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# WATER EFFECT ON CHANGE OF SHEAR RESISTENCE PARAMETERS OF WORKING MEDIA

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## ABSTRACT

This Papers considers the problem of water effect on change of shear resistence parametars of working media. Learning had been geathered through many years investigations on studying the problem of shear charasteristic change of neogene and deluvial clay deposits under moisture content change conditions.

## QUANTITY DETERMINATIONS OF WATER CONTENT CHANGING EFFECT IN SOIL ON SHEARING RESISTANCE PARAMETERS

In order to make corellation between the water content and change of shear charasteristics $\varphi = f(W\%)$ and $c = f(W\%)$, many experimental researchies on different layers were done by numerous authors N.N.Maslov,1963 N.S.Mirjukov,1975,A.M.Rizov, 1976,T.Todorović,1983,1984.etc. All these authors researches shows that the influence degree of moisture change is stipulated by sort of soil and its mineral petrograf compossition,construction,porosity type,compactness,consolidation degree.The mentioned investigations and investigations of this Paper author, are consented

in fact that the effect of water content increasing on shear parametars is experessived at weakly consolidated (or nonconsolidated) than at normaly consolidated and overconsolidated deposit.

This Paper considers the problem of water effect on shear resistence parameters of working media. In order to solve the mentioned problem, many authors have done a lot of investigations studying the change on shear chacasterics of neogene and deluvial clay deposits in water content varying conditions.

One of the pure problem at strenght testings of working media is representativity of tested soil samples, used methodoloqy and shearing test conditions as well. The results, gained by shear testings are not in agreement with real and competent values for the examinated rock mass, because of joint and features existance in it. In this case as a logical consequence of heterogenisity and laboratory examinations on "small" samples, the results scattering comes on. At "small" samples examinations even the smallest feature practically cuts the sample, making predominating shear direction. So that the competantive shear parameters are not provided for the rock mass in whole. Because of that it is necessery to provide enough representative soil samples, in order to accept the competent shear resistance parameters for rock mass in whole applying the engineers reason and experience. Influence of water content change degree of shear parameters will have the different effects in statyc and dynamic conditions, especially in case of sensitive (tyxotropical) soil, and soil liable to liquifaction and plastic liquidity at dynamic overloadings. Solving this problems requests reoloqical treatment, shear testings in dynamic conditions, determination of water force filtration on strenght shange and so on.

Our researches are limited on statyc conditions of water destruction in soil on shearing parameters at neogene clay-marl depositis of open cast working media. Gined results are compared with allready known data from deluvial clay deposits examinations (T.Todorović,1983,1984, Lit. 3 and 4) with adequate interpretation.

## TESTING RESULTS

Geomechanical laboratory researshes of shearing test at varying moisture content, performed on 102 samples from neogene clay layers from opencast location "Kolubara" in Yugoslavia. Such a numerous testing inable us to make corelation between moisture content and shear resistence parameters. By computerising of these data using the matematical approachment of polynome trent analyse, functional connection are found out as follows.

$$\varphi = f(W\%) \quad i \quad c = f(W\%)$$

The 6 th. degree polynome forms make functional connections are as follows.

$$\varphi = 13.95 + 3.99W - 0.396W^2 - 0.058W^3 + 0.0099W^4 - 0.0005W^5 + 0.0000083W^6$$

correlation coefficient 0.9998

$$c = 59.79 + 11.91W - 0.646W^2 - 0.662W^3 + 0.097W^4 - 0.0053W^5 + 0.0001W^6$$

correlation coefficient 0.9994

Fig. 1 - testing results and graphycal presentation of limit and medium functional connection values $\varphi$-W, on the fig. 2 the testing data and graphycal presentation of the function c-W are shown.

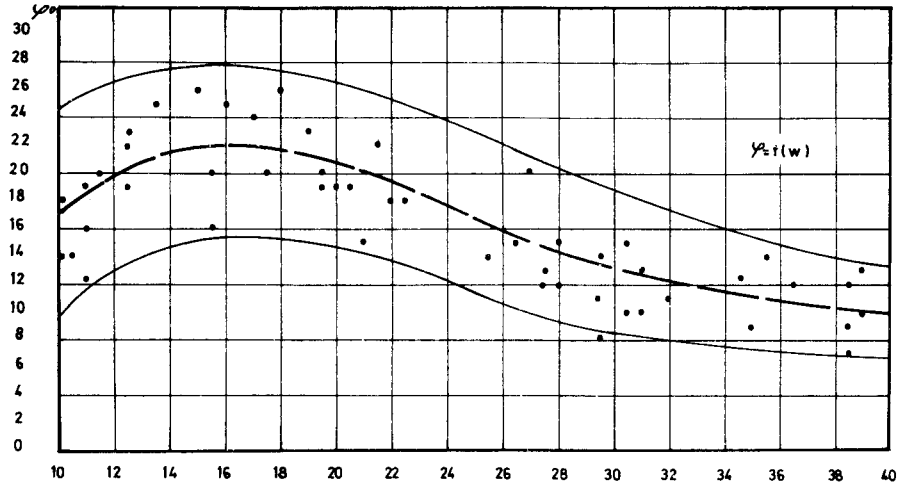


Fig. 1 - Graphycal illustration of restituted correlation connection $\varphi$-W

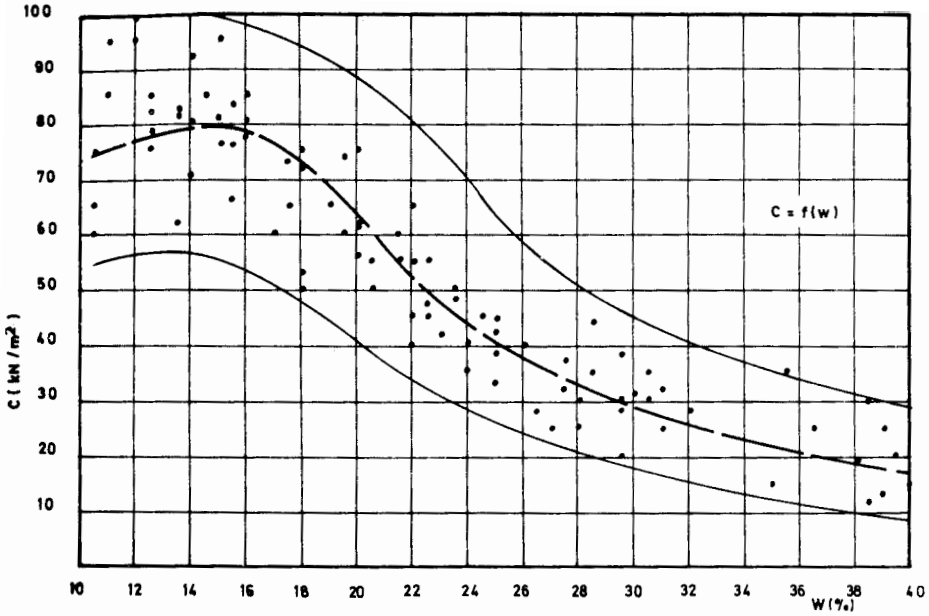


Fig. 2 - Correlation connestion c-W graphyc illustration

In his studies T.Todorović,1983,1984 lit. 3 and 4 detailed treats deluvial clay deposits properties from the same region. By geomechanical laboratory testings on 124 soil samples and mathematical treatment experimentally qained results and using the polynome trent analyse, he restitutes with high percent of eccuracy (K= 99,5%) functional connection between = f (W) and c = f (W). He compares the qained results with the results of N.N.Maslov for the same qenetic media and concluses the slight differences, no matter of their origin difference. Beside that he resumes the following: "Shear resistivity at the optimum water content is more for about 3 times from this one gained with complet water saturation at soil failure. Deluval clay deposits behaviour is very simmilar in the sense of shearing resistance either in cast of constence differenes or their origin. However the specivity for those deposits is their geneze, which characterize their forming (in a way) and predominates their physical properties".

Expirience up to now show us, that the greatest problems of terrain stability, and at the same time the surface open cast, are connected for deluvial and neogene clay deposists under the hydrogeological regime circumstances, that is soil satuaration. Essentional reasons are in change of stresses and soil properties coused by hydrostatic and hydrodynamic groundwater acting to stress state change. It means - the decreasing of shear resistivity of those deposits in saturation conditions.

Fig. - 3 and 4 are presented the paralel changement of internal friction and cohesion in depedance of percent of moisture content at neogene clay deposits (graphyc N°I) and deluvial clay (graphyc N°II).

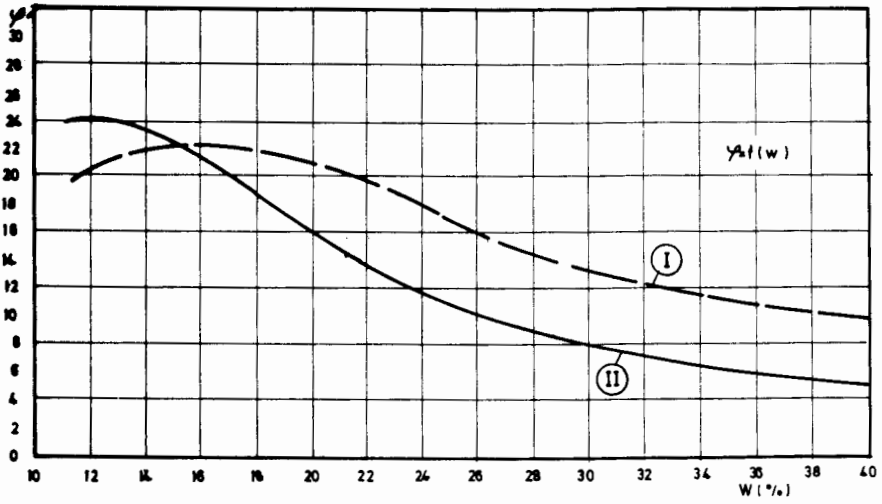


Fig. 3 - The internal friction shange in dependance of moisture content

I Neogene clay deposits
II Deluvial clay deposits

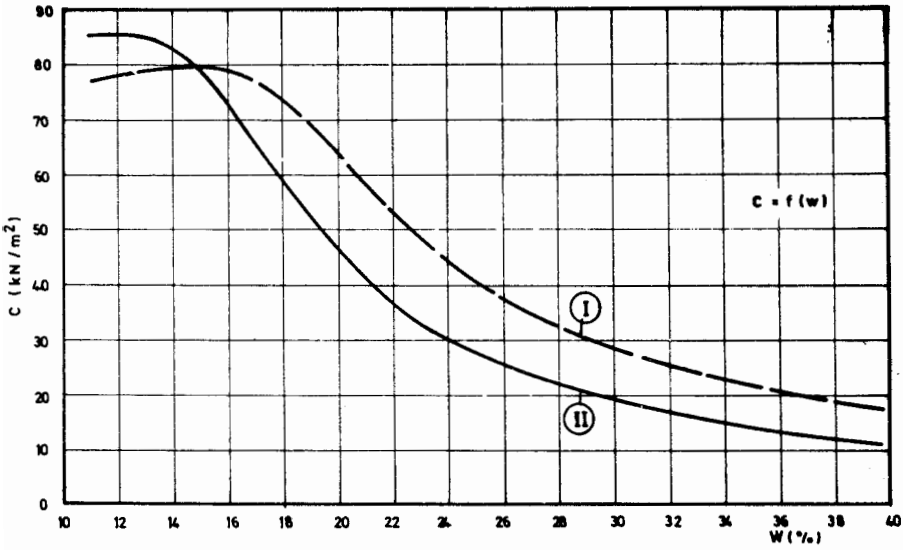


Fig. 4 - Cohesion change in dependance of water content

I Neogene clay deposits
II Deluvial clay deposits

On the base of numerous experimentally geomechacial laboratory perfomed investigations from the large Belgrade and Lazarevac region and the restituded functional connection (by using matematical process of polynome trent analyse) between shear parameters and moisture content (fig.1,2.3,4) the folowing sould be resumed:

- maximum values of shearing parameters are reached at optimum water content: at neogene clay deposits W = 13% - 20% and at deluvial clay deposits W = 11% - 17%, the chear strenght degreesing and tranformation to the residual stress level in both cases is with moisture content more W 30%.
- effect of moisture content change on shear parameters is more expressed at younger and nonconsolidated deluvial deposits, than at normal consolidated (or overconsolidated) neogen clay - marl deposits (fig. 3 and 4).

- Shear parametres (gained at low moisture content values W = = 10% - 12%) shows lower values. This fact can be interpreted that, becouse of soil sample dehydration caused by failing of cohesive connection (especially at plastic soil) happen to form joints and features which practically cut the "small" sample, and at the same time represent predominate shear direction. Here is the explanation for qained unreal low values of shear parameters and results scattering as well. Real values of competent shear parameters in such cases are like that, if they reffere on really restituted discontinuities in rock mass, when shear parameters in some way reflect residual sheare strenght. From this reason accepting competentive parametars values is necessery, beside gained laborary results, to study the compossition and structure (especially feature systems) of rock mass in whole. As absolutelly homogenity in soil cann't be expected at all, it may be only discussed about comperative regions and physical charasteristiss varriations which are analysing at rock massive in whole. In accordance with definition: "Competentive physical spans represent this competentive value which characterise rock mass in whole, in context of defini te problem consideration". (T.Todorović, 1983).

- The gained application results on the same genetic media from other areas, are real and possible, only in case if there exist the compossition similarity the degree of compaction permeability and other physical, mechanical and structural characteristics. The aim of this Paper is to point on shear strenght changement at treated deposits in dependance on humidity, and the same time to show on the open cast slope stability and waste rock deposition with hidrogeological regime of water-table level oscillation changements and on bearing capacity and object foundation problems in such conditions.

## CONCLUSIONS

- With incereasing or decreasing of moisture content at neogene and deluvial clay deposits reffering on their optimal values, shear parametars values decrease (Fig. 3 and 4).

- The degree of influence of moisture content shange shear parametres is conditioned by soil sort and geneze, mineral and petrograph composition, construction, porosity type, compaction or consolidation degree, permeability and its plastyc properties, as well. In dependance on statycal and dynamical loadings (performing the shear tests in dynamic loading conditions) those influences can be more or less, forming a new problem which surpresses the range of this work.

- The aurhors of this Paper, through the results presentation, want to point on shear parameter change problem in moisture content function and on slope stability of bearing capacity and object foundation problems as well, what is frequent problem in commplex hydrogeological conditions in mines with open cast exploatation.

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