WET UNIT WEIGHT AND MOISTURE CONTENT RELATIONSHIP FOR NATURAL CLAY DEPOSITS IN HOUSTON-TEXAS

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Abstract: In this study, relationship between the wet unit weight and moisture content for natural deposits of CL and CH soils in Houston, Texas, was investigated. A total of 381 CH soil and 300 CL soil data were used in the analyses. Also, a linear relationship between unit weight and moisture content was developed.

1 Introduction

The in-situ soil unit weight and moisture content are two of the important properties needed for any civil engineering project. Except in the active zone, the in-situ unit weight and moisture content of soil is greatly influenced by the geology (Ganji, 2006). Density is measured at field based on the ASTM D4564-93(ASTM, 2002). But, measuring the volume of the soil is inconsistent when it contains high moistures (Vipulanandan et al., 2007). The theoretical relationship between unit weight (γ) and moisture content (w) can be represented as follows.

$$\gamma = \frac{(1+w)G_s\gamma_w}{(1+\frac{wG_s}{S})} \qquad \text{..... (1)}$$

Where, S is the degree of saturation and G_s is the specific gravity of solid

2 Objectives

The primary objective was to determine the correlation between wet unit weight and moisture content of natural deposit of CH and CL soils in Houston, Texas.

3 Database

A total of 381 CH soil and 300 CL soil data obtained from the CIGMAT-UH, Geotechnical data base was used in the analysis. The statistical analyses of the data are summarized in Table 1.

Table1. Statistical analysis on geotechnical properties of the selected data

Parameters	CL soil		CH soil	
	Moisture content (w) %	Unit weight (γ) pcf	Moisture content (w) %	Unit weight (γ) pcf
Mean ($\bar{x}$)	18.0	126.9	25.7	119.9
Std. deviation (σ)	4.6	5.4	7.0	6.3
COV	0.3	0.04	0.27	0.05
Variance (σ^2)	21.3	29.2	48.8	39.2
Range	5.0 -34.0	103.0---140.0	13.0---51.0	97.0---136.0

(a) CL Soils: Based on the 300 data, unit weight of the CL soils varied from 103 to 140 pcf with a standard deviation of 5.4 pcf. The COV was 0.04. Also, moisture content varied from 5 to 34 % with a standard deviation of 4.6% and COV of 0.3 (Table 1). Hence, based on the COV, moisture content showed large variation than unit weight.

(b) CH Soils: Based on the 381 data, unit weight of the CH soils varied from 97 to 136 pcf with a standard deviation of 6.3 pcf and COV of 0.05. The moisture content varied from 13 to 51 % with a standard deviation of 7.0 % and COV of 0.27 (Table 1). Hence, based on the COV, moisture content showed large variation than unit weight.

4 Analyses and Discussion

The Eq. (1) was used to predict the theoretical relationship between wet unit weight(γ) and moisture content (w) at fully saturated condition (S=1), with assumed specific gravity of 2.65 for CL and CH soils in Houston, Texas.

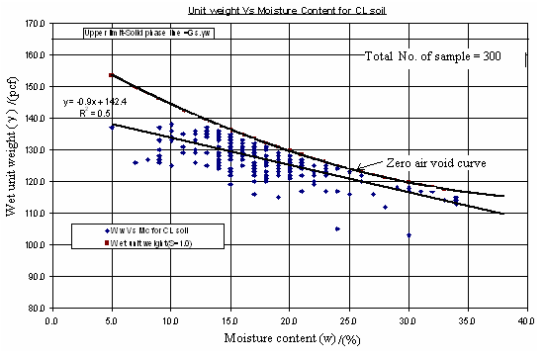

Fig.1 Variation of unit weight with moisture content for CL soil

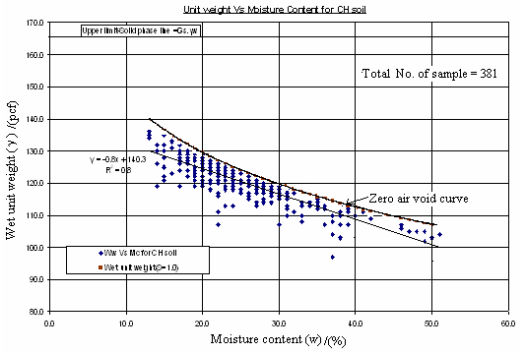

Fig.2 Variation of unit weight with moisture content for CL soil

The linear least square fit of the data below the theoretical curve (zero void curves) give the following relationships.

For CL soil (Fig. 1) $\gamma = -0.9\ w + 142.4$……..$R = 0.71$, $(05 < w < 35)$ …….. (2)

For CH soil (Fig. 2) $\gamma = -0.8\ w + 140.3$..... $R = 0.89$, $(12 < w < 50)$ ……. (3)

5 Conclusions

Relationship between wet unit weight and moisture content for natural clay deposits of CL and CH clays in Houston, Texas, was developed. Based on the COV, the moisture content of the natural clays showed greater variation than unit weights.

6 Acknowledgement

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7 References

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