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Features of Geotechnical Surveys in Areas of Swelling Soil Propagation

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ABSTRACT: The article considers swelling of soils that depend on the mineral, particle size and chemical composition of the soil, natural humidity and density of addition, composition and concentration of the solution interacting with the soil. The values of external pressure on the soil, and it is established that swelling occurs usually with a content of clay particles - in an amount of more than 40 - 60%, density - more than 1.5 - 1.7 g/cm^3, humidity - less than 0.20 - 0.30.

KEYWORDS: external pressure, swelling, granulometric composition, natural humidity, addition densities, mineralogical composition, swelling deformations.

I. INTRODUCTION

The specific ability of swelling clays is that when interacting with water and aqueous solutions, the volume of soil increases and its strength properties change. This reduces the resistance of soils to deformation during engineering action. Soil that increases its volume when soaked with water and has a relative swelling deformation of $\alpha_{sw} \geqslant 0.04$ (under conditions of free swelling) or develops a swelling pressure (under conditions of limited swelling) refers to swelling soils.

II.RELETED WORK

Clayey soils are subdivided according to Table by relative deformation of swelling without load αsw [1].

Table 1.

Varieties of clay soils	**Relative deformation of swelling without load ε_{sw},**
Not swellable	< 0,04
Slightly swellable	0,04...0,08
Medium swellable	0,08...0,12
Highly swellable	*> 0,12*

Swelling soils are characterized by a number of general features and features. These are high dispersion and ductility, montmorillonite-hydrolactic composition, non-water-resistant nature of structural bonds, significant compaction and hardening in a dry state, the presence of shrinkage cracks (0.1 to 15 cm wide), breaking the thickness of clays into separate blocks and leaving to a depth of 3-5 m or more from the surface of the earth, i.e., clay soils with a large content of hydrophilic clay minerals and low humidity in the natural state are swellable.

III. OBJECTS AND METHODS OF RESEARCH

The increase in humidity of swelling soils leads to the rise of the foundations located in them and the development of negative (negative) cracking of the foundations in Zarafshan and Tamdybulak [2.3]. E. A. Sorochan gives examples when the lifting of some structures during swelling of base soils reached 580 mm. Soil shrinkage after drying causes significant precipitation of structures. In some cases, horizontal swelling pressure on underground elements of structures is also dangerous.

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IV. RESULTS OF THE RESEARCH

Swelling soils are common on all continents. In Uzbekistan, swelling clays occupy significant areas mainly in the southern regions of the country with an arid climate. These are the districts of the cities of Central Kyzylkum, the city of Navoi and the Navoi region in Karakalpakia, etc. They are distributed in flat, foothill regions and confined to the zones of dry steppes and semi-deserts. Areas of development of cover swelling clays are characterized by a small amount of atmospheric precipitation, a general shortage of air humidity, long dry periods in summer.

The power of swelling soils ranges from several meters to several tens of meters. The macroscopic appearance of swelling clays is characterized by homogeneity and dense texture. Many varieties of swelling clays are characterized by sludge, enrichment with organic material, microlayer, gypsum. In a dry state, the clays are very dense, hardened and, when hit by a hammer, break up into angular fragments. Swelling (bentonite) clays according to the genesis of origin belong to chemogenic sedimentary rocks and they arose as a result of the chemical decay of volcanic ash in an aquatic environment.

The swellability of soils depends on many factors: the mineral, granulometric and chemical composition of the soil, the natural humidity and density of addition, the composition and concentration of the solution interacting with the soil, the amount of external pressure on the soil, and is usually manifested with the content of clay particles - in an amount of more than 40 - 60%, density - more than 1.5 - 1.7 g/cm3, humidity - less than 0.20 - 0.30.

In case of violation of natural addition of swollen soil (for example, when using it as backfilling soil), the free swelling value can increase to 1.5-2.0 times.

The most swollen (and therefore the most dangerous during construction) are overpopulated weakly cemented clays, formed in an arid climate in shallow basins and containing montmorillonite - a clay mineral with a mobile crystal lattice. Such clays create significant difficulties in their development for construction.

V.CONCLUSION

During geotechnical surveys to justify the construction project, it is allowed to evaluate soil swelling by:

• swelling pressure p_{sw} - pressure arising when volumetric deformations are not possible during soaking and swelling of soil;

• W_{sw} swelling humidity - humidity obtained after completion of soil swelling and termination of liquid absorption process;

• relative deformation of swelling αsw at a given pressure (including at p = 0) - a relative increase in the height of the sample after swelling;

• humidity at the shrinkage limit W_{sh} - soil humidity at the moment of sharp shrinkage decrease;

• relative deformation of shrinkage α_{sh} - relative volumetric or linear reduction of sample size when moisture evaporates from it.

During engineering and geological surveys in areas of swelling soils propagation it is necessary to additionally investigate:

• genesis, distribution and conditions of swelling soils, their confinement to certain geomorphological elements and landforms;

• capacity of swelling soils and its changes in area;

• presence of external signs of soil swelling (shrinkage) - polygonal network of cracks on the surface of the walls of pits and recesses, block separately in slopes and on slopes, shrinkage cracks (the amount of their opening, depth and direction of propagation), presence of suffosion removal of clay particles near open cracks, expansion of the bottom of pits;

• peculiarities of soil structure and texture (layering, fracturing, aggregation, plastering, etc.);

• specific characteristics of swelling soils (relative deformation of swelling without and with load, soil humidity after swelling, swelling pressure, linear and volumetric shrinkage of soil, humidity at the shrinkage limit) and changes of these characteristics by stretching and depth, as well as after interaction with man-made solutions;

• assessment of the degree of swelling process development;

• presence and nature of deformations of buildings and structures caused by swelling or shrinkage of soils;

• assessment of swelling soil properties change during construction and operation of facilities;

• recommendations for taking into account the main features of swelling soils in the development of the territory and the design of construction facilities.

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Thus, when conducting engineering and geological surveys and studies in areas of development and distribution of swollen soils, in addition to general requirements, it is necessary to provide additional information and materials that will allow designers to fully take them into account when designing structures and develop the necessary set of protective measures to ensure their long-term operation.

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