

Elementary discussion on construction technology of foundation treatment for water conservancy and hydropower projects

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Abstract: Human life is inseparable from water resources, and human development is inseparable from electric energy. Water conservancy and hydropower project plays a very important role in all stages of human development, whether it is power generation, irrigation, flood control or drainage, which can not be separated from the construction of water and hydropower projects. This paper briefly discusses and analyzes the basic treatment construction techniques for water conservancy and hydropower projects, giving full play to the key role of water conservancy and hydropower projects in the development of national economy.

Keywords: Water conservancy and hydropower engineering; basic treatment; construction technology

1. Introduction

Water conservancy and hydropower project, in particular, is to make full use of the basic construction of water resources by making full use of the natural characteristics of the water body and making effective control through engineering construction or other ways. As we all know, water conservancy projects usually have the characteristics of long construction time and cost-intensive projects. Therefore, in order to guarantee the quality of water conservancy and hydropower project construction, it is imperative to place construction safety in a critical position during construction of water conservancy and hydropower projects, and to reduce construction costs as much as possible while guaranteeing construction safety. Water conservancy and hydropower engineering foundation construction is a fundamental construction in water conservancy and hydropower engineering^[1]. In the concrete construction, the construction unit must strengthen the construction cost, quality, efficiency and safety and other aspects of supervision and control, as far as possible to build the most good foundation for the construction of the project. In addition, in the construction of the foundation for water conservancy projects, it is usually necessary to excavate the foundation first. However, excavation must be carried out with the support of good external conditions. Conditions such as climate, weather and construction sites must all be considered. Therefore, in the process of foundation excavation, we must fully combine the actual conditions of water conservancy and hydropower project construction, and take relevant measures in different circumstances so as to ensure the orderly conduct of all parts of the project.

2. The important role of construction technology in the construction of water conservancy and hydropower projects

In recent years, all engineering constructions in China have made significant progress, and the construction of water conservancy and hydropower projects in China has also made significant progress. No matter which type of engi-

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neering construction, construction technology is the key method to guarantee the quality of the project, and it is also the same in the construction of water conservancy and hydropower projects. Only by mastering scientific and reasonable construction technology, can the quality of water conservancy and hydropower projects be guaranteed. Architectural engineering is a key part of hydropower and water conservancy projects. Therefore, in the formal construction of water conservancy projects, the relevant construction techniques must be used flexibly. Only by fully understanding and mastering the key technology in the construction process of water and hydropower project, and applying it to the construction of the project, can we guarantee the order, safety and rationality of the construction.

3. Specific requirements for basic treatment of water conservancy and hydropower projects

There are similarities and differences between construction methods of hydraulic engineering and building construction. In the process of water conservancy construction, we can learn from the construction technology to some extent, but at the same time, we should master our own unique construction method. In the construction process of water conservancy projects, construction safety must be guaranteed and no mistakes can occur. According to different terrain requirements, construction must be carried out in strict accordance with the construction plan. To ensure the healthy development of the surrounding environment of water conservancy projects, we should carry out the construction combined with the weather conditions and temperature conditions, so as to ensure the healthy development of water conservancy projects.

3.1 Stability of foundation

Water conservancy and hydropower projects have higher requirements for the foundation. We all know that if the stability of a project cannot be guaranteed, the quality of the project will also be affected. The load of buildings in water conservancy and hydropower projects is usually higher, so it may be influenced by many external factors during operation. According to the survey, in recent years, the common accidents in the construction of water conservancy and hydropower projects in China are caused by the instability of the foundation.

3.2 Pay attention to early preparation

As mentioned earlier, the construction of water conservancy and hydropower projects is different from other construction projects. During the specific operations in the construction process, many parts are more complicated. This requires that the relevant personnel must do a good job of preparatory work for the construction of water conservancy and hydropower projects. For example, water conservancy and hydropower projects are closely related to foundation^[2], and geological conditions are difficult to change. In addition, the structure of many buildings is very complex. If we want to carry out the basic treatment, we must proceed according to different construction conditions. Therefore, the basic process is also various and complex. Therefore, before the construction of water conservancy and hydropower projects, the relevant personnel must go deep into the construction site to carry out geological survey and record the data. In the process of engineering design, these data must be based on these data. Try to avoid error operation caused by erroneous inference and reduce engineering losses.

3.3 Do a good job of quality supervision

Water conservancy and hydropower projects have a certain degree of concealment. For the foundation part, the foundation construction is a very typical concealed construction. The main characteristic of concealed construction is that even if the current part of the work has been completed, it is difficult to carry out specific supervision and inspection. In the end, it is likely to lead to safety hazards until the problem is discovered. At this time in the want to carry on the later maintenance processing, but will be concerned about the whole body, the difficulty is bigger. Therefore, during the construction process, quality inspection and related control must be carried out.

3.4 Standardized drawing design

As we all know, no matter what kind of project is built, we need to design the construction drawings in advance according to the actual situation. In the process of engineering specific implementation, we must make full use of the design situation to carry out the specific construction operation. In addition, in order to fully ensure that the constructors can understand the intentions of the designers, we must show the data in detail when designing the concrete ones.

3.5 Guarantee the efficiency of construction

Under normal circumstances, in order to protect residents' water consumption, the construction efficiency of water conservancy and hydropower projects is relatively high. The construction of the project is under great pressure. In addition, the construction of water conservancy and hydropower projects has great influence on the surrounding environment. When we carry out the concrete development, we must make overall planning in advance. This requires the relevant construction units to choose the best quality construction plan and the highly efficient engineering equipment.

4. Effective way of water conservancy and hydropower foundation construction under current situation

Judging from the current situation, in the process of construction of water conservancy and hydropower infrastructure in China, the following two methods are mainly adopted:

First, if the construction site belongs to the shallow foundation, the operation is relatively simple without the need to lay the slope. Along the measured reference line^[3], a contour line of a groove edge can be cut, and the next operation can be carried out along the work surface.

Second, due to the heavy structural loads caused by the construction of water conservancy projects, it is necessary to ensure that the strength of the foundation can withstand the construction load during the construction. In order to achieve this requirement, we need not only to achieve effective demand for frost resistance, corrosion resistance, durability and moisture resistance of foundation. Besides, in order to fully guarantee the stability of foundation, it is necessary to make sufficient contact between the working face and the foundation.

5. Foundation reinforcement of water conservancy and hydropower projects

5.1 Concrete and reinforced concrete cast-in-place pile construction

Concrete and reinforced concrete cast-in-place pile is a way to directly form holes on piles. And the essential raw materials for perfusion are concrete and sand. Compared with prefabricated piles, the main advantages of concrete and reinforced concrete cast-in-place piles are that the construction operation is more convenient, not too much waste of building materials, and the cost of concrete or sand and stone is lower. But at the same time, there are certain defects in this method. It is very strict to the operation requirements. If there is slight carelessness, problems such as shrinkage holes and broken piles may occur, and the bearing capacity of the load is extremely poor. After a period of development, the piling technology of cast-in-place piles has been continuously improving. Concretely, the methods of pile forming mainly include the following steps:

The first is the drilling of the cast-in-place pile. That is to drill holes in the original pile position, then fill concrete in the hole.

The second is the excavation of the cast-in-place pile. In recent years, the construction industry in China has made obvious progress. The original single pile and pile group foundation usually have small diameter, which is difficult to meet the load bearing capacity and the requirement of settlement. Relatively speaking, the advantages of large-diameter cast-in-place piles are even more obvious. Many developed countries have long applied large-diameter cast-in-place piles to the construction of water conservancy and hydropower projects. The diameter of the large-diameter

cast-in-place pile can reach 1~3m, and the depth of the pile is much larger than that of 20m, and the depth can even reach 80m. This determines that the large diameter cast-in-place pile has a very strong bearing capacity.

The last part is the pipe pouring pile. Concretely speaking, the pipe pouring pile is the design of the combined pile, selecting a steel pipe with the same size, installing the pile boots on the one end of the steel pipe, and then hitting it under the ground by gravity. Then the steel frame is placed inside the steel tube, and then a part of the concrete is poured, the concrete is filled and the steel pipe is pulled out slowly on the other. Attention should be paid to the full use of its vibration to make concrete tamping when extubation. In addition, the vibration irrigation method is also a more commonly used method. Simply, it is to connect the side of the steel pipe to the vibration piling machine together, to install the valve tip at the other end of the steel pipe, and then add a feeding mouth to the upper part of the steel pipe, and then sink into the soil by the vibration force.

5.2 Construction of steel reinforced concrete prefabricated pile

We usually classify reinforced concrete precast concrete piles into hollow piles and solid piles. In comparison with the two types of piles, the strength of the hollow pile is higher and the centrifugal method is used in the production. In calculating its diameter, the diameter of the pile is standard, and the outer diameter of the pile is usually about 4500mm. The use of solid piles is more convenient and can be prefabricated at the construction site, with the feature of "be ready to do it at any time".

6. Intercepting seepage treatment

In the process of construction of water conservancy and hydropower projects, many external factors are gradually changing. Both the groundwater level and the temperature environment will have a significant impact on the construction conditions and other aspects. For example, if the location of groundwater rises during construction and the water flow is closer to the earth's surface, it will likely have a flushing effect on the water flow. This will damage the structure of the foundation to some extent, and problems such as infiltration, settlement and even deformation will follow. This situation is extremely bad for guaranteeing the quality of the project. Therefore, the construction company will take effective measures to prevent such problems ahead of schedule. Specifically, effective treatment methods include the following categories:

6.1 High pressure jet grouting

High pressure jet grouting, that is, a special type of nozzle is used, the grouting pipe is inserted under the soil layer with the function of the rig. After the initial determination of the position, the high pressure pump is used to help the cement slurry through the jet device under the lower part of the drill rod, and then it is spewed out at high speed and finally into the cutting soil layer. In this process, the surrounding soil may be damaged to a certain extent^[4], the drill rod will rotate continuously, and the speed is quickening. By stirring the cement slurry and the soil to achieve the full mixing of the two, the strength of this part of the foundation increases significantly after the gradual solidification.

6.2 Cut-off Wall

The construction of cut-off wall is to build a section of wall under the foundation. Now it has been widely used in seepage control and reinforcement works such as dams and river banks. According to the difference of building materials, the impervious wall can be concretely divided into two categories: cement cut-off wall and plastic concrete cut-off wall.

7. Conclusion

To sum up, the most important part of the construction of water conservancy and hydropower projects is the treatment of the foundation. The stability of the foundation is directly related to the safety of the whole project. In other words, if there is a hidden danger in the foundation, it will not only bring some unnecessary economic losses, but also

harm the safety performance of the construction. This requires that the relevant construction units should put the foundation treatment work in the primary position in the construction of the project, and do a good job of geological survey before the construction of the construction. In the construction process, each part of the operation must be carried out in accordance with the design drawings to ensure that the construction of the project meets the relevant regulatory requirements and do its utmost to ensure the quality of the water conservancy and hydropower project and provide a guarantee for the development of the construction industry in China. In the process of future development, it is also necessary for the relevant technical personnel to continue to explore and research, constantly improve the construction technology, and ensure the development of water conservancy and hydropower projects with a better prospects for development.

References

1. Wei Xu. Elementary discussion on foundation treatment technology of water conservancy and hydropower engineering [J]. *Technology and Enterprise* 2012; 22: 236.
2. Jianfeng Shen. Technical analysis of foundation treatment for water conservancy projects [J]. *Heilongjiang Water Conservancy Technology* 2012; 11: 123-124.
3. Zhen Wang. Yu Chen. Discussion on foundation construction technology of water conservancy and hydropower engineering [J]. *Jiangxi Building Materials* 2013; 02: 121-122.
4. Yunhai Shi. Elementary discussion on foundation treatment technology of water conservancy and hydropower engineering [J]. *Technology and Enterprise* 2013; 19: 202.