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# Construction Design of Slope Support Engineering in Water Conservancy and Hydropower Project

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**Abstract:** Slope support engineering is an important part of water conservancy and hydropower engineering, and its construction design plays a vital role in the safety and stability of the project. With the continuous development of water conservancy and hydropower project construction in China, the requirements for the construction design of slope support engineering are becoming higher and higher. Therefore, it is of great significance to deeply study and discuss the construction design of slope support engineering to improve the quality of the project and ensure the safety of the project. This paper mainly analyzes the construction design of slope support engineering in water conservancy and hydropower projects.

**Keywords:** Water conservancy and hydropower engineering; Slope support; Engineering construction; Construction design

## Introduction

In water conservancy and hydropower projects, slope support engineering is one of the key links to ensure the stability and safe operation of the project. With the continuous expansion of the project scale and the continuous progress of the technology, the construction design of the slope support engineering is particularly important. Slope refers to the slope formed by the undulating terrain or soft soil in the project construction, and its stability directly affects the overall safety and reliability of the project. Therefore, it is of great significance to fully consider the construction design of slope support engineering in the design stage to ensure the smooth progress of the project, improve the quality of the project and reduce safety accidents.<sup>[1]</sup>

## 1. The importance of slope support engineering construction design in water conservancy and hydropower projects

In water conservancy and hydropower projects, the construction design of slope support projects plays a vital role. The slope support project is to protect and reinforce the slope, ensure the stability and safety of the slope, prevent landslides, collapse and other disasters, so as to protect the downstream personnel, buildings and infrastructure from damage.

The importance of construction design of slope support engineering is mainly reflected in the following aspects:

### 1.1 Ensure the safety of the project

Water conservancy and hydropower projects usually involve large reservoirs, DAMS and hydropower stations and other important infrastructure, and the safety of these projects is directly related to the safety of life and property in the downstream area. Slope support engineering can effectively prevent slope instability, reduce the risk of landslide and collapse, so as to ensure the safe operation of the whole water conservancy and hydropower project.

### 1.2 Project service life

Slope instability will cause damage to infrastructure, accelerate aging, and shorten the service life. Through the appropriate slope support design, the slope deformation can be effectively controlled, reduce the impact on the infrastructure, so as to extend the service life of the project.

### 1.3 Reduce the maintenance cost

Slope instability will lead to frequent maintenance and reinforcement work, and increase the maintenance cost. Good slope support design can reduce the maintenance requirements and reduce the overall operating costs.

### 1.4 Protect the ecological environment

Slope instability not only threatens the safety of personnel and infrastructure, but also may cause environmental problems such as soil

erosion and water pollution. Slope support engineering can effectively control these negative effects and protect the surrounding ecological environment.

### **1.5 Compliance with the requirements of laws and regulations**

Many countries and regions have formulated relevant laws and regulations to standardize the design and construction standards of slope support engineering to ensure public safety. Excellent support design helps to meet the regulatory requirements and avoid potential legal risks.

In short, the importance of construction design of slope support projects in water conservancy and hydropower projects cannot be ignored. Careful design and implementation of high-quality support measures can not only ensure the safety of the project, prolong the service life, but also reduce the maintenance cost, protect the ecological environment, in line with the requirements of the laws and regulations. Therefore, in the process of water conservancy and hydropower engineering construction, we must attach great importance to the design and construction of slope support engineering.

## **2. Construction design of slope support engineering in water conservancy and hydropower project**

### **2.1 Slope stability analysis**

In the construction design of the slope support engineering, the slope stability analysis is needed first. This step is based on the comprehensive assessment and analysis of the stability of the slope based on geology, terrain and engineering conditions, so as to determine the appropriate supporting measures and design scheme<sup>[2]</sup>. The first step of slope stability analysis is to collect and sort out relevant geological survey data, including strata, topography, geological structure, rock and soil properties. Through the analysis of these data, we can initially understand the possible stability problems of the slope, and provide the basic data for the subsequent analysis. Next, the geomechanical analysis of the slope is conducted, mainly including the stability calculation and deformation analysis of the slope. In the stability calculation, strength theory or finite element analysis are usually used to analyze the force of the slope and evaluate the stability of the slope. At the same time, the impact of the external load (such as water pressure, earthquake, etc.) of the slope on stability. In deformation analysis, it is necessary to predict the deformation of slope, including displacement, deformation rate, to evaluate the stability of slope. In addition to the geomechanical analysis, the influence of the slope on the stability. Hydrogeological conditions include precipitation, groundwater level, river water level and other factors, which have an important influence on the stability of the slope. By analyzing these hydrogeological conditions, the stability of the slope can be evaluated more accurately, and the corresponding support measures can be determined.

### **2.2 Supporting structure design**

The design of the supporting structure must take into account the geological conditions, topographic characteristics, engineering requirements and feasibility of the slope to ensure the stability, reliability and economy of the supporting structure. First, the geological design of the support structure. This includes the investigation of strata, rock and soil properties, topography and landform, groundwater conditions and other aspects. Through the analysis of this information, we can understand the stability of the slope and provide the basic data for the supporting structure design. Secondly, the design of the supporting structure should choose the appropriate supporting form and structure type according to the specific situation of the slope. Common supporting structures include retaining wall, retaining dam, slope protection wall, slope protection network, etc. When choosing the support form, it is necessary to consider the slope height, slope, soil characteristics and engineering requirements comprehensively. For different types of slope, different forms of supporting structure may be needed to ensure its stability and safety<sup>[3]</sup>. In the design process of supporting structure, the selection and use of supporting materials should also be considered. The selection of supporting materials should be comprehensively considered according to the engineering requirements, geological conditions and economic factors. Common support materials include concrete, reinforced concrete, sand and stone material, slope protection network, etc. Choosing the appropriate supporting materials can improve the stability and durability of the supporting structure, but also can reduce the project cost and maintenance cost. In addition, in the supporting structure design, but also need to consider the construction technology and construction method. Reasonable construction technology and construction method can improve the construction efficiency of the project, reduce the construction risk, and ensure the quality and safety of the support structure. Therefore, in the design process needs to fully consider the actual situation of the construction, to determine the appropriate construction technology and construction method.

### **2.3 Material selection**

In water conservancy and hydropower projects, in the construction design of slope support projects, material selection is a crucial link. The selection of suitable materials can directly affect the stability, durability and economy of the supporting structure. Therefore, the geological conditions of the slope, engineering requirements and the performance characteristics of the material should be fully considered in the selection of materials. First of all, it is necessary to choose suitable supporting materials according to the geological conditions of the slope and

the design requirements of the supporting structure. Common support materials include concrete, reinforced concrete, sand and stone material, slope protection network, etc. Concrete and reinforced concrete are usually used in large-scale, higher requirements of supporting engineering, with strong compression and tensile resistance, can effectively improve the stability and durability of the supporting structure. Sand and stone material is often used as filling material or cushion material, which can effectively reinforce the slope and improve the bearing capacity of the supporting structure. Slope protection network is usually used for the protection of slope surface, which can effectively prevent the landslide and erosion of soil and improve the stability of slope. Secondly, the properties and scope of application need to be considered. Different materials have different performance characteristics, such as compressive strength, tensile strength, impact resistance, weather resistance, etc. According to the specific requirements and environmental conditions of the project, the materials with appropriate performance characteristics are selected to ensure the stability and durability of the supporting structure. At the same time, it also needs to consider the availability and cost of materials and other factors to choose economic and practical materials<sup>[4]</sup>. In the selection of materials, the construction technology and construction method of materials also need to be considered. The construction technology and construction methods of different materials may be different, so we need to choose the appropriate construction technology and construction methods according to the actual situation, in order to ensure the construction quality and safety of the supporting structure.

### 3. Tag

To sum up, the construction design of slope support engineering is an indispensable part of water conservancy and hydropower projects. Through reasonable design and construction, the project can effectively improve the safety and stability of the project, to provide a guarantee for the smooth implementation of the project. It is hoped that the construction design of slope support engineering can provide some reference for the design and construction of related engineering.

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