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# Application Of Effective Technology To Increase Of Base Stability Of Low Pressure Hydrotechnical Constructions On Soft Grounds

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## ABSTRACT

An important issue is the construction of low-pressure hydrotechnical constructions in areas with difficult engineering and geological conditions, ensuring their strength and stability during operation, increasing base stability. This paper presents the option of applying effective technology in the design and construction of the ground of low-pressure hydrotechnical constructions in such areas without compromising the properties of the soil.

## KEYWORDS

Low-pressure hydrotechnical constructions, base, stability, soft ground, technology, reliability, safety, injection path, composite materials.

## INTRODUCTION

According to the current normative documents, low-pressure hydrotechnical constructions (HTC) are made of ground material on rocky grounds up to 25 meters in height and on non-rocky grounds up to 15 meters, as well as on concrete in rocky grounds up to 25 meters and non-rocky grounds up to 10 meters facilities. In addition, 50 mln. $m^3$ reservoirs used for reclamation purposes; construction of hydraulic, hydroaccumulation, thermal power plants up to 10 MW; irrigation and drainage facilities in reclamation systems up to 50 thousand; water transmission capacity 20 mln. $m^3$ of water canals and a complex of structures in them are also low-pressure HTC [1].

An important task in the operation of low-pressure HTC is to ensure the reliability and safety of their operation. However, the presence of accidents in low-pressure HTC is higher than in high-pressure and medium-

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pressure facilities, which is due to their unsatisfactory level of maintenance, lack or absence of workers, lack of funds for repairs, in some cases due to the owner and operator explained by the absence of.

Currently, 273 large and especially important water facilities are being operated under the control of the State Inspectorate "Davsuvkhojaliknazorat" under the Ministry of Water Resources of the Republic of Uzbekistan [2,3]. Their distribution by classes is shown in Figure 1.

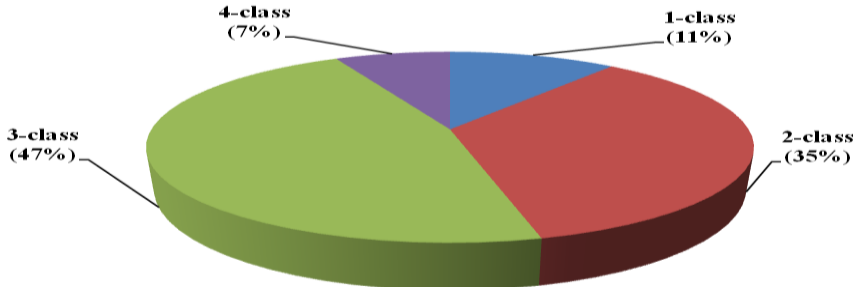


**Figure 1. Distribution of large and separate important objects by classes**

As can be seen from Figure 1, HTC of perfection class III-IV account for 54% of total constructions. The safety requirements for the largest and most responsible Class I-III HTC are fully met, while for Class IV HTC they are not fully met, and in some cases are ignored and not enforced in practices.

Many low-pressure HTC have been in operation for more than 50-60 years, which has led to a deterioration in their technical condition and, accordingly, to their reliability and safety [4].

According to statistics [5], there have been more than 300 accidents in class IV HTC in recent years. Due to the lack of proper control over the safety of low-pressure class IV HTC, the efficiency of working with this category of facilities remains insufficient or even low.

## METHODS OF RESEARCH

Most low-pressure HTC in Uzbekistan are built on non-rocky grounds, especially sand, sandy loam, loam, and so on. The practical tasks of non-rocky grouns are to predict and determine the strength of the soil, to determine the amount of deformation and stagnation of natural bases, the effect of ground pressure on structures.

One of the most difficult challenges in the Central Asian context is the construction of HTC on soft grounds, ensuring their durability and stability during operation. Construction on such grounds poses great challenges for designers and builders, as such soils are characterized by low strength and high compressibility when saturated with water. Therefore, the leading scientists and specialists in the construction of the

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foundation of the building are faced with the problem of saving material and labor resources in the preparation of the ground and the quality of the construction of the foundation.

In present time the importance of controlling soft grounds today, there is no well-developed and recognized computational method that addresses the preparation of bases and foundations for low-pressure HTC. Therefore, no significant structures have been built in such complex engineering-geological conditions.

## RESULTS OF RESEARCH

HTC floor preparation is one of the most labor-intensive and material-intensive parts of construction. According to a number of scientists and experts, the cost of preparing the ground and building foundations is usually 15-20% of the total cost of the structure, but in the case of complex soils it reaches 20-30% [6]. But when comparing the existing low-pressure HTC design work with current conditions, it became clear that these numbers are very high.

Injection reinforcement is now common to overcome the problems associated with soft grounds located on the ground of buildings. Reinforcement of soft grounds by injection of composite mixtures has been widely used in recent years in the preparation of industrial, engineering, civil and HTC grounds. Most often, this method is used to preserve and prevent deterioration by strengthening the soils in the ground of existing structures. A separate backwardness is observed in the field of hydraulic engineering construction. Cementing and bitumen of soils are successfully used to eliminate water inflow into the HTC pit.

The main advantages of composite material injection methods are technical simplicity and ease of use, as well as environmental safety. In addition, the method does not require complex equipment. One of the important shortcomings is the strength and waterproofing of the fortified soil after injection of the mixture, the unpredictability of the volume obtained, as well as the lack of normative documents that clearly define the calculated volume of the fortified soil. Another serious drawback is the high cost of imported high-dispersion cement used.

Anti-filtration curtains using composite materials are seen as one of the promising methods of application in the design of low-pressure HTC floors on soft grounds. In order to actively introduce the method into practice, it is necessary to substantiate its sufficient reliability in its design. Based on the accumulated experience, due to such measures it is possible to avoid the use of complex and expensive work on strengthening the ground and foundations of structures.

By injecting polymeric materials, it can be effective to ensure the stability of the soil in the ground by constructing anti-filtration curtains in the vicinity of the upper forebay by injection, i.e. in front of the apron (Figure 2). Although this method is proposed by the author, the options for constructing an anti-filtration curtain are based on a feasibility study. According to a number of scientists, the use of injection curtains has become

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widespread. The composition of mixtures is very diverse: clay-bentonite-phosphate, cement-clay-phosphate, bentonite-silicate-aluminate, silicate-aluminate.

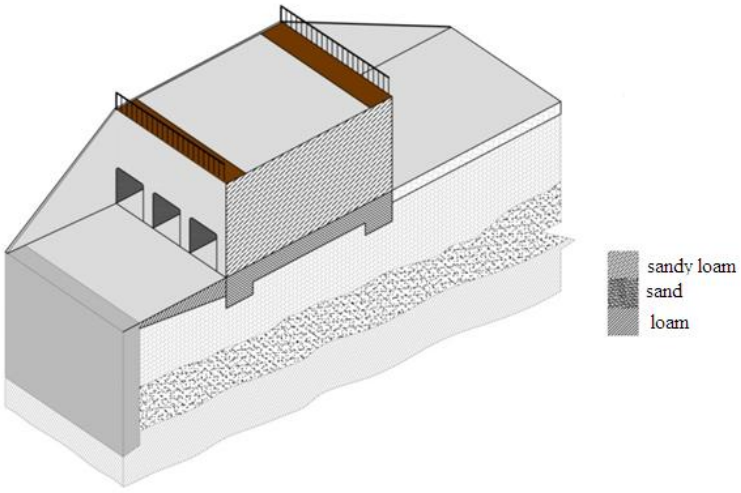


**Figure 2. Scheme of construction of anti-filtration curtains in front of the apron using composite materials**

Analyzing the above, injection molding of grounds can be considered as the most effective technological method of low-pressure HTC bases. During reinforcement, the various reagents introduced into the ground begin to harden, creating strong structural bonds between the ground particles, thereby increasing the strength and reducing the compaction of the grounds, as well as reducing their water permeability and sensitivity to changes in the external environment.

All injection molding work on existing structures should be carried out in accordance with the reinforcement project. Since exploration works, as a rule, do not provide complete and accurate information about grounds, their structure and properties, the formulation of injection molding and injection molding technology is produced in the process of driving reinforcing mixtures in close proximity to the object under study.

In addition, the issue of reducing the cost of materials used in modern construction is important. The main way to reduce their cost is the use of local materials, including primer-concrete treated with binder materials.

Injection reinforcement of grounds, which has long been known in HTC construction practice, is widely used and used as anti-filtration devices to improve HTC bases. Often, mud mixes are used to save cement mix. However, the depth of the clay mixture does not exceed 30 m, under which a cementing curtain is made. When it is necessary to know the depth of the structure of the ground, the filtration properties of the ground and the methods of calculation of the filtration of the HTC base - it is effective in the correct design of anti-filtration devices.

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## CONCLUSION

Reinforcement of soft soils by injection with composite materials has good results, such as technical simplicity, ease of use, low environmental impact, does not require complex equipment, in the design and construction of low-pressure HTC bases on soft grounds without compromising the properties of grounds. In general, anti-filtration technologies using composite materials are one of the promising methods of application in the design of low-pressure HTC bases on soft grounds.

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