eISSN: 2229-3213 pISSN: 2229-3205
The Journal of Applied Science and Social Science
Volume 16,Issue 02 February, 2026

COMPRESSION COMPRESSION OF SOILS

Mirzaev Abdikhannon,
Lecturer of the Department of
"Transport Logistics" of Andijan State Technical Institute

Abstract

Compression compression is a process associated with the decrease in the volume and settlement of soil layers under the action of external loads, which is especially important when determining deformations under foundations. In our study, compressibility indicators and odometer tests conducted under laboratory conditions were analyzed. Compression properties of various soils (sandy, clay, and loess) were also compared.

Key words

deformations, consolidation, soil compression, compression curve, static sounding, dynamic sounding

Introduction. When designing buildings, it is necessary to know the properties of the mechanical properties of soils for calculating deformations and assessing the strength of soil masses. The mechanical properties of soils are understood as their ability to resist changes in volume and shape as a result of force (surface and mass) and physical (moisture, temperature, etc.) influences. The characteristics of these properties differ for different types and conditions of soils and depend on operational stresses. The properties of mechanical properties at maximum stress are called deformation, since they determine the soil's ability to resist the development of deformations (pocket and horizontal displacements) [1]. In the case of maximum power, these properties are called strength and determine the soil's ability to resist destruction. The filtration properties of soils are also taken into account, since the rate of water displacement through pores significantly affects the processes of soil deformation and destruction [2]. Compression tests are used to obtain the dependence of soil sample deformation on load, to determine the compression coefficient, the modulus of secant odometric deformation, the modulus of tangential odometric deformation, and the overload modulus. Consolidation tests are used to obtain the time dependence of deformation at a given load value and to determine the filtration and secondary consolidation coefficients. Soil compression is the compression of soil without the possibility of lateral expansion. The strength and stability of any constructed object depend on the properties of the soil on which it is built [3]. Therefore, geologists first carefully study the proposed construction site, conduct soil compression tests, and conduct physicochemical analyses of the soils. The obtained results serve as the basis for calculating the foundation, from which the reliability of the building under construction will subsequently depend. The load is applied to the soil step by step, holding each step until the deformations are completely weakened. Measurement of deformations is carried out using indicators. The change in the porosity coefficient is determined by the change in the height Δh of the soil sample. The relationship between the pressure value P and the soil porosity coefficient values e is plotted on the graph. By connecting the experimental points, a graph of the compression curve is plotted [4,5].

Metodologiya. In laboratory tests, the compression method is used to study the mechanical properties of soil, which allows for precise observation of how the soil porosity changes with a change in its density. Based on the results of these experiments, a graph of compression curves is constructed, showing the dependence of the porosity coefficient on the applied stress. Each type of soil has its own characteristics, so unlike others, it corresponds to a very distinct compression curve [6]. Analysis of the compression curve is very important in the comprehensive study of soils, as it is based on the assessment of soils as a basis for the foundation. Soils with a rigid skeleton usually have lower compressibility, depending on the initial density. We are mainly

talking about coarse sandy and gravelly soils, while the compression curve will be almost the same due to the water saturation of different soils (i.e., the porosity coefficient will be the same). For soils with an elastic skeleton, the porosity coefficient changes more during compression. This is due to the fact that their structure is more complex, the composition is more widespread, and particles of a crustal configuration are present in significant quantities (clays). Different soils of this group have different compressibility, which is clearly reflected in the compressibility curve. In sedimentary soils, compression curves have a characteristic appearance [7,8].

Result and discussion. The research was conducted according to GOST 19912-2012. In the process of static sounding, a large amount of data was obtained: the bearing capacity of the piles was calculated, information was obtained about the non-drying strength of soil layers (cutting resistance of unstable foundations), the angle of internal friction was calculated, as well as the modulus of compressive deformation and floor pressure. In addition, thanks to the use of special equipment, the test depth has now been increased to 45 m. The technique allows for the collection of groundwater and rock samples and the study of soils under natural conditions. The probe is a metal rod with a cone-shaped end with a diameter of 33-77 mm. The compressive force is transmitted to the end through a rod, which increases when the probe is immersed in the soil properties under the action of a static pressing load and by measuring the soil's resistance to the probe penetration. With the help of samples obtained by static probing, a number of important problems are solved, for example: dividing the geosection into layers determined by depth and area; classification of soils according to their properties, composition, state; studying the spatial variability of properties to choose a rational design model for the foundation; determining physical and mechanical properties using special formulas and an analytical approach; designing and performing calculations of foundations, including determining the calculated soil resistance, pile loads, pile installation, etc. Simultaneously with static sounding, geophysical research is carried out, including electrical prospecting, seismic profiling, etc.

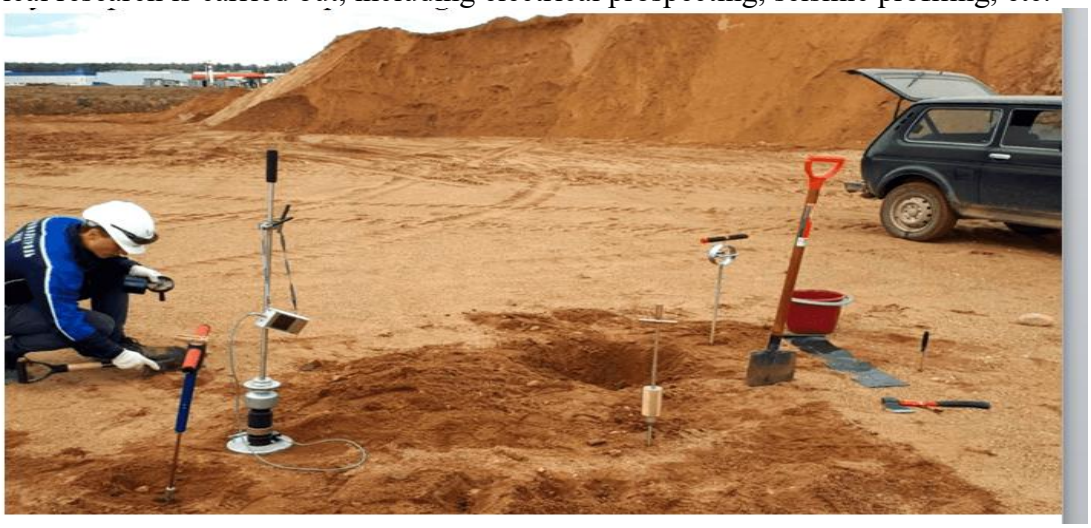

Figure 1. Dynamic sounding

The research was conducted according to GOST 19912-2012. This method was applied in soils with a natural base of a sandy layer and was implemented as a foundation plate grid, i.e., the upper part of the foundation distributes the load between the load-bearing elements of the building. A probe, impact device, and measuring device were used to conduct the research. Special wheeled or track devices with a hammer weighing up to 63.5 kg were used. During the probing process, the following data were obtained about the soil layers: indicator of non-drained power; parameters of dynamic resistance; modulus of non-drained deformation. Despite the fact that the data obtained are limited, they are sufficient for the design of buildings and structures with a moderate or low load on the foundation. Testing with stamps: These studies are carried out to determine the stamp modulus of soil deformation in accordance with GOST 20276.1-2020.

A stamp is a hard metal structure pressed into the ground. Due to its rigidity, the structure is considered non-deformable under external pressure. During the tests, the actual vertical load on the thickness of the structure was simulated, taking into account the influence of the scale. During the study, settlement was monitored and the maximum pressure leading to soil deformation was calculated. Thus, this method is a full-scale simulation of the soil compaction process, i.e., research conducted under conditions corresponding to the working conditions.

Figure 2. Compression methods

Compression methods are used to study the mechanical properties and deformation parameters of the soil. The sample is subjected to high pressure. The research is carried out according to GOST 12248.4-2020. During the test, the soil is compressed from the sides without expansion. The main parameters determined during the compression effect are: soil sample density; fine particle density; natural soil moisture.

Compression studies are carried out in laboratories equipped with special devices for studying compression. Their essence lies in carrying out this type of compression of the selected samples in the absence of lateral expansion. That is, the test sample is compressed, but it does not fall. The main parameter is compression, characterized by the calculated modulus of soil deformation. It is this that serves as the main indicator of the expected shrinkage and a factor in the correct assessment of the soil as the basis of the foundation.

Conclusion. Compression compression of soils is directly related to their composition, moisture content, and density and is an important factor in determining the amount of settlement under the foundation. Audometer tests conducted under laboratory conditions made it possible to accurately assess the compressibility indicators of soils. As a result of the analysis, it was established that the degree of compression is higher in clay and loess soils, and relatively lower in sandy soils. The obtained results confirm the need to take into account the compression properties of the soil when designing buildings and structures and serve to ensure the reliability and stability of foundations.

Referens

1. K. Terzaghi, R. B. Peck, and G. Mesri, Soil Mechanics in Engineering Practice, 3rd ed. New York, NY, USA: John Wiley & Sons, 1996, pp. 1–592.

2. B. M. Das and K. Sobhan, Principles of Geotechnical Engineering, 8th ed. Stamford, CT, USA: Cengage Learning, 2014, pp. 1–768.

3. V. N. S. Murthy, Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. New York, NY, USA: Marcel Dekker, 2002, pp. 1–1056.

4. T. W. Lambe and R. V. Whitman, Soil Mechanics. New York, NY, USA: John Wiley & Sons, 1969, pp. 1–553.

5. H. B. Seed and K. L. Lee, “Settlement analysis of clay layers,” Journal of the Soil Mechanics and Foundations Division, vol. 92, no. 2, pp. 1–19, 1966.

6. A. Casagrande, “The determination of the pre-consolidation load and its practical

significance," in Proceedings of the 1st International Conference on Soil Mechanics and Foundation Engineering, Cambridge, MA, USA, 1936, pp. 60–64.

7. H. Atkinson, The Mechanics of Soils and Foundations, 2nd ed. London, U.K.: CRC Press, 2007, pp. 1–457.

8. D. W. Taylor, Fundamentals of Soil Mechanics. New York, NY, USA: John Wiley & Sons, 1948, pp. 1–700.