Experimental and Field Studies at the Pskem Dam Site

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ABSTRACT

The article deals with the control of non-cohesive soils. The currently existing definitions of the control parameters for laying soils at each facility are individual and require extensive experimental work to justify the control parameters for laying soils in the body of the dam. This takes into account a huge number of parameters: grain composition, humidity, layer thickness, density, etc.

Keywords: soils, dam body, grain composition, humidity, layer thickness, density, deformability, filtration, soil laying, strength.

During the construction of hydraulic structures from local materials of high-quality embankments of dams, the main task is to ensure high-quality soil laying.

In general, the quality of materials in any areas of earth-and-rock dams is determined by their density, strength, deformability, and filtration characteristics. To meet these requirements, it was previously necessary to refine the grain compositions of soils and laying densities at the decisive stage of construction, and this determined the need for experimental studies to determine the shear strength of materials in laboratory conditions.

The construction of a large hydraulic structure, such as the Pskem earth and stone dam, 200 meters high, is a complex problem with a number of issues.

The design of soil foundations is carried out according to the first limit state, determined by the bearing capacity of soils, and according to the second limit state, determined by the deformations of these soils. Moreover, the calculation of the bases for deformations is carried out for the main combination of loads, and the calculation of the bases for the bearing capacity - for the main, additional or special combination of loads.

The purpose of field research was to develop and select a method for performing work on laying and compacting soil material, ensuring the highest density. On the basis of these studies, technical conditions for the construction of thrust prisms of the Pskem rock-and-earth dam are further drawn up.

This article presents the results of the work performed in 2020 with a brief methodology for field and laboratory studies. The article presents data characterizing the material intended for laying in the body of the dam.

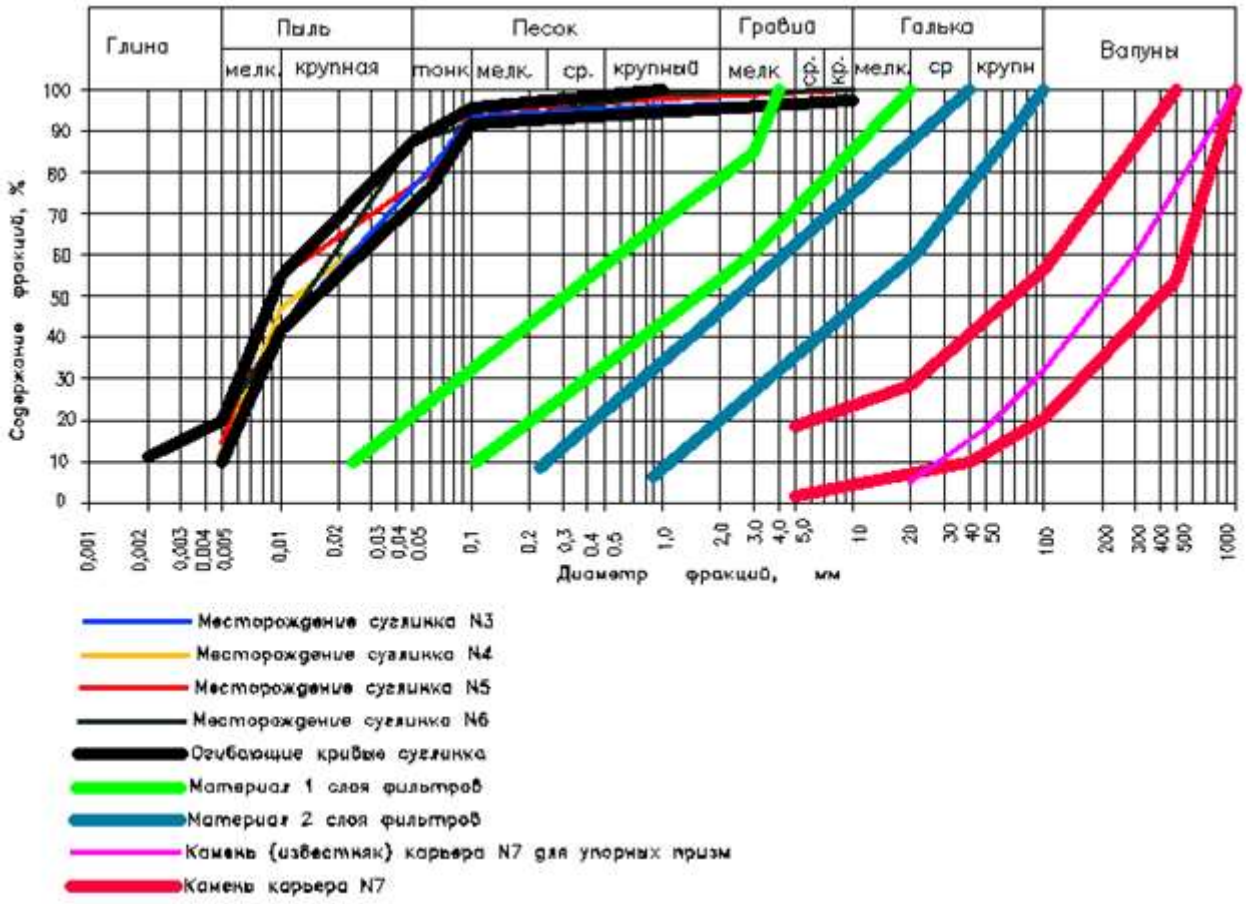
The thrust prisms of the dam of the Pskemsky hydroelectric complex are built from the rock mass. As a quarry for thrust prisms, it is planned to use deposit No. 7a, located in the upper pool on the left bank, 2.0-3.0 km from the dam site. For the experimental site, a stone quarry was developed by the BV method. Transportation was carried out by a heavy dump truck of the BELAZ type with a carrying capacity of up to 40 tons. On the experimental site, the soil was leveled with a bulldozer in uncompacted layers 60, 70, 80 cm thick. After leveling, the soil was watered with water from a water carrier at a rate of 200 liters per 1 m3. Compaction was carried out with a smooth

roller weighing 27 tons, type "SANY" with vibration on and off, at low speed. After every second penetration, the density was determined by the "pit-hole" method, two pits on each layer.

Sampling from the layer is carried out from the surface of its occurrence as follows:

- a carefully leveled horizontal platform 1.5x1.5 m is prepared, within which a metal frame 1.1x1.1 m is installed and a "pit-hole" is passed to the depth of the tested layer or density determination horizon;

- the material selected from the pit was weighed and dispersed into fractions.



Graph of the design curves of the particle size distribution of materials for the embankment of the Pskem dam (Dam. 1910-10-102. Hydroproject JSC 2020).

The volume of the pit was measured by pouring water onto a pre-lined polyethylene film 0.2 mm thick, the surface of the "pit-hole". The volumetric weight of the soil is determined as the quotient of dividing the weight of the sample by the volume of the pit: ; where P - weight, kg; V - volume, litas; - volumetric weight of wet soil. The results of the experiments carried out are shown on the graph of the dependence of the density of dry soil on the number of penetrations of the rink (see Fig. 1,2,3).

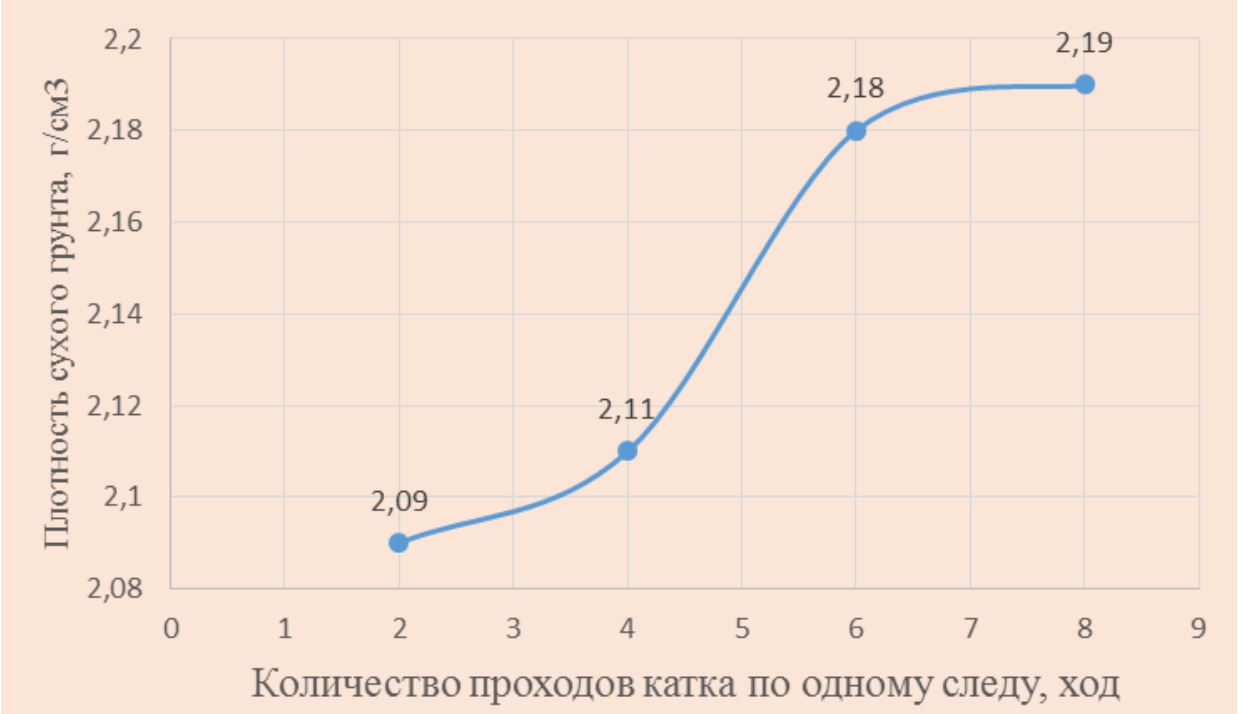


Fig.1. Graph of the dependence of the density of dry soil with a layer thickness of 50 cm on the number of passes of a smooth roller (26000 kg.) with the vibrator turned on, water irrigation 160 l / m3 WB, stone.

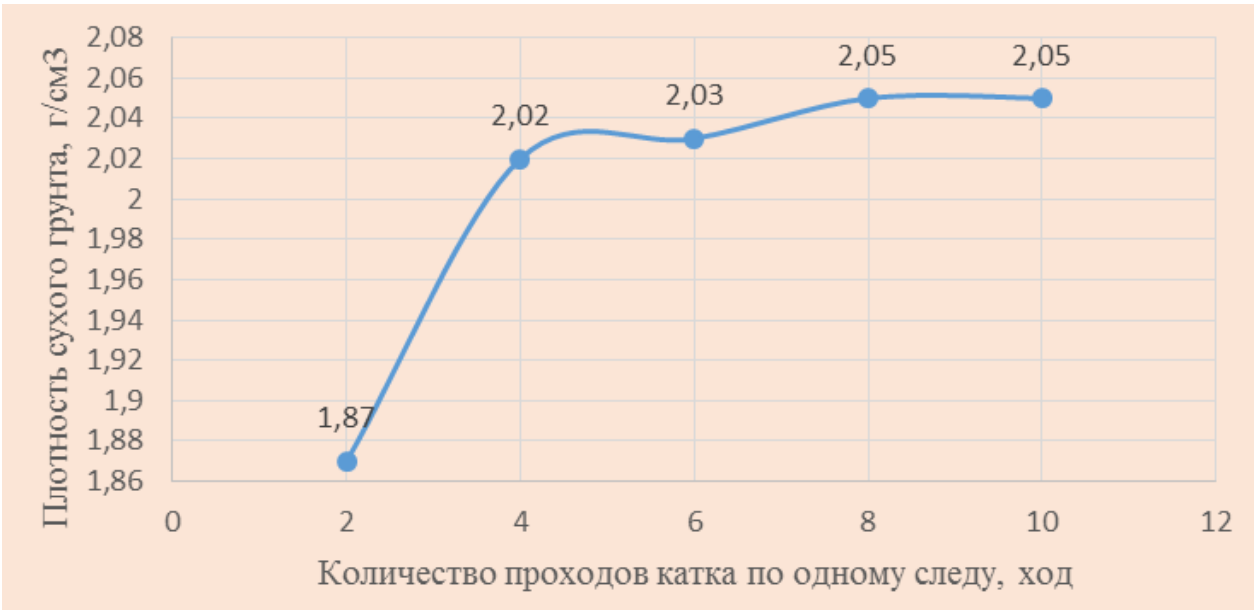


Fig.2. Graph of the dependence of the density of dry soil with a layer thickness of 70 cm on the number of passes of a smooth roller (26000 kg.) with the vibrator turned on, water irrigation 160 l / m3 NB, stone.

Fig.3. Graph of the dependence of the density of dry soil with a layer thickness of 80 cm on the number of passes of a smooth roller (26000 kg.) with the vibrator turned on, water irrigation 160 l / m3 NB, stone.

3. Conclusions And Recommendations

Based on the work carried out, the following conclusions and recommendations can be drawn:

Resistant prisms from the rock mass were laid in layers of 50, 70, 80 cm by moistening from a water carrier (water consumption 100÷120 l per 1 m3 of overburden) and compaction with a 27-ton roller in four to six passes, with a layer thickness of 50 cm, the average density ρd.cp =2.19 t/m3, with a layer thickness of 70 cm average density ρd.cp=2.10 t/m3, with a layer thickness of 80 cm average density ρd.cp=2.04 t/m3. The data were obtained on an experimental site with a particle size distribution with a maximum particle diameter of up to 200 mm. In the body of the dam, the maximum fractions will increase. Increasing the size of fractions in the rock mass to 600-800 mm will increase the density of the mixture by 0.1-0.015 t/m3.

When developing stone quarries using explosions, it is possible to evaluate the grain composition of the resulting stone material using experimental optimal curves.

At the same time, one can also judge the effectiveness of the applied method of conducting drilling and blasting operations in a quarry, which ensures the production of stone material of the required grain composition. To obtain complete information on the grain composition of the stone material, experimental blasting should be carried out, in which the method of explosions will be determined to obtain the required fractions.

The “fish” of the stone curve for the thrust prism reaches up to 1000 mm in fraction, and according to the results of experiments on the experimental site, 200 mm, i.e. the given curve on the graph is the upper curve. To obtain data from the lower curve, it is necessary to carry out studies during the backfilling process at the construction site of the Pskem dam.

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