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RESEARCH IN ENGINEERING-GEOLOGICAL CHARACTERISTICS OF FOREST SOILS OF THE CITY OF KYZYLORDA

Abstract. The article analyzes the problem of studying loess rocks. The objects of study in this work were foundations composed of soft soils. In engineering-geological assessment of loess deposits, the conditions of occurrence of loess rocks are of great importance. The research was carried out on the territory of Kyzylorda, where the total thickness of the subsidence layer and overlying technogenic deposits reaches 5-7m.

The processes studied in the work - long-term sedimentation of subsidence soil, as well as fluctuations in the level of groundwater that affect it, are characteristic of many cities. So on 20% of the territory of Kazakhstan there are peat deposits, and changes in the level of groundwater are one of the main factors that have a negative impact on foundations, underground structures and foundations in cities.

The obtained calculation methods, monitoring data, constructive solutions of underground utilities in loess territories can be used in similar engineering and geological conditions, which will increase the reliability of these structures, reduce the cost of their construction and operation

Keywords: base, foundation, subsiding soils, loess rocks, geological research.

For the normal functioning of the foundations, and, therefore, the man-made objects erected on them, it is necessary to have high-quality geotechnical design support, which includes a comprehensive analysis of engineering and geological conditions, the calculation of the stress-strain state of the foundations and the organization of monitoring of the processes developing in them.

The objects of study in this work were foundations made up of weak soils (Figure 1). The studies were carried out on the territory of Kyzylorda, where the total thickness of the subsidence stratum and the overlying technogenic deposits reaches 5-7 m. Long-term sedimentation of loess at the base causes damage to urban infrastructure objects - utilities, roads, sidewalks, landscaping elements, etc.

The research was carried out under the guidance of the senior lecturer of the

Department of Architecture and construction production, candidate of technical sciences A.Budikova.

A number of scientific works, i.e. geotechnical surveys of the projected dormitory building in Kyzylorda were carried out jointly with the associate professor, R.Kubenov, candidate of technical sciences. of the Department of oil and gas engineering, a master's student of the Department of Architecture and construction production, T.Baimanov, as well as students of the STR-19-1u group, E.Aldamnazarov and N.Mambet.

To carry out a comparative analysis of the variability of the properties of loess soils in the city of Kyzylorda in the south of Kazakhstan, we carried out laboratory studies of the physical and mechanical properties of loess subsidence soils before and after their soaking [6].

Physical characteristics of soils - weight moisture w, moisture at the plasticity limit W_p and yield W_L, soil density ρ, particle density ρ_s were determined in accordance with the requirements of the current GOST [2]; strength - angle of internal friction φ and specific adhesion c - on single-plane cut devices PSG-2M, deformability indicators - in compression devices in accordance with the requirements of SP RK 1.02-105-2014 [3] and during stamp tests of samples of undisturbed loess soil in a tray.

The advantage of laboratory research is the ability to study the expected processes taking into account the spatial variability of loess soils, the time factor, the deformed state, etc. These methods provide for obtaining material in the amount necessary for statistical data processing in order to identify correlations between changes in the moisture regime of loess soils and their deformability.

In statistical processing of experimental data to determine the physical characteristics, the values of the standard deviation S and the coefficient of variation ν are used, which characterize the variability of the primordial soil indicators and are determined by the formulas.

$$S = \sqrt{\sum_{i=1}^{n} \frac{(x - x_i)^2}{n-1}}, \quad (1)$$

$$\nu = \frac{S}{X^n}, \quad (2)$$

where n is the number of definitions, x_n is the normative value of the characteristic, which is defined as the arithmetic mean.

For the strength characteristics of the soil *φ* and *c*, the method of statistical processing is that the standard values $tg\varphi_n$ and c_n are determined as parameters of the linear dependence of the shear resistance on pressure and are calculated by the least squares method for the entire set of experimental values of τ with the total number of determinations n.

Calculations of the standard value of the characteristics being determined and the standard deviation are made according to the formulas:

for the coefficient of friction:

$$tg\varphi_n = \frac{\left(n\sum_{i=1}^{n} \tau_i \sigma_i - \sum_{i=1}^{n} \tau_i \sum_{i=1}^{n} \sigma_i\right)}{n\sum_{i=1}^{n} \sigma_i^2 - \left(\sum_{i=1}^{n} \sigma_i\right)^2}, \quad (3)$$

$$S_{tg\varphi} = S_r \sqrt{\frac{n}{n\sum \sigma_i^2 - \left(\sum \sigma_i\right)^2}}, \quad (4)$$

or specific adhesion:

$$c_n = \frac{\sum_{i=1}^{n} \tau_i - tg\varphi_n \sum_{i=1}^{n} \sigma_i}{n}, \quad (5)$$

$$S_c = S_r \sqrt{\frac{\sum^{i=1} \sigma_i^2}{n\sum^{i=1} \sigma_i^2 - \left(\sum \sigma_i\right)^2}}, \quad (6)$$

To study the changes in the characteristics of loess soil during soaking, monoliths were selected from 5 pits of various depths, drilled in the Terenozek region of Kyzylorda, Kazakhstan. Loess soil in all five pits is represented by hard loess loam of varying thickness (from 3 to 7m). Laboratory studies of loess soil samples were carried out in the soil laboratory of the Department of Architecture and construction production of the Korkyt Ata Kyzylorda university.

Determination of the characteristics of loess soil was carried out using soil samples of natural moisture, which were cut out of the monolith with a sampling ring with a height of h=1cm, diameter d=7cm and their density ρ_0 was found, then the density of dry soil ρd_0 and the porosity coefficient e_0 at p=0 were calculated. The characteristics of soil of natural moisture content, obtained by statistical processing of data from at least three samples of loess soil for each of the characteristics cut from monoliths taken from different pits, are shown in table 1. The standard deviation *S* was no more than 0.02 at a confidence level α=0,85.

Table 1 - Characteristics of natural moisture soil

Pit №	Sampling depth, *m*	ρ_s т/м^3	ρ, т/м^3	w, %	w_P, %	w_L, %	Coeffi-cient poro-sity,*e*	porosity, *n*
1	4,2	2,73	1,485	7,6	16	25	0,978	0,494
2	3,8	2,72	1,483	8,6	17	28	0,996	0,499
3	4,6	2,70	1,480	7,9	16,6	25,7	0,968	0,492
4	3,3	2,74	1,503	8,5	18	28	0,985	0,496
5	4,5	2,75	1,504	8,1	17	27	0,977	0,494
Average value		2,73	1,491	8,14	16,92	26,74	0,981	0,495

To determine the deformation and strength characteristics, samples of loess soil of natural moisture, cut from the same monoliths, were tested in the odometer and for shear (shear) in a direct single-shear plane shear device. The obtained experimental results were processed by statistical methods according to formulas (1-6).

The processes studied in the work - long-term sedimentation of subsiding soil, as well as fluctuations in the level of groundwater that affect it, are characteristic of many cities. So on 20% of the territory of Kazakhstan there are peat deposits, and changes in the level of groundwater are one of the main factors that have a negative impact on foundations, underground structures and foundations in cities [5].

Table 2 – Average compression test results loess soils of natural moisture w = 8%

Load per sample, p, MPa	Density dry soil, ρ_d, т/м^3	Coefficient porosity, e_{icp}	porosity, n
0	1,378	0,981	0,495
0,05	1,385	0,971	0,492
0,1	1,391	0,962	0,490
0,2	1,402	0,947	0,486
0,3	1,405	0,942	0,485
0,4	1,407	0,940	0,484

The obtained calculation methods, monitoring data, constructive solutions for underground utilities in loess territories can be used in similar engineering and geological conditions, which will increase the reliability of these structures, reduce the cost of their construction and operation.

The most important characteristics of loess soils are porosity, volumetric and specific gravity, moisture, plasticity, granulometric and mineralogical composition, structure and subsidence. These characteristics determine the properties of research according to the methods described in the instructions and manuals.

The total porosity of loess soils ranges from 30 to 38%, but most often it is 40-50%. Non-subsiding varieties of loess soils have a porosity of less than 40%. The highest porosity is characteristic of the upper part of the loess strata. So, in the Karaozek region at a depth of 0-6m, the porosity is 39-44%, at a depth of 6-12m - 37-49%.

The porosity of loess soils also varies over the area, reaching the highest values on watersheds in more arid regions, where soils of type II subsidence are common. The porosity of loess soils of various genesis is not the same. It reaches the highest values in loess soils of aeolian genesis and the smallest in those of water origin.

Figure 1 – Selection of soil samples from a pit (candidate of technical sciences, associate professor R.Kubenov, students E.Aldamnazarov, N Mambet, A.Budikova - senior teacher, candidate of technical sciences, and undergraduate T.Baimanov)

Normal porosity characterizes the volume of gaps between soil particles. This interparticle porosity forms a continuous interconnecting system, which is able to significantly reduce under the action of loads on the soil. Such pores occupy the bulk of the total porosity of loess soils (from 13 to 35%). The highest interparticle porosity is found in loess soils of type II subsidence, which have a granular structure and low natural humidity (less than 12%), as well as a hydrosluidic-quartz or hydrosluidic-kaolinite composition of minerals in clay fractions.

The total porosity of loess soils, determined in laboratory conditions, also includes the porosity corresponding to the maximum volumetric hydroscopicity, and macropores. The amount of porosity that corresponds to the maximum volumetric hydroscopicity depends on the composition of clay minerals in the soil and its moisture content. These include pores between highly dispersed particles and interpacket gaps in clay minerals such as montmorillonite. Such pores are always filled with aqueous solutions. The value of this type of porosity in loess strata is small (2-10%) [1].

Figure 3 - Place of sampling of soil of the designed building (pit 2.2m deep)

Figure 4 - The resulting monolith of undisturbed structure

Macropores of loess soils are usually distinguishable visually, as their size exceeds 0.5mm. They increase the overall porosity of the rock by 3-6%. By the nature of the walls, the macropores are divided into loose and cemented. Loose macropores are easily destroyed in water, cemented ones, on the contrary, are relatively waterproof.

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ҚЫЗЫЛОРДА ҚАЛАСЫНЫҢ ОРМАН ТОПЫРАҚТАРЫНЫҢ ИНЖЕНЕРЛІК-ГЕОЛОГИЯЛЫҚ СИПАТТАМАЛАРЫН ЗЕРТТЕУ

Аннотация. Мақалада орман тұқымдарын зерттеу мәселесі қарастырылған. Бұл жұмыстағы зерттеу нысандары әлсіз топырақтардан тұратын негіз болып табылады. Инженерлік-геологиялық бағалауда орман жыныстарының пайда болу жағдайлары үлкен маңызға ие. Зерттеулер Қызылорда қаласының аумағында жүргізілді, мұнда шөгінді топырақтың қасиеттері анықталды және техногендік шөгінділердің қалыңдығы 5-7 метрге дейін болды.

Жұмыста зерттелген процестер - шөгу топырағының ұзақ мерзімді тұнбасы, сонымен қатар оған әсер ететін жер асты сулары деңгейінің ауытқуы көптеген қалаларға тән. Сонымен, Қазақстан аумағының 20% - ында шымтезек шөгінділері бар, ал жер асты сулары деңгейінің өзгеруі қалалардағы іргетастарға, жер асты құрылыстарына және іргетастарға кері әсер ететін негізгі факторлардың бірі болып табылады.

Алынған есептеу әдістері, бақылау мәліметтері, орман алқаптарындағы жерасты коммуникациялары үшін сындарлы шешімдер ұқсас инженерлік-геологиялық жағдайларда пайдаланылуы мүмкін, бұл осы құрылымдардың сенімділігін арттырады, оларды салу мен пайдалану құнын төмендетеді.

Кілт сөздер: негіз, іргетас, шөгінді топырақтар, лёссті жыныстар, геологиялық зерттеу.

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ИССЛЕДОВАНИЕ ИНЖЕНЕРНО-ГЕОЛОГИЧЕСКОЙ ХАРАКТЕРИСТИКИ ЛЁССОВЫХ ГРУНТОВ ГОРОДА КЫЗЫЛОРДЫ

Аннотация. В статье анализуется задача исследований лёссовых пород. Объектом изучения в настоящей работе послужили основания, сложенные слабыми грунтами. При инженерно-геологической оценке лёссовых отложений большое значение имеют условия залегания лёссовых пород. Исследования выполнялись на территории г.Кызылорды, где суммарная мощность просадочного толща и перекрывающих его техногенных отложений достигает 5-7м.

Изученные в работе процессы – длительная осадка просадочного грунта, а также влияющие на нее колебания уровня грунтовых вод – являются характерными для многих городов. Так, на 20% территории Казахстана имеются отложения торфа, а изменения уровня грунтовых вод являются одними из основных факторов, оказывающих негативное воздействие на основания, подземные сооружения и фундаменты в городах.

Полученные методики расчета, данные мониторинга, конструктивные решения подземных инженерных коммуникаций на лёссовых территориях могут найти применение в аналогичных инженерно-геологических условиях, что позволит повысить надежность указанных сооружений, сократить затраты на их устройство и эксплуатацию.

Ключевые слова: основание, фундамент, просадочные грунты, лёссовые породы, геологическое исследование.

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REFERENCES

[1] Soil mechanics, foundations and foundations // Edited by Academician RIA, Doctor of Technical Sciences, Professor S.B. Ukhov. M., "High School", 2002.

[2] GOST 23161-12 Soils. Method for laboratory determination of subsidence characteristics (reprint) // Soils. Method of laboratory determination of subsiding characteristics, Interstate standard M., Standardinform, 2013.

[3] SP RK 1.02-105-2014, Engineering surveys for construction. Basic provisions // Code of rules of the Republic of Kazakhstan, Astana 2015.

[4] Ukhov S.B., Semyonov V.V., Znamenskiy V.V. and others. Soil mechanics, foundations and foundations // M.: Higher school, 2002-566p.

[5] Budikova A.M., Baymanov T.O. Analysis of engineering and geological studies of sites, composed of weak clayey soils // Bulletin of Science and Education №7 (85), Scientific and Methodological Journal of the Russian Federation, ISSN 2541-7851 // Certificate SERIES: 10 VNO 01156 dated 04/08/2020, p.11-16, publishing house "Problems of Science", Moscow, 2020.

[6] Budikova A.M., Otepbergen N.O., Engineering and geological studies of loess subsidence soils // Scientific journal of the Russian Federation // Problems of Science No. 04(28), 2018, pp. 44-47.

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