometer Value and Soaked California Bearing Ratio”-Annual Transactions of IESL -2003 section (Digesr), pp 120-122, Institution of engineers, Sri Lank
4. P. K. SAHOO & K. SUDHAKAR REDDY- “ Evaluation of subgrade soil using Dynamic cone Penetrometer”- *International Journal of Earth Sciences and Engineering* ISSN 0974-5904, Vol. 02, No. 04, August 2009, pp. 384-388
5. Deepika Chukka, Chakravarthi.V.K-“ Evaluation of Properties of Soil Subgrade Using Dynamic Cone Penetration Index”- *International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 4, Issue 4 (October 2012), PP. 07-15 7*
6. Adil Mehraj , Firddous Ahmed, Mohammad Zubair, Irshad Gani Bhat & Ajaz Masood_ “ Experimental Study On In-situ and Laboratory Co-Relation of Dynamic Cone Penetrometer Test Result With Sub- Grade CBR for Lacustrine and Alluvial Plain Soil of Kashmir”- *International Journal of Civil Structural, Environment and Infrastructure (IJCSIEIRD)* ISSN(P): 2249-6866;ISSN(E): 2249-7978 vol. 4,Issue 4, Aug 2014, 45-52 TJPRC pvt.Ltd.
7. Parampreet Kaur, K.S.Gill, B.S.Walia-“ Correlation Between Soaked CBR Value and CBR Value Obtained With Dynamic Cone Penetrometer”- *IJREAS* Volume2, Issue 2 (February 2012) ISSN:2249-3905
- 8.Varghese George, CH.Nageshwar Rao and R.Shivashankar-“Investigation on Unsoked Bleded Laterite Using DCP and CBR test”- *Journal of the Indian Roads Congress*, October-December 2009, paper No.556
9. Bandyopadhyay.K , Bhattacharjee.S-“Comparative Study Between Laboratory and Field CBR by DCP and IS Method”- Indian Geotechnical Conference – 2010, GEO trendz December 16-18, 2010 IGS Mumbai Chapter & IIT BOMBAY
10. Simo Tosovic, Vladeta Vujanic-“ C.B.R Testing with Dynamic conical Penetrometer in the process of road rehabilitation and construction control”- *SLOVENSKI KONGRES O CESTAH IN PROMETU*, Portorož, 20. – 22. oktobra 2010
- 11.Gill,K.S, Jha,J.N, Choudhary, A.K-“ CBR Value Estimation Using Dynamic Cone Penetrometer”- Indian Geotechnical Conference – 2010, *GEOTrendz* December 16–18, 2010 IGS Mumbai Chapter & IIT Bombay
- level compared to standard compaction energy level. Variations between four days soaked lab DCP CBR
- 12.Dar-Hao Chen, Jian-Neng Wang, and John Bilyeu-“Application of Dynamic cone Penetrometer in Evaluation of Base and Subgrade Layers”- *Transportation Research Record 1764 Paper No. 01-034*

