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ENHANCE MANAGEMENT CORRELATION OF LABORATORY CBR VALUE AND DCP IN LANDCOMPENSATED ON ROAD CONSTRUCTION HIGH CLAB TOLL – INDERAPURA

Jupriah Sarifah [1], Bangun Pasaribu[2]
[1,2] Universitas Islam Sumatera Utara, Medan, North Sumatera, Indonesia

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ABSTRACT

How to test the Dynamic Cone Penetrometer (DCP). It is a quick procedure for evaluating the strength of subgrade and road base layers at a relatively low cost. This paper discusses the relationship between laboratory CBR and DCP values for compacted soil on the inderapura high cliff toll road. The CBR test is a test that is well known in general, especially in the construction of toll roads and landfills. However, this CBR test has some drawbacks. For this reason, the DCP test is used as a substitute for the CBR test. This research, which has been conducted, produces a graph of the correlation between CBR and DCP values with different calculations. In this study, we will look for correlation calculations of CBR and DCP values in soils that are close to the actual CBR values. The data is obtained by compacting the soil, laboratory CBR test and continued with DCP which all activities are in the field and in the laboratory. CBR values using the DCP test were 4.73, 10.31, 3.68 while laboratory CBR values were obtained from samples of 8.02%, 7.29%, 5.20%. From the analysis carried out, the CBR and DCP values are not much different from the laboratory CBR values.

E-mail:
jupriah@ft.uisu.ac.id,
bangun@ft.uisu.ac.id

1. INTRODUCTION

Soil is one of the main elements in the construction of civil engineering buildings, one way is the construction of new toll roads where the CBR value must be known in advance for pavement planning. The CBR value is the ratio of the strength of the subgrade or other materials used to make standard aggregate material pavements (material standards).

In construction work, especially in the construction of toll roads, airport roads, or warehouse work floors, the carrying capacity of the soil plays an important role in the planning of the pavement to be built. If the strength of the soil soil is insufficient, there will be damage to the pavement. Therefore, by knowing the carrying capacity of the soil, the thickness of the road pavement components can be planned so that the road functions properly according to the planned design life.

To find out the value of the carrying capacity of the soil can be tested on the soil. In general, in planning road pavements, CBR (California Bearing Ratio) values are used. Where in determining the CBR value there are several methods, namely Field CBR testing (In situ), CBR Field Undisturbed (Undisturbed Soaken), CBR Laboratory, and DCP (Dynamic Cone Penetrometer).

The CBR value can be used as a basis for further road embankment planning, depending on the desired road class. The higher the CBR value, the better the subgrade. CBR testing can be done directly in the field, that isusing conventional methods, but it requires time and high costs, besides that it can also be done in the laboratory.

2. LITERATURE REVIEW.

2.1 Land

Soil is the basic material whose function is to support buildings and is very influential in a structure or construction in Civil Engineering work, be it building construction, bridges or road construction. If the soil supports the construction of a toll road, a good subgrade is required to lay the pavement sections placed on the subgrade. The strength and durability as well as the thickness of the road pavement construction layers are highly dependent on the properties and carrying capacity of the subgrade.

2.2 Soil Classification System.

Soil classification is a related science categorization well based on the characteristics that distinguish each type of soil. Soil classification describes the mechanical characteristics of the soil, also determines the quality of the soil for planning purposes as well as in the implementation of a construction.

The purpose of this soil classification is to estimate the physical properties of the soil by classifying the soil by class.

1. Soil classification based on grain size or texture.
2. Soil classification by USCS system.
3. Classification of land with the AASHTO system.

2.3 Soil Mechanical Properties.

Soil mechanical properties are a procedure for testing soil properties which are expressed as a percentage of total dry weight and can be determined by several tests.

1. Compaction (Compaction).

Soil compaction is an attempt to increase the density of the soil. The relationship between the unit weight of dry soil and the volume of wet and dry soil water is expressed by the following equation:

$$\gamma d = \gamma d / (1+w)$$

Where :

γd : dry unit weight (gr/cm3)
γs : wet density (gr/cm3)
w : water content (%)

2. California Bearing Ratio (CBR) test.

CBR (California Bearing Ratio) is the ratio between the penetration stress of a soil layer/material or pavement to the penetration stress of standard materials with the same depth and penetration speed (expressed in percent).

2.4 *Dynamic Cone Penetrometer*(DCP)

Testing with this DCP tool is basically the same as the Dynamic Cone Penetrometer (DCP), that is, they both look for the CBR value of a layer of soil directly in the field. It's just that the DCP tool is used to find out the original soil CBR value, while the DCP is only to get the strength of the embankment soil when making road bodies, this tool is used in earthworks because it is easy to move to all the points needed but the location of the layer being checked is not as deep as a soil inspection with sondir tool.

Based on research that has been done by previous researchers, many formulas for the relationship between DCP and CBR are described in the following formula:

$$\text{Log (CBR)} = a + b \log (DCP)$$ DCP

= Where :

DCP: value(mm/blow)

a. : constant value between 2.44 – 2.60
b. : constant value between 1.07 – 1.16

The above equation can be used for several types of soil, including granular, cohessive, aggregate base course, to piemond residual soil.

3. METHODS

The location for the thesis planning for laboratory CBR and DCP tests will be carried out at the Toll Road Section of Tebing Tinggi - Inderapura. Administratively, the project location for the Implementation of the Trans Sumatra Toll Road Section of Tebing Tinggi - Inderapura is located in North Sumatra Province. Implementation of the Tebing Tinggi - Inderapura Toll Road section in 4 zones with a total length of 20.4 km from the Tebing Tinggi - Inderapura Toll Road project starting from STA 86 + 250 to STA 106 + 650. This study used a set of DCP dynamic cone penetrometer tools.

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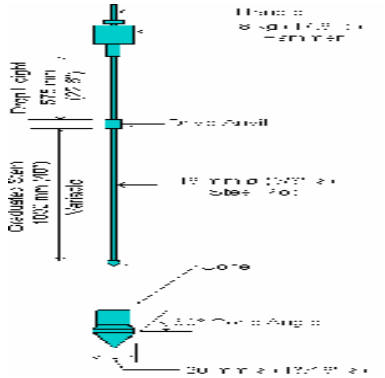

Figure 1. Dynamic Tool Drawing*Cone Penetrometer*

Data collection technique

1. Phase I: This data collection technique uses a set of Dynamic Cone Penetrometer (DCP) tools.
2. Phase II : For soil testing using a Dynamic Cone Penetrometer (DCP)
3. Stage III: This data collection technique uses laboratory CBR data that has been tested with a percentage of 0% and 16%.

Testing of Physical And Mechanical Properties

All tests are carried out according to predefined standard rules like this:

1. Atterberg Limits(ASTM D4318-84)
2. Granular Analysis (ASTMC136-46)
3. Standard Compaction (ASTM D698-78 And D558-82).

4. RESULTS AND DISCUSSION

Original Soil Condition

Prior to the DCP test, the soil samples prepared in this study were soil samples from the Tebing Tinggi - Inderapura STA Toll Road project. 104 + 975 – 105 + 025 + 025 Soil samples were taken from a depth of ±1m.

Table 1. Data on Soil Physical Properties Testing Results.

Unit Properties	Unit	Results
Specific Gravity (GS)		2,583
Liquid Limit (LL)	%	36.97
Plastic Limit (PL)	%	28,36
Plasticity Index (PI)	%	11.31
Sieve Analysis	%	71.45
Dry Fill Weight (γd max)	gr/cm^3	1.423
RateWater (W)	%	28.56

Classification of Land Based on Classification

As for based on the data system obtained from the soil physical properties test in the form of: Soil in the form of passing sieve No.200 = 71.45 % atterberg limits:

1. Liquid limit (LL) = 39.97 %
2. Plastic limit (PL) = 28.36 %
3. Plasticity index (PI) = 11.31 %

Soil Classification System Unified Soil Classification (USCS)

As for based on the data system obtained from the soil physical properties test in the form of: Soil in the form of passing sieve No.200 = 71.45 % atterberg limits:

1.Liquid limit (LL) = 39.97 %
2.Plastic limit (PL) = 28.36 %
3.Plasticity index (PI) = 11.31 %

Table 2. CBR 5 X 30 Stroke Test Results

	CBR value	
	0.1"	0.2"
ON	218.84 x 100 % 3 x 1000 = 7.29 %	342.78 x 100 % 3 x 1500 = 7.62 %

Table 3. 5 X 10 Stroke CBR Test Results

	CBR value	
	0.1"	0.2"
ON	155.95 x 100 % 3 x 1000 = 5.20 %	248.91 x 100 % 3 x 1500 = 5.53 %

Value CorrelationCbr Using Tools (Dynamic Cone Penetrometer)

From the data obtained from the DCP value taken is the average value of penetration per blow (mm/blow). From the existing DCP values, you can find the CBR value that occurs and conversely, the greater the DCP value (mm/blow), the smaller the CBR value obtained from several experiments by previous studies. The results of the field testing carried out were the DCP (Dynamic Cone Penetrometer) test at a predetermined point. Where the results of this test after being processed produce field CBR values.

Table 4. DCP STA 104 + 975 R2

Punch ulan	Reading (cm)	(mm)	Pentraction (cm)	CBR (%)	Hi x CBR(1/3)
0	0	0	0	0	
1	13.0	130.0	13.0	1.26	14.02
1	21.0	210.0	8.00	2.17	10.35
1	28.0	280.0	7.00	2.52	9.52
1	33.0	330.0	5.00	3.68	7.72
1	38.0	380.0	5.00	3.68	7.72
1	43.0	430.0	5.00	3.6	7.72
1	47.0	470.0	4.00	4.73	6.71
1	52.0	520.0	5.00	3.68	7.72
1	57.0	570.0	5.00	3.68	7.72
1	63.0	630.0	6.00	3.00	8.65

Table 5. Results of Laboratory CBR and DCP values

Location	CBR Laboratory	DCP TEST
STA 104+975	*8.02%*	*4.73*
STA 105+000	*7.29%*	*6.53*
STA 105+025	*5.20%*	*3.68*

5. CONCLUSION

From the research that has been done it can be concluded that onconstruction of the Trans Sumatra toll road at STA. 104 + 975 – 105 + 025 has a good moisture content. From the research that has been done it can be concluded that onconstruction of the Trans Sumatra Toll Road at STA. 104 + 975 – 105 + 025 + 025. It is classified as clay, because it has a very high water content. CBR values using the DCP test were 4.73, 10.31, 3.68 while laboratory CBR values were obtained from samples of 8.02%, 7.29%, 5.20%. From the analysis carried out, the CBR and DCP values are not much different from the laboratory CBR values.

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