Properties of Houston Area Clay Soils

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Abstract
In this study, variation of liquid limit, plasticity index and the undrained shear strength of CL and CH soils with depth up to about 80 feet depth was analyzed along interstate highway I-10 in West Houston. Depth based analysis was done to determine the effect of two geological formations in the area.

1. Introduction

When performing laboratory tests to determine the soil properties, it is critical to understand the geology of the area to better interpret the test results. There are two geological formations in the Houston, Texas area and these are known as Beaumont and Montgomery formations. Beaumont formation is the recent of the two formations and the depth of the soil in this formation in the Houston area could be up to 40 feet [1]. There are numerous property correlations for clayey soils based on the index and strength properties. Hence, it was of interest to investigate the effect of depth on the soil properties in the Houston soils.

2. Objective

To investigate the variation of liquid limit, plasticity index and shear strength of CL and CH soils along Highway I-10 in West Houston, Texas with respect to depth. Also to determine the effect of the two geological formations on the geotechnical properties that are being investigated.

3. Results and Analyses

The database GEOTECH-TX currently being developed was mined to get the data up to 80 ft at 10 ft intervals and the average property for each 10 ft class interval was determined.

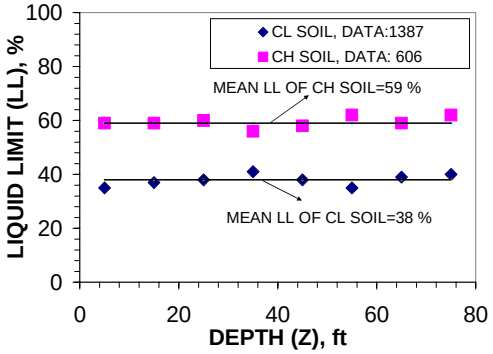

Fig 1. Liquid Limit Vs Depth along Highway I-10 in West Houston

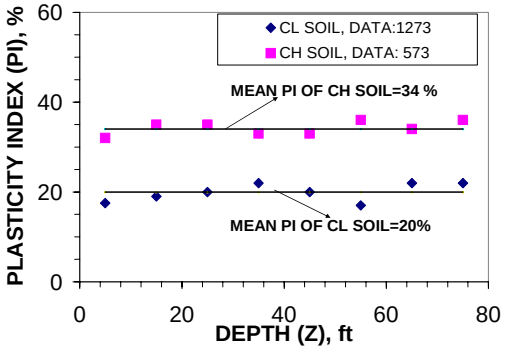

Fig 2. Plasticity Index Vs Depth along Highway I-10 in West Houston

Liquid Limit (LL) Vs. Depth (Z): Total of 1387 and 606 data on CL and CH soil were used in the analyses. The variation of average liquid limit with depth is shown in Fig. 1.

The average value of the LL was 38 % and 59 % with a standard deviation of 2.17 and 2.0 a coefficient of variation (COV) of 5.7 % and 3.4% for CL and CH soil respectively. It can be observed that the average LL was almost independent of the depth. Hence the two geological formations didn't affect the LL of CL and CH soils.

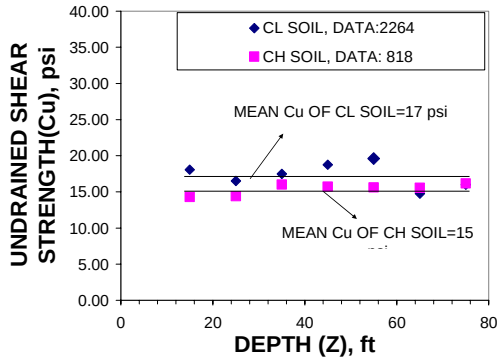

Fig. 3. Undrained Shear Strength Vs. Depth along Highway I-10 sec of West Houston (z >10')

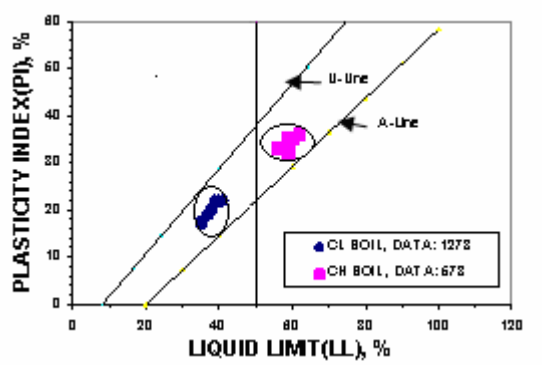

Fig. 4. PI Vs LL of CL and CH soil along Highway I-10 in West Houston

Plasticity Index (PI) Vs. Depth (Z): Total of 1273 and 573 data of CL and CH soil were used in the analysis. The variation of average plasticity index with depth is shown in Fig. 2. The average value of the PI was 20 % and 34 % with a standard deviation of 2.0 and 1.5 a coefficient of variation (COV) of 10 % and 4.3% for CL and CH soil respectively. It can be observed that the average PI was almost independent of the depth. Hence the two geological formations didn't affect the PI of CL and CH soils.

Undrained Shear Strength (Cu) Vs. Depth (Z>10'): Total of 2264 and 818 data of CL and CH soil were used in the analysis. The variation of undrained shear strength with depth is shown.0 in Fig. 3. It can be observed that the average Cu was almost independent of the depth. The average value of the Cu was 17 psi and 15 psi with a standard deviation of 1.67 and 0.75 a coefficient of variation (COV) of 9.6 % and 4.9 % for CL and CH soil respectively. Hence the two geological formations didn't affect the PI of CL and CH soils.

Distribution of CL and CH soil based on data of LL and PI:

A Casagrande's Plasticity Chart [2] was developed to show the typical values of LL and PI for CL and CH soils of Highway I-10 Houston Data was shown in Fig. 4. From the plot, the distribution of CL soil and CH soils of Highway I-10 were shown in circles.

4. Conclusions

Along Highway- I-10 section, liquid limit, plasticity index was independent of depth. Undrained shear strength was independent of the depth after 10 ft.

5. Acknowledgement

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6. References

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2. Holtz, R. D., and Kovacs, W. D. (1981), "An Introduction to Geotechnical Engineering." *Pentice Hall*, New Jersey, 49-54.