

VOLUME CHANGES OF HEAVY SOILS OF EAST SLOVAKIAN LOWLAND

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Introduction

Volume changes of heavy soils when shrinking and swelling are significant processes because they are accompanied with soil surface decreasing and cracks formation. Predominantly, formation and dynamics of cracks have an important impact on transport processes in heavy soils and consequently on their water regime. East Slovakian lowland (ESL) belongs to the most important regions of Slovakia from the point of view of heavy soils occurrence. 45% of entire soil survey of ESL belongs to heavy soils. Relatively small attention has been paid to heavy soils volume changes of the region up to now. Results of heavy soils changes laboratory analysis of six locations of East Slovakian Lowland characterised by different particle size distribution, namely content of I. category particles (from 23% to 89%), are introduced in the presented study.

The study presented follows up the knowledge of volume changes of loam-clayey soils depending on their water content (Murray, Quirk, 1980; Chan, 1982; McGary, 1988), their shrinking under the natural conditions (Bronswijk, 1990) of the methods of volume change determination in intact soil clods and intact soil samples removed to metal containers of cylindrical shape (Bronswijk et al., 1990; Crescimanno et al., 1995; Bronswijk, 1998; Hoogmoed, Bouma, 1980), about analytical expressions of shrinking characteristics of the loam-clay soils (Crescimanno, Provenzano, 1999; McGarry, Daniels, 1987) and it contains the results gained from the study of the volume changes loam-clay soils of the of East Slovakian Lowland

Materials and methods

Methods were based on taking away of intact soil samples of the defined amount from the chosen soil horizons and locations of East Slovakian Lowland and consequential measuring and analysis their volume and water content changes under the process of their drying under the laboratory conditions.

The samples taking away were done at four locations. They are the following: Senné, Michalovce, Vysoká and Somotor. The soil samples were taken away in the layers of 10 cm down to the depth of 0.8 m except for the location Vysoká, where concerning the homogeneity of sandy sub-topsoil layers, the sample taking away was stopped at the depth of 0.6 m. Three soil cylinders were taken away from every layer using the Kopecký method. Altogether 90 soil cylinders at 30 soil horizons were taken away. Concurrently, soil samples for the particle size distribution analysis were taken away as well.

The soil samples were being saturated to the water field capacity (WFC) and consecutively they were exposed to the conditions of drying. During the drying, the changes of their weights and geometric dimensions were measured at certain time intervals. The geometric dimensions of the dried soil samples or soil peds were twice measured at upper and lower sides at two perpendicular directions. The height of the original peds was measured at the first phase of drying in two opposite points (because of the reduction of the risk of their damage) and at the next phases it was done in three opposite points. Time intervals were chosen according to the dimension intensity and weight changes. The soil samples were weighed every half an hour during initial stages of drying when it was not physically possible to take the samples out of the cylinders. The whole process of drying was ended when the differences of measured values between two measurements were approximating to the estimated measurement mistake and were oscillating around the mean value of the minimum volume and water content values. The overall time of drying of the samples took thirty and a half an hour. The above mentioned

method was used for all 90 experimental soil samples. For the purpose of documentation, the results gained for five soil horizons are chosen from the voluminous data file in a way to characterise the whole file of analysed samples from the point of view of the particle size distribution (Tall, 2005). The content of the I. cat. particles and the content of I.fr. within it were the criteria of the choice. The content of I. fr. namely the physical clay has the principal influence on the volume changes of the soil when there are the changes of its water content. Processing of the time course of the volume changes and water content changes in samples with different particle size distribution during drying was the focus of analysis of results reached by soil samples drying.

Result an discussion

The aim of the analysis was to study the dependence between the soil volume, particle size distribution and the bulk water content as well as to quantify them and to find an appropriate analytical expression. The analytical expression is used to calculate the bulk situation of the soil functional expression of the soil volume change during drying in comparison to its maximum volume on the basis of information on the soil particle size distribution and its water content.

Results of the experimental research of the volume changes depending on the water content and the particle size distribution are graphically displayed in fig. 1, 2 and 3.

Conclusion

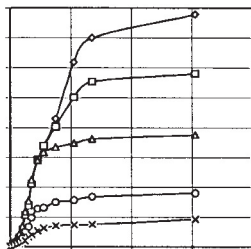
The study presents results of quantification of volume changes of heavy soils based on laboratory measurements of size of their samples (the total of 90 samples) exposed to conditions of drying during 30 and a half of an hour. The obtained data files concerning the changes of their bulk were consecutively used for evaluation of:

The course of volume changes of soils with the different particle size distribution during drying, fig. 1

Volume changes of soils with different water contents and with different content of I. fraction or I. cat., fig. 2

The course of volume changes of soils with the different particle size distribution depending on their water content, fig. 3

The presented results show clearly that volume changes are possible to quantify depending on different soil characteristics.



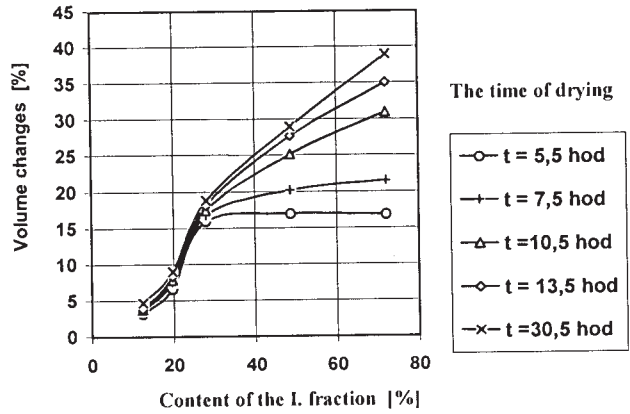


Fig. 2. The course of the volume changes of the soils with the different particle size distribution during drying depending on the bulk water content. Differences at individual levels of l. fraction content are obvious.

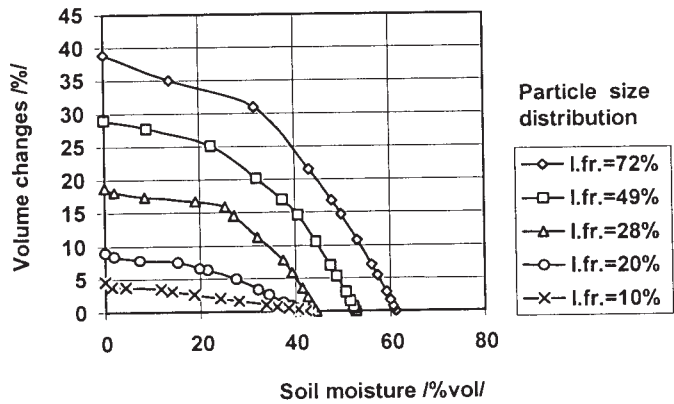


Fig. 3. The soil volume changes at different water contents (bulk water content 0 is expressed by the time of drying) with the different content of particles of l. fraction.

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