Comparison of Strength Properties of Artificial Soils and Houston Clayey Soils

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Abstract: In this study, relations between strength and index properties of artificial soil mixes are investigated to represent the natural CH and CL clayey soils in Houston. Property correlations between maximum undrained shear strength and plasticity index of artificial soil was investigated.

1 Introduction

In order to study the effects of various soil constituents on the strength and index properties of Houston area clay soils, artificial soil mixes must be developed to perform control studies. Based on the liquid limirt (LL) and plasticity index (PI) values, Houston CH and CL type clayey soils were simulated with artificial soil mixes (Fig 1&2). The relationship between undrained shear strength (S_u) and index properties are reported in the literature (Duncan (2005), and Ganji (2006)). Also using the remolded marine clay soils, samples were prepared at 0.5*LL % of moisture content, relationship between S_u with LL was determined by Dennehy, in1978.

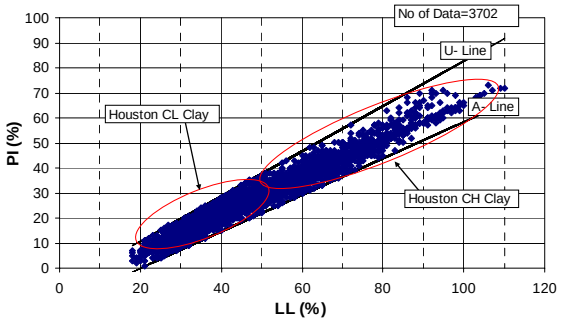

Fig 1. Houston CH and CL type clay soils

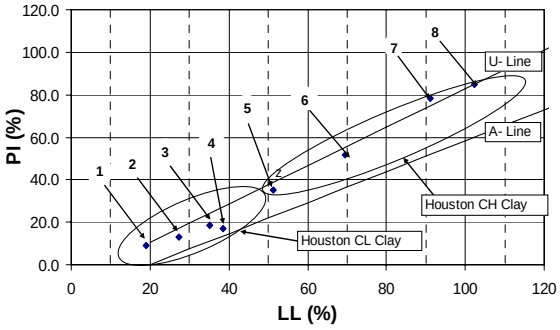

Fig 2. Artificial soil mix which represent the Houston soil
(1-K30S70, 2-K50S50, 3-K70S30, 4-B10S90, 5-B10K40S50, 6-B15K35S50, 7-B20K30S50, and 8-B20S80)

2 Objectives

The objective of the study was to compare the strength properties of CL and CH soils in Houston-Texas, with artificial soils and remolded soils with similar index properties.

3 Methods and Materials

Commercially available kaolinite and bentonite were used in preparing the sandy clay samples. Based on the ASTM standards, compaction, moisture content, unconfined compression (UCC), and Atterberg limits tests were performed to determine the geotechnical and strength properties of the selected artificial soil mixes. CIGMAT soil database and literature by Dennehy (1978) were used for Houston clay soil data and remolded soil data respectively.

4 Results and Analysis

Correlation between undrained shear strength (S_u) and PI was investigated for artificial soil and Houston soil. The variation of S_u with PI was represented by an exponential relation (Fig 3). The

maximum undrained shear strength ($S_{u/max}$) correlation developed for the artificial soil over predicted 90% of the field data (Fig 4). Also, the S_u-PI correlation predicted for marine clay soils at 0.5*LL % of moisture content over predicted only 17 % of field data of Houston CH and CL Soils (Fig 4). Almost 73 % of field data were bounded by both the artificial soil and remolded marine clay soil relationships presented in the equations (1) and (2).

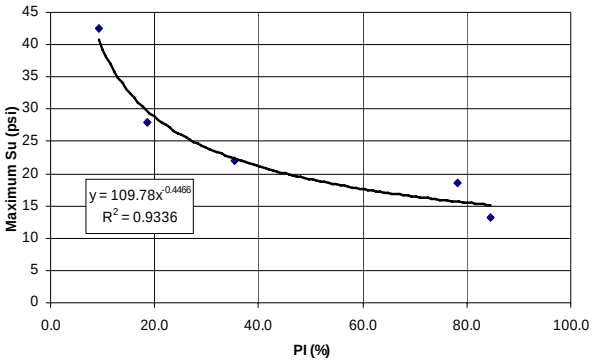

Fig 3. $S_{u/max}$ Vs PI for Artificial soil mixes

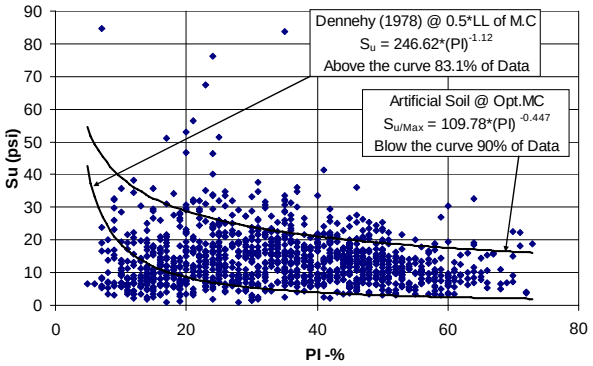

Fig 4. Experimentally predicted $S_{u/max}$-PI curve plotted on the field data

-Artificial soil

$$S_{u/Max} = 109.78*(PI)^{-0.447} \quad \text{(At optimum moisture content)} \quad (1)$$

Remolded marine clay (Dennehy, 1978)

$$S_u = 246.62*(PI)^{-1.12} \quad \text{(At 0.5*LL \% of moisture content)} \quad (2)$$

5 Conclusions

A set of artificial clayey soil mixes were prepared using commercially available kaolinite, bentonites, and sand to represent the CH and CL type of soils based on their index properties. The maximum undrained shear strength ($S_{u/max}$) correlation developed for the artificial soil over predicted 90 % the field data while the remolded marine clay soil prepared at 0.5*LL over predicted 17 % the field data.

6 Acknowledgement

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7 References

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