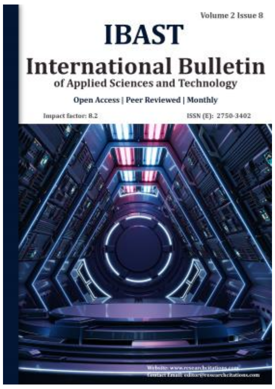

CONSTRUCTION OF BUILDINGS AND STRUCTURES IN DIFFICULT SOIL CONDITIONS AND SEISMIC REGIONS OF THE REPUBLICS OF CENTRAL ASIA

Khakimov Gayrat Akramovich
PhD
Abduraimova Khadicha Rakhmankulovna
PhD,
Associated profeccor at department
"Design of building and structures",
Muminov Abdujamil Abduxalilovich
Berdimurodov Abdukihayum
Sobirova Zulfiya
Tashkent Universitete of Architecture and Civil Engineering, Tashkent, Uzbekistan
https://doi.org/10.5281/zenodo.8019713

Annotation. This scientific article describes modern methods of arranging artificial foundations for buildings and structures erected in difficult soil conditions and seismic areas, on subsidence loess and weak water-saturated clay soils. Also, information is given on some reliable structural measures (use of deep foundations, pile foundations, cutting structures with sedimentary seams, installation of strapping belts, etc.) used in buildings and structures in difficult soil conditions and seismic areas.

Key words: weak clay soil, subsidence loess soil, bulk soil, seismic areas, earthquakes, settlement and subsidence, vibration method, seismic deformation, acceleration, strength characteristics of soils, foundations.

Introduction. In the republics of Central Asia, the problem of building buildings and structures in difficult soil conditions is very important, since many territories of these republics are composed of weak clayey and subsidence loess soils. Also, large territories of these republics belong to seismic regions where earthquakes with an intensity of 8-9 points or more are possible according to the International MSK-64 scale [for example: 9 point Almaty (Kazakhstan) earthquakes of 1887, 1911, 8-9 point Gazli (Uzbekistan) 1976, 1984, 9 points Ashgabat (Turkmenistan) 1948, 10 points Khait (Tajikistan) and many others]. Ground conditions in seismic areas are also referred to as complex ground conditions.

It is known that during construction on weak water-saturated clayey and subsiding loess soils, as well as in other difficult soil conditions, settlements and subsidences of the foundations of buildings and structures turn out to be much greater than is allowed for this type of structures.

The design and erection of buildings on weak clayey, subsiding loess soils in areas subject to frequent seismic impacts with ensuring trouble-free operation is one of the most difficult problems of modern earthquake-resistant construction. The difficulty of this problem is determined by the specific properties of moistened weak clayey and subsidence loess soils, one of the most seismically unstable soils capable of subsidence measured by several tens of centimeters, and sometimes even meters, both from additional moisture and from vibration. Additional drawdown during an earthquake can have a significant value, exceeding the usual drawdown by 2-3 times (according to prof. Rasulov Kh.Z., Saifiddinov S., Uzbekistan). This circumstance, along with other factors, leads to catastrophic phenomena associated with the death of a large number of people during earthquakes.

The importance of studying the phenomenon of additional deformation is dictated by the need to assess and prevent possible damage to buildings erected on weak clayey and subsidence loess soils in seismic zones, as well as to analyze the consequences of earthquakes.

Review of scientific literature and methods. The works of Yu.M.Abelev, M.Yu.Abelev, N.N.Maslov, N.I.Kriger, S.B.Ukhov (Russia), A.A. Musaelyan, I.G. Tairov, A. Ruziev (Tajikistan), Kh.Z. Rasulov, S.M. Kasymov (Uzbekistan) and others.

Numerous analyzes of the causes of deformation of buildings and structures located on weak clayey and subsidence loess soils have shown that they are characterized by the following main features that must be taken into account when designing buildings and structures:

- high compressibility of soils, leading to very large settlements of buildings and structures located on them, and as a result of deformation and failure of structures.
- their low strength, low values of shear resistance, as well as the difficulty to ensure the stability of foundations and entire buildings and structures on the soils under consideration;
- a sharp decrease in shear resistance when they are moistened, due to a decrease in the strength characteristics of soils;
- long duration of sedimentation of buildings and structures, sometimes reaching several decades;
- additional deformation when exposed to dynamic or seismic forces.

In difficult soil conditions, it is necessary to take into account when conducting studies of foundations composed of subsiding loess soils, weak clay soils, bulk soils, that after a while all foundation soils will become saturated with water. When designing buildings and structures, it is necessary to carry out calculations of foundations in difficult soil conditions of natural soil moisture and for completely water-saturated soils.

Insufficiency, as well as low quality of engineering and geological surveys, are often the reasons for erroneous design decisions on foundations and foundation structures. In difficult soil conditions, when designing bases and foundations, it requires high and special qualifications of designers.

It is often required to predict the behavior of foundations with a score greater than 9 and evaluate possible settlements. In zones with a seismicity of more than 9 points, a more detailed study of the properties of soils under intense dynamic impacts is necessary.

At present, foundations of the main types for the most common soil conditions can be designed taking into account the seismic resistance of structures with high technical and economic indicators. However, with the development of seismology and earthquake-resistant construction, new challenges arise for builders, especially in connection with the need to build structures in areas where they were previously considered unsuitable for construction.

These materials obtained make it possible to correct the forecasts that will be given in analogous natural conditions at new construction sites, as well as to improve the methodology of engineering and geological surveys.

The main direction of modern foundation engineering in difficult soil conditions is to refine the methods of surveying and designing foundations and to develop new technological methods for constructing artificial foundations and erecting economical foundations.

During the construction of buildings and structures in difficult soil conditions, in most cases it is necessary to arrange an artificial foundation and change the design of structures to increase their rigidity, and in order to ensure trouble-free operation of such buildings and structures for a long time, even with the possibility of uneven precipitation, special constructive measures: cutting the structure with sedimentary seams, installing monolithic foundations from crossed reinforced concrete strips, installing interfloor reinforced concrete strapping belts, etc.

As you know, the main constructive measure in the construction of civil and agricultural buildings is the use of reinforced concrete and metal belts. As you can see, there is some overexpenditure of metal here, but operating costs are significantly reduced. It is known that the rigidity of buildings increases significantly when reinforced concrete belts are installed, which are laid continuously at the level of floors, and when a significant increase in the rigidity of the building is not required, it is possible to install reinforced concrete belts at the level of the basement floor and at the floor level of the penultimate floor. Industrial and civil buildings built of brick with reinforced concrete belts allow precipitation 3-5 times greater. Than panel or block buildings.

The design and erection of buildings and structures on weak clay and subsidence loess soils, in seismic regions, ensuring their strength, stability and reliable operation is one of the most difficult problems of modern construction.

The study of the causes of deformations of buildings and structures erected on weak clayey and moist subsiding loess soils under seismic impact shows that uneven subsidence of the foundation and deformation of the erected structures occur even at a minimum pressure on the soil, and the nature of the deformation of the structure depends on soil conditions and seismic intensity. A typical example of this is the consequences of the Gazli (Uzbekistan) 1976.1984. and Verninsky (Alma-Ata, Kazakhstan) earthquakes of 1887, 1911, when not only 2-storey panel and brick houses were completely destroyed, but also lighter ones, including wooden structures, i.e. buildings and structures were damaged regardless of the specific pressure transmitted to the base and the power of the active (compressible) zone.

Thus, in the presence of weak clayey and subsidence loess soils capable of moving into a dynamically disturbed state, it is not always possible to ensure the strength and stability of structures by calculating their foundations according to the first limit state (by bearing capacity).

In this regard, there is a need to develop a new design principle, based on the conditions for the joint operation of the entire structure as a whole with the base, i.e. taking into account the strength characteristics of the base soils, the specifics of the building structure.

Conclusions. One of the most reliable methods that ensure the strength and stability of the operation of structures, by assigning the value of the design pressure to the base and calculating the limitation of the average settlement and the difference in settlements of individual adjacent foundations due to the difference in settlements, would be the observance of the condition when $\alpha_{кр} > \alpha_{сейс.}$(where, $\alpha_{кр}$, $\alpha_{сейс.}$ are, respectively, the values of the critical and seismic accelerations of vibrations of soil particles) at all points of the foundation.

It is known that each type of soil, depending on its composition, state and properties, has its own critical acceleration of vibrations of soil particles. Most authors call the critical

IBAST | Volume 3, Issue 6, June

acceleration $\alpha_{кр}$ such an acceleration of vibrations of soil particles, upon reaching which the soil is in a state of limiting equilibrium and a slight excess of acceleration against the critical one is sufficient for the water-saturated soil to go into a state of loss of its dynamic stability, i.e. into a state of liquefaction. As a result of liquefaction, there is a drop in the structural strength of the soil and the development of significant plastic deformations both in soils lying in the zones bordering the foundation and in the sub-foundation zone of the base, leading to unacceptable deformations of the structure itself.

Conditions when $\alpha_{кр} > \alpha_{сейс.}$ can be achieved by increasing the strength characteristics of soils. One way to increase the strength characteristics of soils is their compaction.

Currently, soil compaction is carried out by one of the well-known methods: using static rollers, heavy rammers, pre-soaking, explosion, vibration compaction, etc. Based on the conditions of the problem, the most interesting for our research is vibrocompaction with rollers. Vibrocompaction with rollers is widely used in the practice of hydraulic engineering and road construction.

Our studies in the field have shown that the strength characteristics of compacted loess soils with vibration methods are much different from compacted soils with other methods. In addition, during soil compaction with vibration, the soil experiences seismic (dynamic) effects even before the construction of the building.

The method of vibrocompaction with rollers is the most economical and efficient, especially for soil compaction of the foundations of low-rise buildings and bulk soils around the foundation. This ensures the creation of appropriate strength for weak clayey and loess subsidence soils of the foundations and in the lateral zones of the foundation and contributes to the elimination of seismic subsidence phenomena, respectively increasing the value of α_{cr} in the areas under consideration. The mass application of this method in the practice of construction on weak clayey and loess subsidence soils in seismic regions, however, requires additional laboratory and field experimental studies and its own theoretical justification for solving the problem

References:

1.Khakimov, G. A. "Changes in the Strength Characteristics of Glinistx Soils under the Influence of Dynamic Forces International Journal of Engineering and Advanced Technology, IJEAT." Exploring innovation (2020): 639-643.

2.Khakimov, Gayrat Akramovich. "The nature of the change in the connectivity of moistened loess soils during vibration." American Journal of Applied Science and Technology 2.06 (2022): 26-41.

3.Khakimov, Gayrat Akramovich. "CHANGES IN PLASTIC ZONES IN LESS BASES UNDER SEISMIC VIBRATIONS."

4.Khakimov, G. A., and M. A. Muminov. "CONSTRUCTION OF BUILDINGS ON WEAK MOIST CLAY SOILS IN SEISMICALLY ACTIVE ZONES OF UZBEKISTAN." Web of Scientist: International Scientific Research Journal 3.12 (2022): 755-760

5.GMFN, Dos, Samiyeva Sh Kh, and Master MA Muminov. "DEFORMATION OF MOISTENED LOESS FOUNDATIONS OF BUILDINGS UNDER STATIC AND DYNAMIC LOADS." (2022).

6.Khajiev, N. M. "CHANGE IN THE CONSISTENCY CHARACTERISTICS OF THE WETTED LUSSIC BASES (GRUNTS) OF BUILDINGS UNDER THE INFLUENCE OF SEISMIC FORCES." Академические исследования в современной науке 1.13 (2022): 261-267.

7.Miralimov, Mirrakhim Mirmakhmutovich. "Principles of Regulation of Thermal Protection of Enclosing Structures and Their Impact on the Energy Efficiency Of Buildings." Design Engineering (2021): 496-510.

8.Хакимов, Ғайрат, et al. "ЭНЕРГИЯТЕЖАМКОР ВА ПАСТ ЭНЕРГИЯ ЭҲТИЁЖЛИ ЗАМОНАВИЙ БИНОЛАР ҚУРИЛИШИНИНГ ЖАҲОН АМАЛИЁТИ ВА УНДАН ЎЗБЕКИСТОН ШАРОИТИДА ФОЙДАЛАНИШ ИСТИҚБОЛЛАРИ." Talqin va tadqiqotlar 1.19 (2023).

9.Khakimov, Gayrat. "CONSTRUCTION OF BUILDINGS AND STRUCTURES IN DIFFICULT GROUND CONDITIONS AND SEISMIC AREAS." International Bulletin of Applied Science and Technology 3.2 (2023): 203-209

10.Akramovich, Khakimov Gayrat, and Islamova Nargiza Abdukarimovna. "MAIN ASPECTS OF ENERGY CONSERVATION IN CIVIL ENGINEERING." Open Access Repository 9.4 (2023): 116-123.

11.GA Khakimov,SS Kh, AA Muminov, AE Berdimurodov, JA Muminov. “COMPACTION OF LOESS BASES OF BUILDINGS AND STRUCTURES, AS WELLAS BULK SOILS AROUND THE FOUNDATION USING VIBRATORY ROLLERS IN SEISMIC AREAS”. Galaxy International Interdisciplinary Research Journal 11 (4), 306-311.

12.Makhmudovich M. S. et al. Research Of The Work Of The System" Base-Foundation With A Damping Layer-Building" On An Inhomogene Soil Base //Turkish Journal of Computer and Mathematics Education (TURCOMAT). – 2021. – Т. 12. – №. 7. – С. 2006-2015.