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Fastening of Pressure Slopes of Soil Dams under Conditions of Change Water Level in the Reservoir

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ABSTRACT: The article discusses the fastening of pressure slopes of soil dams operating in conditions of changing water levels in the reservoir. Calculations are given for determining required number of filter cups in the fastenings of the slopes of soil dams providing the required stability.

KEY WORDS: soil dam, slope fastening, filtration, filtration strength, filter cups, slope stability, rapid decrease in the water level in the reservoir,

I.INTRODUCTION

It is known that the fastening of pressure slopes of soil dams works in conditions of variable water level in the upstream. And as experience has shown in the operation of earthen dams of central Asian reservoirs in the slope mounts, cracking and destruction of the linings under the influence of a weighing filtration head took place.

In earthen dams composed of fine sand without gravel-pebble prisms (occurring in Central Asia), the fastening of the pressure slope is arranged in the form of reinforced concrete slabs of large sizes (10x10 and even 20x20 m each) with construction joints in 2.5 and even 5, 0. Temperature joints are made deaf with a width that provides free deformation of the plates during sedimentation of the dam and jamming of bitumen mastic.

Therefore, in order to ensure the reliability of the fastening operation on the perception of the main loads acting on the cladding, fasteners are often adopted, which is a cladding of monolithic concrete slabs with filter cups choked in it with check valves laid either directly on an earthen slope or on a sand and gravel preparation. They should provide a quick and organized exit of filtration water from under the slabs without soil suffusion and a decrease in filtration pressure during a sharp depletion of the water level in the reservoir. The disadvantages of this mount are the low reliability of its operation due to the rapid failure of the valves, the possibility of siltation, the complexity and high cost of manufacturing them in sufficiently large quantities.

II. METHODS OF RESEARCH

We have developed a new design of the cladding with filter cups and obtained a patent [1] which allows for an organized output of filtration water when the water level in the upper pool is discharged with specified costs from the concrete cladding to its surface and to reduce the weighing water pressure on the cladding to the acceptable values and exclude suffusion in soils. These conditions should be provided with sufficient sizes of glasses and their quantity in the area under consideration. The exclusion of the suffusion of the material of the dam body, the anti-filtration elements, as well as the loading layer is ensured by the correct selection of the material of the glass filters.

Need for filter cups should be established according to the criteria of the permeability of the dam body material or its anti-filtration elements and this reservoir operation mode according to the characteristics.

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$$P = \frac{KT}{\mu} \leq 200\ [m] \quad (1)$$

where μ is the coefficient of water loss of the soil of the body or anti-filter element of the dam;

K - coefficient of soil filtration of the dam body (m / day);

T is the time of the discharge of the water level in the reservoir.

At P> 200m, filter cups should not be done, because when the water level in the reservoir is triggered, a weighing head under the lining will not be formed due to the free outflow of filtration water.

The number of glasses is set depending on the permeability and size of the loading layer under the lining, the speed of air-blast reduction, the laying of the uphill slope and the dimensions of the live section of the glasses:
The feasibility of the device glasses is characterized by the criteria

$$\frac{K}{\delta} \geq 50[\text{days}] \quad (2)$$

where K is the filtration coefficient of the loading layer of the slope of the dam
δ - load thickness
So with a decrease in air-blast, the total working area of the living section of the glasses decreases, it is necessary to change the density of the network, increasing the number of glasses in the lower part of the lining. In this case, the lining should be divided by the height of the air-blast discharge into three zones.
The living cross-sectional area of glasses in one horizontal row of concrete cladding is calculated according to

$$\Omega = \alpha\delta\ell n^2 \frac{\vartheta}{Ki^2} \quad (3)$$

where α is a coefficient taking into account the zoning of the arrangement of glasses (for zones I-α = 1.05; II-α = 0.7 and III-α = 0.5);
l is the length along the front (m);
n is the porosity of the loading layer (in fractions of a unit);
ϑ - air-blast reduction rate;
i- is the gradient of the pressure of the filtration water under load (depends on the size of the uphill slope of the dam "m" and is taken equal:

$$i = \frac{1}{\sqrt{m^2+1}} \quad (4)$$

The filtration coefficient of the material of the load can be determined empirically or calculated by empirical dependence with the known particle size distribution

$$K = \frac{3{,}99}{\nu} \sqrt[3]{\eta} \frac{n^3}{(1-n)^2} D_{17}^2;\ \text{см/с} \quad (5)$$

η- is the coefficient of heterogeneity of the material of the load;
D_{17}- particle diameter of the soil of the load, less than which it contains 17% by weight;
N- is the kinematic viscosity coefficient of water cm2 / s (at a water temperature T = 100C ν = 0.0131 cm2 / s).

The porosity coefficient of the load is calculated according to

$$n = \frac{0{,}63}{\sqrt[6]{\eta}+0{,}63} \quad (6)$$

An example of calculating the number of glasses in the pressure slope of reservoirs.

Initial data. The loading layer of the upper slope of the dam is made of sand-gravel-pebble soils. Its thickness is δ = 2m.

The particle size distribution curve has the following characteristics: D_{10}=0,012 m, D_{17}=0,035 cm, D_{60}=2,2 cm,

$$\eta = \frac{D_{60}}{D_{10}} = 183 \quad \text{climbing} \quad m = 3$$

Glasses are made of circular cross-section with a diameter of 0.3 m.

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Determine the number of glasses by zone per unit area of the lining component along the length along the dam ℓ = 100 p.m. and the depth of air-blast operation h = 20 m, if the air-blast reduction rate is v = 1 m / day.

We establish the expediency of the device of glasses according to the criterion

To determine the filtration coefficient, we find the value of porosity from dependence (6)

$$n = \frac{0{,}63}{\sqrt[6]{183} + 0{,}63} = 0{,}23$$

From dependence (5) we determine the filtration coefficient of the material of the load:

$$K = \frac{3{,}99}{0{,}0131}\sqrt[3]{183}\frac{0{,}23^3}{(1-0{,}23)^2}0{,}035^2 = 0{,}21 sm/c = 182 \text{ m/hour.}$$

We find the criterion $\frac{k}{\delta} = \frac{182}{2} = 91\ hour$

Which is within acceptable values (>50). Therefore, the arrangement of glasses for a given dam in order to unload filter water from under the lining will be appropriate.

We break the surface of the cladding into three zones.

The length of the lining along the transverse profile of the dam within the prism of the air-blast discharge (h = 20 m) will be

$$\ell_1 = \sqrt{m^2 + 1}h = \sqrt{3^2 + 1} \cdot 20 = 63{,}2\, m$$

The dimensions of each of the 3 zones of the facing are taken equal to $\frac{\ell_1}{3} = 21\text{m}$

The gradient of the pressure of the filtration water under the lining is found according to

$$i = \frac{1}{\sqrt{m^2 + 1}} = \frac{1}{\sqrt{3^2 + 1}} \cong 0{,}32$$

III.CONCLUSION

Consequently, determine the living area of the glasses in a horizontal row at a length of ℓ = 100p.m. according to for zone I (lower)

$$\Omega_1 = 1{,}05 \cdot 2 \cdot 100 \cdot 0{,}23^2 \frac{1}{182 \cdot 0{,}32} = 0{,}6\, m^2$$

For the middle (II) and upper (III) zones, the cup area is, respectively: Ω2 = 0.4 m2 and Ω3 = 0.29 m2
The horizontal distance between the glasses is taken equal and calculated according to

$$a = \frac{\ell\omega}{\Omega}$$

Where $\frac{\Omega}{\omega}$ is the number of glasses horizontally

The living cross-sectional area of the glasses in our $\omega = \frac{\pi d^2}{4}$ case is $\omega = \frac{3{,}14 \cdot 0{,}3^2}{4} = 0{,}07$ m^2

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Having found the number of glasses horizontally for each zone (I-9, II-6, and III-4 glasses), we determine the step between them $a_1 = 2$ м, $a_2 = 17$ м, $a_3 = 25$ м.

Normally, to the axis of the dam, the step between the glasses "b" is taken from the estimated speed of air-blast reduction:
At ϑ = 1.0-1.7 m/hour b =5 m;
ϑ = 0,5-1.0 m/hour b =7 m;
ϑ = до 0,5 m/hour b =10 m.

The number of glasses by zone is set after determining the size of the zones and the distances between the glasses

In our case, the distance between the glasses along the normal to the axis of the dam is taken equal to b = 6 m.

In each zone I-III, we set $\frac{\ell}{3b} = 3$ a row of glasses.

The number of glasses in the zones will be:

$$\text{Izone}\frac{\Omega}{\omega}\cdot\frac{\ell_1}{3b} = 9\text{x}3 = 27; \text{II} - 18 \text{ and III} - 12\text{glasses.}$$

REFERENCES

[1]Fixing the slopes of the canal. Patent of the Republic of Uzbekistan No. 316 is published in bull. No. 2 of 1993
[2]Kosichenko Y.M., Shkulanov E.I. Lobanov G.L., Savenkova E.A., Korenovsky A.M. Design of antifiltration lining of drainage channels. Scientific review, Novocherkassk. 2011. 61 p.
[3] Tugay V.M. The influence of fluctuations in the water level in the channels on the stability of precast reinforced concrete. - Land reclamation and water management, Kiev: Urozhai, 1983, issue 58, pp. 59-63.
[4] Aravin V.I., Numerov S.N. Filtration calculations of hydraulic structures. – Publishing house: Goslitizdat for construction and architecture. 1955, p. 292.