European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 2 No. 5, MAY 2021,
ISSN: 2660-5562

METHOD FOR INCREASING THE SLOPE STABILITY OF HYDRAULIC FACILITIES

Khamdamov Bekmamat
Candidate of technical sciences, associate professor.
Safarov Fazliddin,
Khasanov Shamsiddin
Undergraduates of Tashkent state technical university named after Islam Karimov.

Article history:

Received: 2nd April 2021
Accepted: 21th April 2021
Published: 9th May 2021

Abstract:
The article provides literature analysis on the use and operation of hydraulic structures from reinforced soil. Methods and methods of fixing slopes of hydrotechnical structures of hydropower facilities are given. Conclusions and recommendations on the use of structures made of such materials in the hydraulic structures slopes.

Keywords: Hydraulic structures, reinforcing material, soil, concrete, lining, load, dam, anchor

INTRODUCTION.

In the hydraulic structures slopes of hydropower facilities after a certain time occurs for various displacement reasons of the structure or parts thereof in vertical or horizontal directions, which is called the structure deformation.

Deformations can be uniform or uneven, which can lead to cracking and even the structure destruction or part of a structure. Soil deformation occurs mainly by the slow creep process of the soil skeleton and filtration processes of water from the soil pores. All deformation types are related to the soil layers nature, their composition and properties.

The structures deformation occurs due to natural and man-made factors.

Natural factors include: compliance of rocks to various engineering-geological and hydrogeological factors, their freezing and thawing, change in hydrometric conditions, change in long-term temperatures, humidity and groundwater level, earthquake, etc.

Technogenic factors include: dead weight of the structure, due to an artificial increase or decrease in the groundwater level, changes in the rocks properties, carrying out various construction work types in the immediate vicinity of the structure, due to the hydropower units operation, the vehicles movement, etc. [8]

METHODS AND METHODS OF FASTENING THE HYDRAULIC STRUCTURES SLOPES OF HYDROPOWER FACILITIES

Fastening of the hydraulic structures slopes is carried out to protect them from the following influences:

- erosion by the current or wave of water in the pool or in the channel;
- destruction by floating objects or ice;
- erosion by the filtration flow of water flowing out of the soil pores, for example, when the water level in the canal drops or when waves roll back;
- destruction by wind;
- penetration of earth-moving animals;
- heaving of clay soil in winter or shrinkage in summer.

Currently, the following types of slope fastening are available:

Option 1 - fastening the slope with prefabricated reinforced concrete slabs (Fig.1.,a);

Option 2 - fastening the slope with monolithic reinforced concrete (with a thrust block made of precast concrete) (Fig.1.,b);

Option 3 - fastening the slope with monolithic reinforced concrete (without a thrust block);

Option 4 - fastening the slope with metal boxes filled with stone (fig. 1., c);

There is one drawback in these structures - the slope is not stable, in extreme cases (earthquake, flooding of ground water) can lead to the slope collapse on a circular-cylindrical sliding surface.

To increase the pliable slopes stability by means of reinforcement is from geotextile materials. Geotextile or other reinforcing material is laid in the dam body, dam slopes and embankment channels. The length of the reinforcing material and the height distance can be determined by calculation (Fig.2) [1,3]

Based on the measurement data, it is possible to approximately determine the finding of the maximum stress force:

1) on the surface of the wall, these forces are located at a distance λ from its front face, here λ= 0.3 H (H- wall height);
2) at the bottom of the wall, these forces intersect with an inclined line

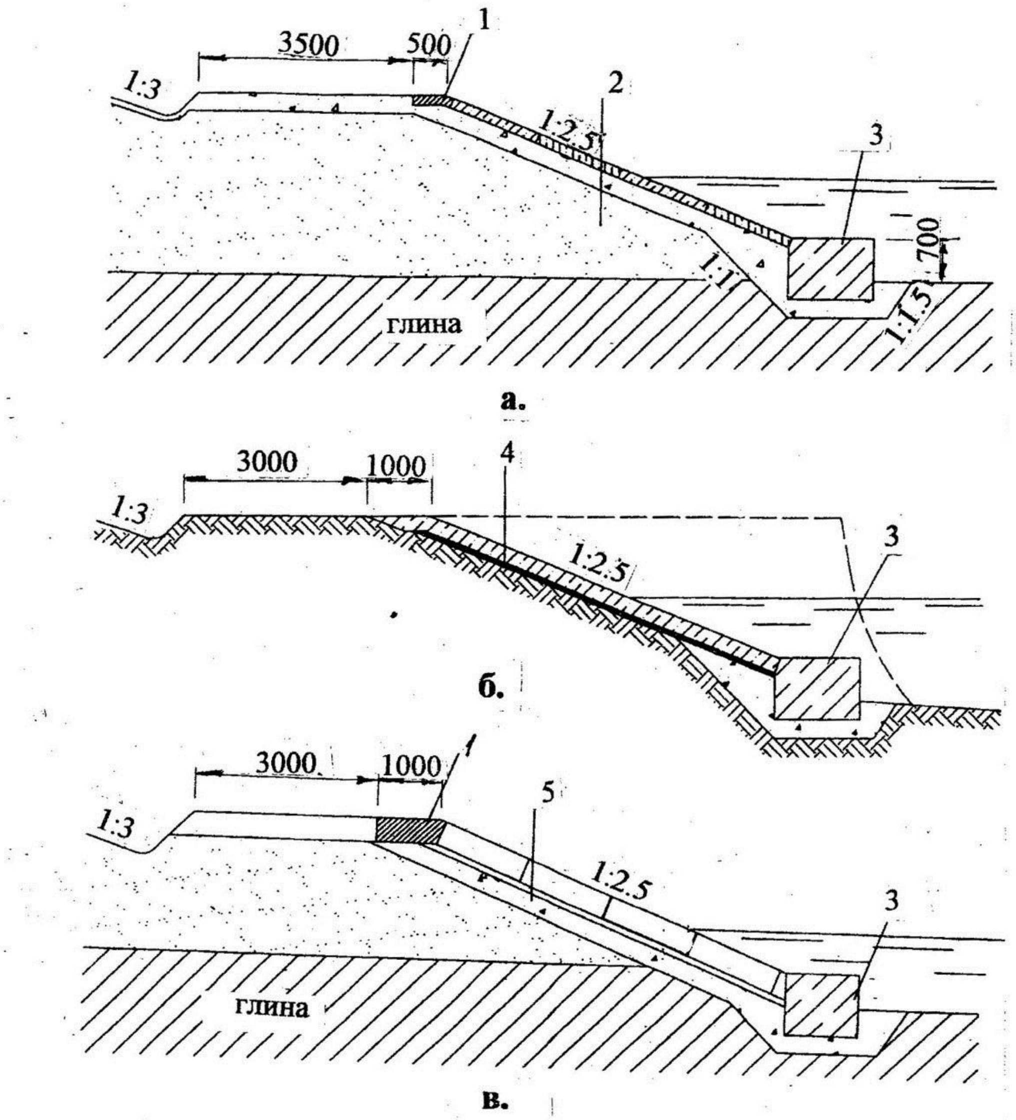

Fig.1. Fastening of slopes: a) with precast reinforced concrete; b) monolithic concrete; c) iron boxes: 1- monolithic reinforced concrete; 2- reinforced concrete slab PP-1.5, t = 160 mm on preparation from gravel-sand mixture t = 300 mm; 3- thrust block; 4 - monolithic concrete on two layers of preparation of gravel and sand, t = 150 – 200 mm each; 5 – metal boxes filled with stone in the preparation of crushed stone t = 100 mm from gravel-sand mixture, t = 300 mm.

at 450 angle to the horizontal.

The deviation of the maximum voltage value, as established by measurements, depends on the structure's deepening depth [2,4]

Determine the maximum number of reinforcement layers *n* from the ratio

$$n = \frac{T}{T_{max}}$$

here *T – is a* maximum horizontal force holding slope;

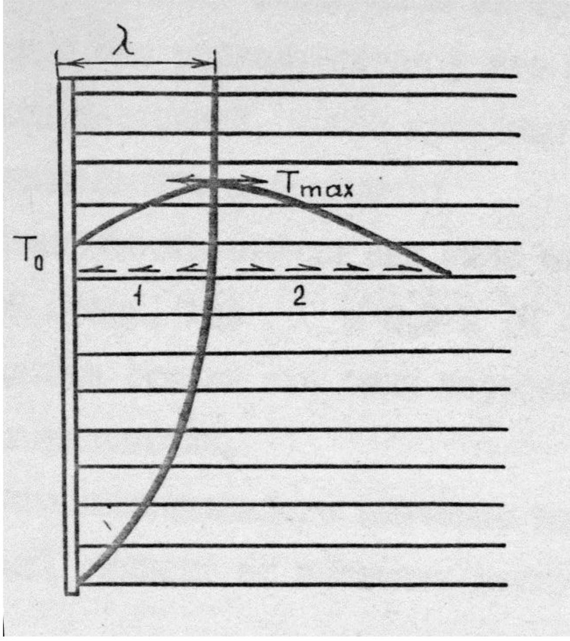

Fig.2. Distribution of tensile forces along the reinforcement:1- active zone; 2- resistance zone.

$$T = K_a \sigma_1 S_h S_v$$

here S_h and S_v- respectively, the vertical and horizontal spacing of the reinforcement; σ_1 – is a vertical stress caused by overlying soil pressure; K_a – is an active soil pressure coefficient.

T_{max}– is a maximum tensile force in the reinforcing element at H depth.

$$T_{max} = K_a \gamma H \Delta H$$

To prevent the destruction of the structures slopes, the following unconventional method of fastening the slopes is proposed (Fig. 3)

The difference between the proposed method and the traditional one is that, when using this method, we will obtain savings in building material and achieve a reduction in the construction period of the facility.

Such constructions can be used in the reconstruction of the cascade in Bozsu HPP during the construction of retaining walls, since the existing cascade of these HPP is located within the city limits of Tashkent, i.e. in cramped conditions, accordingly, the expansion of the construction pit is associated with the obstacle of existing communications, buildings and structures for urban purposes, which cannot be demolished. The use of such structures allows construction in cramped conditions without damage to the environment, which is a very important condition, from a technical and economic point of view, in modern construction in urban conditions [5,6].

Laboratory studies carried out by this article author confirm the above statements reliability [7,9].

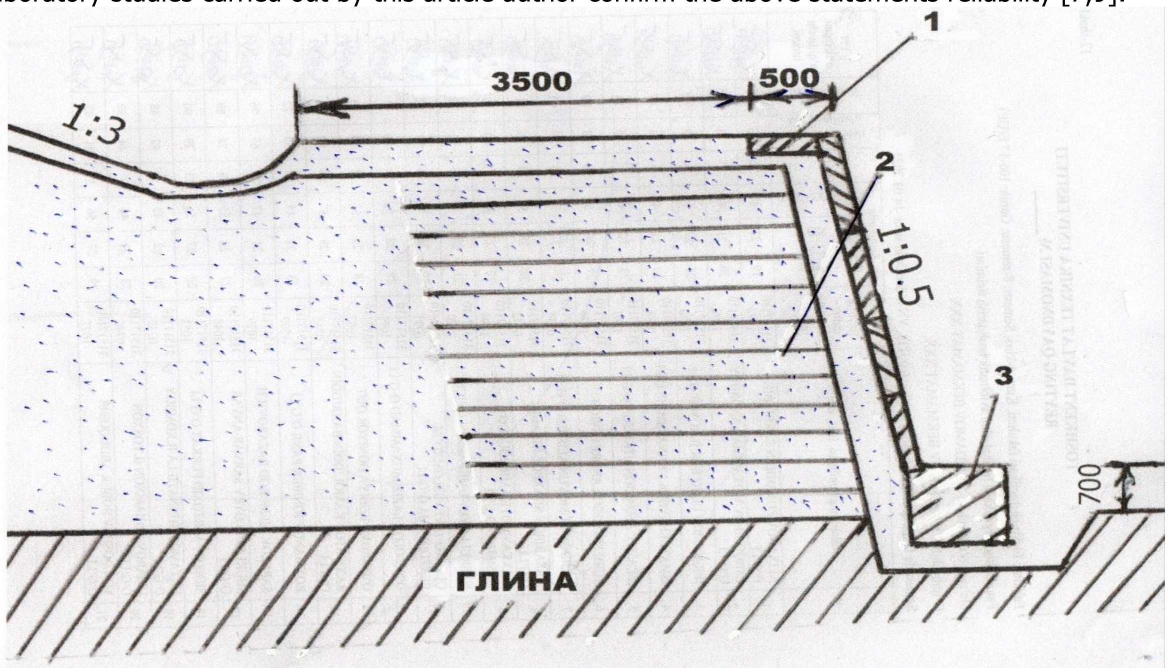

Fig-3. Proposed slope attachment option.

1- monolithic reinforced concrete, 2- reinforced slope, 3- thrust block

2-

CONCLUSIONS:

1. Due to the use of reinforcing elements, the structure slope becomes steeper, which will lead to a decrease in the earthworks volume.
2. Such structures can be used in settlements where construction work is carried out in cramped conditions.
3. These structures can be used for the reconstruction of the Bossuy HPP cascade, since these HPPs are located within the settlements

REFERENCES

1. Aksenov A.K., Shtikel D.Yu. Improvement of the methodology for determining the parameters of the interaction of reinforcement with soil in reinforced soil structures. M .: Proceedings of the Union. 1986. p.43…50.
2. Barvashov V.A., Voronel D.A. Reinforced soil structures. NIIOSP named after Gersevanov // Building and architecture. Building construction. M .: NIIOSP, 1984. Issue. 7.– 68p.
3. Vidal A. Reinforced soil in the body of a dam, embankments, (France). № 1933988, CL. 01p 1963-65.
4. Voronel D.A. Retaining wall made of reinforced soil with precast concrete outer cladding (Norway) // Building and architecture. E.I. Foreign experience. Issue 24. M.: 1984. –p. 15…17.
5. Khamdamov B., Khamdamov U.B. Reinforcement of earthen hydraulic structures using reinforcement. Materials of the international scientific-practical conference "Problems of increasing the efficiency of the use of electrical energy in the agro-industrial complex branches" TIIIMSH Tashkent 2018.
6. Hamdamov B., Ibragimova K. An unconventional method of erecting hydraulic structures from soil materials. Collection of materials of the I international scientific and practical conference "Actual problems of the introduction of innovative equipment and technology at enterprises for the building materials production, the chemical industry and related industries" May 24-25, 2019 4th volume. Fergana – 2019
7. Khamdamov B., Nizamov O.Kh., Shodibekova F.T. Laboratory research of models from reinforced soil. Architecture, construction, design, TASI, Tashkent, 2019.
8. Kaganov G.M., Rumyantsev I.S. Hydraulic structures. M. Energoatomizdat, 1994.
9. Oleg Glovatsky, B Hamdamov, Fakhriddin Bekchanov and Azamat Saparov. Strengthening technology and modeling of dams fromreinforced soil.PICSE 2020IOP Conf. Series: Materials Science and Engineering 1030 (2021) 012155IOP Publishingdoi:10.1088/1757-899X/1030/1/012155