UDC 624. 01.001:624.15: 622.693.26 08.05.12:

M.S.Ivanova, candidate of Technical Sciences, (Donbass State Technical University, Alchevsk, Ukraine), Y.A.Otrosh, candidate of Technical Sciences, (Academy of Fire Safety named Heroes of Chernobyl, Cherkassy, Ukraine), N.V.Kamakina, graduate student, (Luhansk National University of Taras Shevchenko, Ukraine)

METHOD FOR DETERMINING SOIL DENSITY IN LABORATORY CONDITIONS

The work is dedicated to the design of the foundations of buildings and structures located on the territory of the stacked soil subsidence. The relevance of this work is the need to improve the way the tests in order to obtain reliable values of the characteristics and, based on the adoption of innovative solutions that meet the real conditions of the construction in the case of the location of the buildings in the complex engineering-geological and cramped conditions.

Key words: soil subsidence, research , ways trials, cramped conditions.

Problem setting. The limited conditions of the territories under construction usually create certain problems during the erection of new buildings and structures or during the reconstruction of old ones. These problems include, first of all, the subsidential soils which are wide-spread in Donbass. Search for new engineering solution to satisfy the demands to the structural protection measures for construction on the subsidential soils both during the erection of new buildings and during the existing buildings reconstruction is *an important task.*

This problem can be solved using such well-known methods as the basement artificial soil improvement by the soil subsidential properties elimination (chemical grouting). This of solution is quite expensive which makes its large-scale application impossible.

The latest achievements and published works analysis.

Soil subsidential properties investigation is connected with their occurrence in Ukraine, on the territory of Russian Federation and other CIS countries.

This problem of designing the basements composed of subsidential soils is far from the final solution due to the fact that serious violations of norms and regulations take place during the buildings and structures construction and maintenance.

Nowadays serious attention is paid to construction in industrial regions of Ukraine. The technological solutions taken during the designing and zero circle works influence the erected buildings and constructions durability. In this particular case we mean the situations when the work performers disregard obligatory design standards.

In some cases the taken decisions reliability decrease is connected with the existing design standards.

Thus, during the tests, soil subsidence deformations are not completely implemented, and the subsidence values are understated. In actual practice soil anthropogenic watering often takes place because of emergency leakages of high-temperature liquids from engineering services and technological liquids. Such circumstances have negative effects, which indicates that existing design standards of buildings and constructions design and erection need improvement.

Problem setting and solving. Raising of task and her decision consists of removal of emergency situation, arising up on the investigated area and in the necessity of planning of foundations for the folded situations in default of reliable results of determination of parameters of soils which would allow correctly to estimate building properties of soils.

These parameters have large variation frequently, that does not allow properly to design building and building both on grounds with both on subsidential soils and on grounds which are

exposed to earning additionally. Building of territories with difficult engineer-geological terms is conducted, as a rule, in exceptional cases because of deficit of free areas with the normal ground terms.

In this connection before designers the problem is set about the necessity of decision of problem on limitation of moving of grounds and foundations, non-admission of destruction of constructions in the period of building and during further exploitation of building and building because of display of uneven deformations of foundation.

A decision the set problem can be illustrated by the state of territory of mine court of the three-storeyed building of the domestic setting intended under building.

Objects are situated near the coal-mine "Romanovskay", Perevalsk district of Luhansk region on the territory with not eliminated subsidence. The technical state of present building is appraised as unapt for further exploitation because of presence of cracks and other damages, caused by uneven deformations of foundation, look a fig. 1, 2. The inspection results revealed, that the grounds consists of the 2nd type subsidence soils with not eliminated subsidence and is being undermined.

Fig. 1 – General view of area of inspection of the ground foundation, with by the clearly expressed superficial cracks

Fig. 2 – General view of existent building, located on investigated territories with the clearly expressed superficial cracks

In view of the above - investigated object is in the emergency state and becomes an object for a today's discussion, and also by an example for development of measures, shutting out destruction of constructions in the period of building and during further exploitation of building.

A decision the set problem is carried out by application of correct engineering decision and due to the improvement of method of receipt of reliable results, and it will be considered below in text.

On the investigated area control pit-holes were unsealed contoured collapsing building, monoliths were whereupon selected.

Under foundation, executed with retreats from project requirements, found out the powerful runback of moisture, probably from the accumulation of rain-waters or from the loss of water from the pipelines of nearby territory. Additional researches are set another unfavorable factor, this detected coal, presence of on subsidential specula (fig. 1) of different diameter and depth.

In this connection a calculation was renewed in the presence of on subsidential properties of soils of foundation in accordance with п. 4.3 ДБН В. 1.1.-5-2000 ч. II. and, on the base of the got results, necessary recommendations are neat assisting strengthening of foundation. For the receipt of descriptions of soils for subsequent calculations devices, fixative the real moving of foundation, were used. Calculation resistance of the ground foundation is specified on results tests, executed company OOO PKF "Geolservis" in 2012. These results were compared with the analogical results of tests of soils, extracted from pit-holes in May, 2013. Treatment of results of tests of soils is conducted by standard methods in accordance the requirements of normative documents and untraditional method [1-3].

Further research on confirmation of reasons of deformation of foundation consisted of verification of results an experimental way in a laboratory, such parameters were here taken into account as, closeness, humidity, прочностные descriptions.

Purpose and description of purpose. To improve the accuracy and reliability of the results of the density of the soil mass has been proposed an improved method for determining one of the search parameters, the weighing of the sample in water.

Appointment work - is the use of authentically the derived parameters in the calculations for the design of buildings and structures in difficult engineering conditions, especially at elevated temperature conditions associated with fire resistance of building structure.

Distinctive feature of the offered work. A distinctive feature of the proposed method is enclosed in accounting for, soil characteristics reliably obtained, depending on their density, moisture and affecting in turn the parameters of resistance structures, especially at elevated fire combustion mode. Any of these factors can lead to extreme emergency operating structures, the deformation due to the absence of a base at a method for determining these parameters in real time, and depending on the crowded conditions of the area.

New in the offered method is that unlike standard determination of closeness of soils at weighing in water, a device is applied, which is provided with Block of "A" - containing adaptation for weighing in water of standard, by Block of "B" is adaptation for treatment of standard, by Block of "C" - which executes collection and treatment of information with an output on COMPUTER. The put purpose was arrived at by the increase of exactness of closeness of soil weighing in water, by the exception of intervention from a human factor due to application of device in Block of "A", provided with electronic scales and "П"-shaped rack (conditionally it is not shown on a picture), Block of "B" and Block of "C", eliminating influence of human factor on exactness of measuring.

It is well carried out with the help of by the improvement of method for determination of closeness of soil weighing in water by introduction of blocks of "A"", B"," C" containing electronic scales and devices, in "П"-shaped rack, executed from Plastic-aluminum, in overhead part which is locate a capture for hanging of standard.

It allowed to arrive at the increase of exactness and authenticity of the got results at determination of closeness of soil weighing in water.

The essence of method of determination of basic parameter consisted in the receipt of the real size of description of soil. Offered flow-chart, containing a device for the definitions of soil weighing in water, it is shown on a Fig.3.

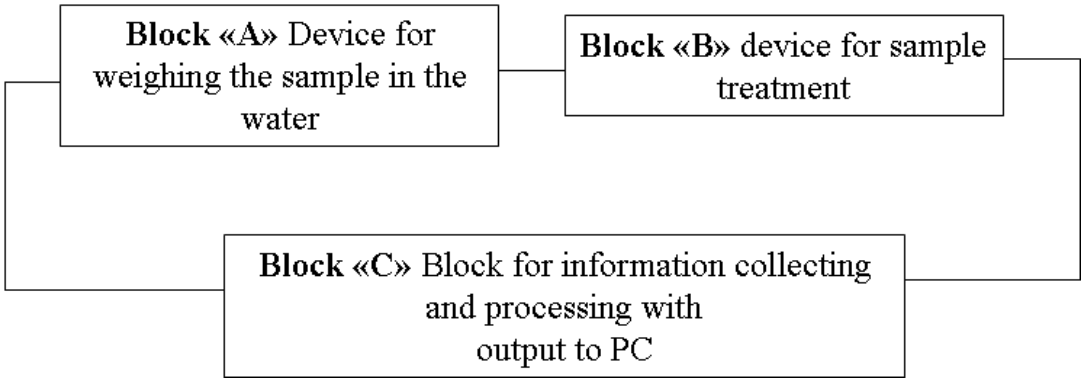

Fig. 3 – Flow-chart of device for determine the density of soil weighing in water

Where Block of "A" is adaptation for weighing in water of standard, contains: scales laboratory electronic; standard; glass glass with water in "П"-shaped rack for capture for the suspension of the sample. Block «B» - a device for treating a sample comprising: a sand bath; capacity to heat the wax;

Block of "C" - executes collection and treatment of information with an output on COMPUTER contains: device, device for collection and information transfer, display.

The device works as follows. In the block "A" comes in soil sample with a sharp protruding parts for cut from the sample in the form of an oval shape, and cut from the him of not less than V=50 cm^3 protruding parts using a knife.

Further the soil sample enters Block of "B" for strapped with by a thin filament, which is to be the long 15-20 см. and completed weigh before and after paraffining,

On the free end of filament to make loop for hanging soil sample on a capture , "A" located in Block.

In Block of "C" the of soil sample is covered by a paraffin shell (conditionally it is not shown on a picture) by immersion on 2-3 seconds in a paraffin, which is heated to the temperature of 57-60^{O}C, and after return in Block of "A" for weighing of mass in glass with water.

Block of "C" in the moment of receipt, information from a perceiving device collects information about mass and destroys on a display testimonies or on a command do and show on the hard printing

Squeeze out the bubbles of air, educed on the hardening surface of paraffin,, pricking above them a shell and smoothing over the place of puncture the heated needle. The cooled, after paraffining sample Holding of the sample, to weigh in Block "A", containing electronic scales, where it is lowered in a glass of water and weigh again, followed by collection of information Bloc «C» at the time of receipt of the sample, and by displaying the readings on a command do and show on the hard printing.

The glass of water establish directly on electronic scales and a soil sample, tied with a thread is suspended on a P-shaped rack, which is located capture for hanging. Length of filament must provide the complete ducking of standard.

The soil sample at weighing must not touch glass, filled with water. after coating with paraffin, drag out from water, wipe a filtration paper and once again send in Block of "A" weigh in an order to check, whether water did not penetrate into a shell.

If the increase of mass will lay down a more than 0,02 g, a standard is bracked and experience recurs with other standard of soil. Conduct a calculation on a formula (1),

$$\rho = \frac{0{,}9 \times m \times \rho_W}{0{,}9 \times (m_1 - m_2) - \rho_W (m_2 - m)}, \quad (1)$$

where m – mass of the soil sample before covering with paraffin, g;
m_1 – mass of the soil sample after coating with paraffin, g;
m_2 – mass of the soil sample after coating wax with water, g;
m_3 – mass of glass with water, g;
m_4 – mass glass of water and soil samples after coating with paraffin, g,
$m_2=m_4-m_3$
ρ_W – water density, g/cm^3.

On results researches it is set by means of the offered method, that the ground grounds are presented by clays hard, subsidencep, type of II, with the drawdown more than 12 cm. Results were processed by means of COMPUTER in the real mode of process of test control. Further verification allowed to set that at the increase of humidity of soils of foundation calculation resistance goes down from R_P= 473 кPa to R_P= 440 кPa.

Use of the improved method on determination of basic parameter entering in the complement of calculation formula at determination of calculation resistance on soil, allow to improve the accuracy and reliability of the results, Coming from certain descriptions of soils (degrees of humidity) drawn conclusion that soil is that the soil too overdamping.

Reason of overdamping of soils atmospheric fallouts and possible losses of liquids serve as from technological pipelines. Soakage of soils, and also their heterogeneity on extending and depth assists development of the uneven sinking. A presence is in soils of the carbonate including, able to get soaked from moisture, results in their moving.

All above-stated factors assist appearance of heel which will increase in time, and to assist destruction of constructions.

Therefore protecting of soils of foundation from a soakage it is necessary to execute by the device of the ground pillow. The parameters of soil of pillow must provide calculation resistance of soil of R= 494 кPa.

Taking into account a that circumstance, that прочностные descriptions of soils depend on their closeness and humidity, it is necessary to take into account at planning of foundations, that any of these factors can result in the emergency situation of on-the-road building because of deformation of foundation at a hit in him source of soakage.

For correct exploitation of area with building, subject to tearing down it is necessary to foresee drainage with the purpose of taking of the saved moisture from atmospheric fallouts, possible aquatic losses, located on him.

At planning of new building to pick up the necessary sizes of the tiled foundation for a calculation and planning of the system "The base - slab - foundation - foundation - buildings" and execute requirement on sufficientness of bearing strength of laying layer under the sole of foundation.

Conclusions. On the basis of the conducted researches by means of the offered method, the following is set.

1.Enhanceable authenticity of results of control researches by means of the offered method, that allowed to set veritable reasons, to the emergency situation, at the inspection of area located near-by a mine court.

2.Confirmed by the offered method of determination of closeness of the ground array her real size which influenced on authenticity of eventual size of calculation resistance of soil and her bearing possibility.

3.It is confirmed that soils of foundation are clays hard, II of type, properties of which were not removed on May, 2013 due to a parameter entering in the complement of calculation formula on determination of resistance of pressure of soil.

4.Set heterogeneity of soil on extending and depth which causes uneven fallouts, as a result, there are moving of more dense particles of soil, containing the carbonate including.

5.In connections with the high degree of humidity of the ground array, it is recommended to foresee drainage on the perimeter of building with the purpose of taking of the saved moisture from atmospheric fallouts, possible aquatic losses.

LITERATURE

1. Иванова М.С., Левченко А.А. Программное обеспечение по обработке опытных данных, получаемых методом экспресс-анализа при определении физико-механических характеристик грунтов. //Будівельні конструкції. Міжвідомчий науково-технічний збірник. Вип.60-К.: НДІБК, 20 04.-С. 427-428.