Laboratory testing of the cohesive soils and the correlation between the resisting characteristics of soils and their physical parameters

Des essais en laboratoire des sols cohésive et de la corrélation entre les caractéristiques de résistance des sols et de leurs paramètres physiques

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ABSTRACT

In Albania are present many serious phenomena's as movement of terrains, landslides, slopes instability ect. All this problems are tied with the shear strength of soils. In this paper we would like to present a part of our study that determines the resisting characteristics of cohesive soils by different methods in laboratory. Also we would like to establish relations between resisting characteristics of soil determined by different methods and their correlation with physical and mechanical parameters of soil.

RÉSUMÉ

En Albanie, sont présents un grand nombre de graves phénomènes de mouvement de terrain, glissements de terrain, l'instabilité des pentes, etc. Tous ces problèmes sont liés à la résistance au cisaillement des sols. Dans ce papier, nous voudrions vous présenter une partie de notre étude qui détermine les caractéristiques de résistance à la cohésive sols par des méthodes différentes en laboratoire. Aussi nous tenons à établir des relations entre les caractéristiques de la résistance au cisaillement des sols déterminé par différentes méthodes et leur corrélation avec les paramètres physiques et mécaniques des sols.

Keywords: Shear strength, Cohesion, Physical parameters, Correlation.

1 INTRODUCTION

Every year in Albania are present sliding masses of different quantities and slope instability which are provoked from natural conditions, or by human activity. In the other part impetuous construction of highway particularly in mountain zones, has caused, in many cases destruction of natural equilibrium. Except this it happened because there isn't enough knowledge about shear strength of soils and for the factors which influence in their value. For this reason we have realized this study were we would like to present the different factors that have influenced the shear strength of cohesive soils and the different correlation between resisting and physical parameters of soils.

2 THE USED METHODS

In AlTEAs laboratory and in the Geotechnical laboratory of Civil Engineering Faculty we have made over 50 tests to determine the shear strength of cohesive soils. The undisturbed samples are tested by ASTM normative in: direct shear apparatus, triaxial apparatus, unconfined compression apparatus. All tests are realized with samples of first quality by EC-7. From this study we have reached some conclusions about the dependence of the shear strength with the physical parameters of soils, their bearing capacity, modulus of deformation ect. Finally we found some correlation between cohesion of soils determined by different methods.

3 RESULTS OF TESTS

The results of the tests are expressed in graphical mode, in different relations. The relations that we found are between the friction angle Φ and the physical parameters as:

e-void ratio

LL-liquid limit

PI-plasticity index

γ_d-dry density

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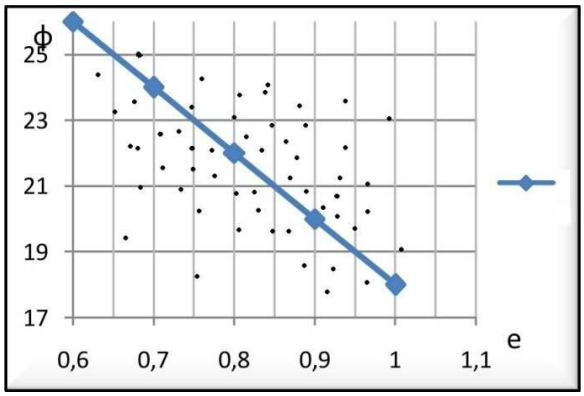
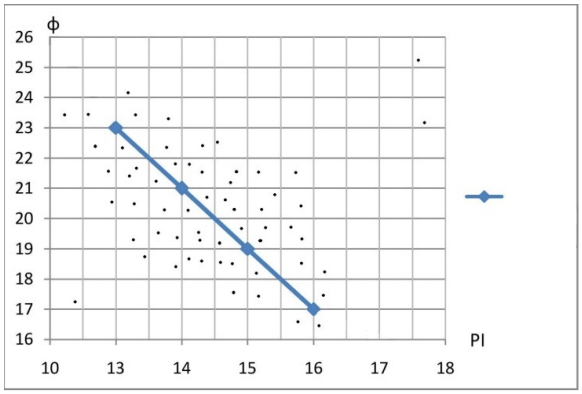
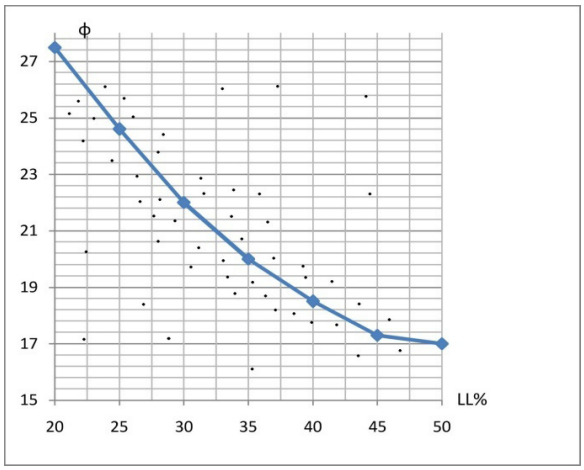


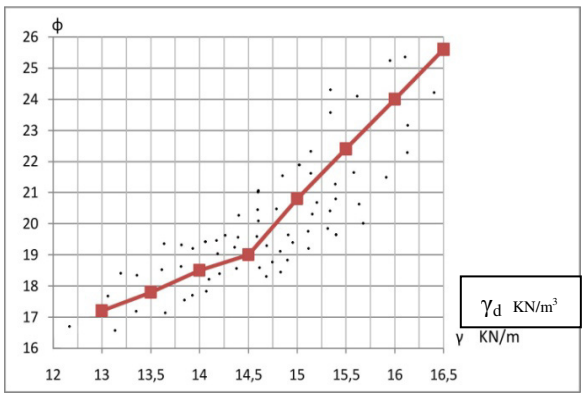
(Fig.1) Relation between Φ-e



(Fig.2) Relation between Φ-PI

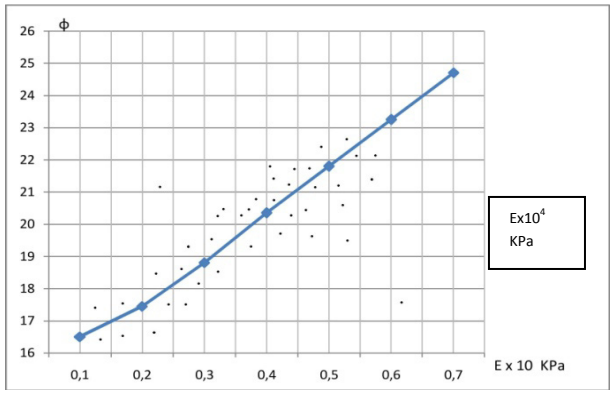


(Fig.3) Relation between Φ-LL (is valuable for PI=1 to 17)

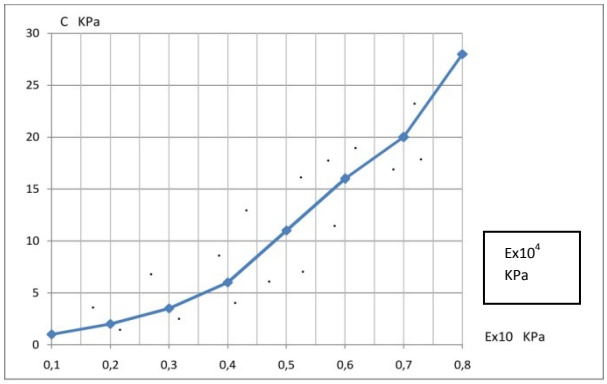


(Fig.4) Relation between Φ- γ_d

We have found the relation between friction angles Φ and the cohesion-C with modulus of deformation-E.



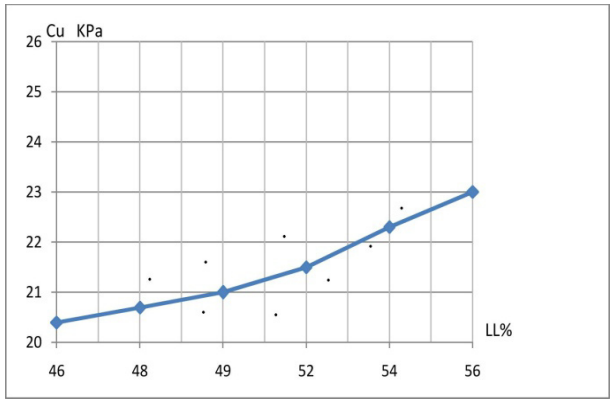
(Fig.5) Retion between Φ-E



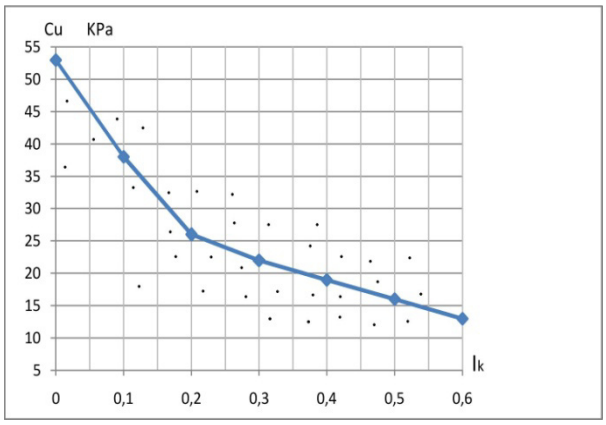
(Fig.6) Relation between C-E

Also we have found some relations between Cu determined in unconfined compression apparatus, and physical parameters: liquid limit-LL, consistency index I_K, and bearing capacity of soil R.

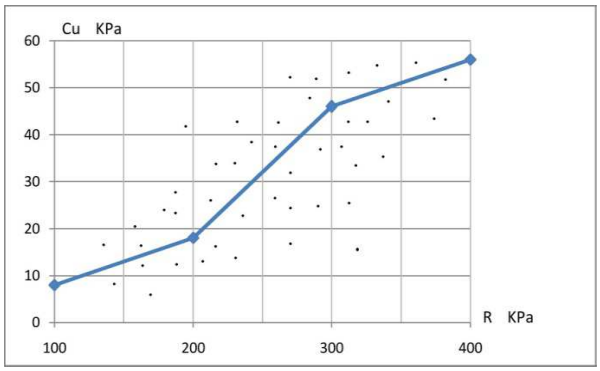
I_K= W-PL / LL-PL



(Fig.7) Relation between Cu-LL



(Fig.8) Relation between Cu-I_K



(Fig.9) Relation between Cu-R

Finally we had the opportunity to establish some correlation between the value of the cohesion determined by three methods.

C-in direct shear apparatus

Cuu-in triaxial apparatus by test UU

Cu-in unconfined compression apparatus

C≈Cuu (0.41—0.9)

C≈Cu (0.46—0.94)

Cuu/Cu≈0.9—1.2

After the statistical elaboration of the results we reached this correlations:

C≈0.608 Cuu

C≈0.624 Cu

Cuu≈1.12 Cu

4 CONCLUSIONS

The shear strength of the cohesive soils with PI=**7—17** have good correlation with physical parameters. We have determined the following correlations:

$\Phi \approx 26^0$- (e-0.6)*20

$\Phi \approx 25^0$- (PI-12)*2

$\Phi \approx 16^0 + (\gamma_d - 12)*1.23$ until γ_d =14.5 KN/m^3

$\Phi \approx 16^0 + (\gamma_d - 13.5)*3.2$ for γ_d=(14.5—16.5) KN/m^3

$\Phi \approx 16^0 + (E-0.1x10^4)*14.5$ E is expressed in Kpa

Cu≈20.4+ (LL-46)*0.18 for the soils with PI>17

Cu≈50-I_K*140 for the soils with I_K=0 —0.2

Cu≈25-(I_K-0.2)*30 for the soils with I_K=0.2—0.6

Cu≈ (0.084—0.14) R

In case of the preliminary geotechnical studies can be used this correlations to create approximately the geotechnical model and to do the preliminary calculation.

REFERENCES

Atkinson, J. 1997. *An introduction to the mechanics of soils and foundations*. London: Mc Graw-Hill.
In text: (Atkinson 1997)
Bozo, L. 2007. *Geotechnics I, Soil Mechanics*. Tirana: Printing Natyra.
In text: (Bozo 2007)
Sobolevsky, D. 1995. *Strength of dilating soil and load-holding capacity of deep foundation*. Rotterdam:A.A.Balkema.
In text: (Sobolevsky 1995)