

# Research on Application of Diversion Technology in Construction of Water Conservancy Projects

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**Keywords:** Water Conservancy Projects; Diversion Technology; Construction Quality; Application Research

**Abstract:** With the continuous development and progress of the times, the construction of water conservancy projects has become more mature. It can better solve the problems caused by water shortage. Practice has shown that the introduction of diversion technology in the construction of water conservancy projects can provide a favorable guarantee for the construction quality of projects <sup>[1]</sup>. In order to improve the quality of projects, this paper analyzes the application of diversion technology in the construction of water conservancy projects, and explores its influencing factors during construction.

## Introduction

Water resources in the world are scarce, and China is also one of the countries with water shortage. The use of water resources has become the focus of social attention and affects the development of society. In order to alleviate the pressure of water resources, the country has invested a lot of financial and material resources in the construction of water conservancy to ensure the support of diversion technology, and strengthened the construction of water conservancy projects with the reasonable use of river trend for drainage to ensure the stable development of the country.

## 1. Significance of Water Diversion Technology in the Construction Quality of Projects

The policy of reform and opening up in China has developed, and the level of the national economy has been greatly improved, and the rational use of water resources has become a major problem at the moment. There are still many deficiencies in the construction of water conservancy in China, and the problem should be solved according to local conditions. The use of diversion technology can effectively make up for the defects in the construction, and successfully carry out the construction of water conservancy projects and ensure the development of water resources and electric power. The daily life of residents and the production and development of industries are inseparable from water resources. Only by ensuring sufficient water supply can the basic daily life of people be guaranteed <sup>[2]</sup>. Therefore, it is necessary to conduct research on diversion technology. The use of diversion technology in water conservancy projects can effectively promote the smooth completion of construction.

## 2. Brief Introduction of Diversion Technology

Diversion technology refers to the water conservancy technology used in the construction of water conservancy projects to maximize the flow of water in accordance with the originally planned route. Introducing diversion technology to water conservancy projects can reasonably control and utilize running water to ensure the quality of water conservancy projects. Diversion technology is composed of river closure and drainage. The main characteristics of the cited diversion technology during the construction of water conservancy projects are three aspects. The first element to be considered is the reasonable selection of dam construction site, which needs to be considered in conjunction with the local geographic characteristics and comprehensive conditions, including the

difficulty and period of construction; the second element is to determine the construction plan. When considering the dam construction site, it is also necessary to consider whether the construction plan is feasible to make the project layout and division of labor reasonable, and to determine whether diversion technology is needed in the project; the third factor is that after the construction site and scheme are determined, the use of advanced technology is scientifically used to assist construction, improve construction efficiency, and promote the development of water conservancy projects<sup>[3]</sup>.

### **3. All Types of Water Discharge by Cofferdam Method in the Whole Section of Water Conservancy Project**

#### **3.1 Brief Introduction of Channel Diversion**

Channel diversion is to excavate channels on the bank or beach of the river and build transverse cofferdams at the upstream and downstream of the foundation pit, so that the river flow through the channels from top to bottom. It is mainly suitable for construction projects with narrow riverbed and inconvenient stage diversion, large diversion flow but poor geographical environment conditions, navigation, ice discharge and timber passing requirements during construction. The method of channel diversion is convenient, but some matters should be paid attention to. The first choice for diversion is to be placed in an open and spacious place, which is conducive to the development of water conservancy projects. The basic requirement of channel diversion is that running water is unobstructed without any obstruction of foreign matters to ensure normal discharge. Therefore, the width of the channel bottom should be less than the turning diameter of the channel, and it is better to be less than five times of the turning diameter of the channel to ensure smooth flow. The axis of the channel body is more prominent than the cofferdam to effectively avoid water impact. The axis of channel shall be set well, and its length shall be well controlled, as well as the depth of the excavated channel. The most suitable depth is to make the entrance and exit of the channel exactly level with the upstream effluent, and the direct angle between the main channel and the open channel shall not exceed 30 degrees. The channel constructed shall be set strictly according to the standards of no scouring and no silting, and its position and shape shall be adjusted continuously after the structure of the inlet and outlet is determined. When excavating downward, the quantity shall be increased and the exist of channel shall be raised<sup>[4]</sup>.

#### **3.2 Brief Introduction of Tunnel Diversion**

In general, the method of tunnel diversion is only needed in the place where there is a tunnel, and the length of the tunnel line should be reduced when selecting the diversion position of the tunnel. When the dam site is in the river bay, the tunnel line is suitable to be arranged on the convex bank side. Generally, the tunnel axis is set in a straight line way, while a few are set in a curve way. When the axis is a curve, it needs to ensure that the diameter of the tunnel is smaller than the radius of the bend, but its diameter is larger than the width of the tunnel. A straight line shall be set at the first position where the bending degree of the tunnel is less than 60 degrees, and the length of the straight line shall be greater than the diameter of the tunnel to ensure the smooth flow of water. The angle between the entrance and exist of tunnel and the flow is more than 30 degrees. The angle can be adjusted according to the specific situation of the flow. The tunnel bottom should be designed according to the actual needs. It can be gentle slope or steep slope to avoid the existence of reverse slope.

#### **3.3 Brief Introduction of Culvert Diversion**

The method of culvert diversion is adopted to ensure that there is no leakage between the dam body and the outer wall of the culvert during the construction of water conservancy projects to ensure smooth diversion. In order to reduce the seepage flow, throttling can be set on the outer wall of the culvert to cover the whole culvert to ensure the flow speed. Culvert pipes are in the environment of being washed by large flow of water for a long time, so it is necessary to ensure that

pipes are in good condition before diversion. Once water seepage is found, the pipes shall be blocked immediately. When the water seepage is serious, it is necessary to guide and drain the pipes in time to ensure the sealing of pipes.

#### **4. Main Factors To Be Considered In the Application of Diversion Technology in the Construction of Water Conservancy Projects**

The introduction of construction technology into water conservancy projects requires consideration of various factors. A complete construction project requires an on-site inspection in advance. Cofferdams and other construction methods are used to effectively maintain the foundation pits in the project. Scientific drainage will create a good geographical environment for the smooth construction of water conservancy projects efficiently. The above are a brief introduction of some factors influences construction, which will be analyzed in detail below.

##### **4.1 Influencing Factors of the Geological Environment in the Construction Area**

During the entire period of the completion of water conservancy projects, members of the construction project consider the geological environmental factors on both sides of the river and the river bed when thinking about the efficient scheme of construction with diversion technology, and carry out without affecting the construction site of the building. Under normal circumstances, rivers have the characteristics of weathering thin layers. The rocks are extremely hard and have the capacity of pressure resistance, and tunnel diversion should be selected for construction. In addition, when the weathered rock layer in the river is extremely thick and easily broken, and the sedimentary layer on the beach is thick, and channel diversion can be selected for construction [5].

##### **4.2 Influencing Factors of Terrain Conditions in the Construction Area**

In the construction of water conservancy projects, it is also necessary to take advantage of the regional terrain. In general, when there are natural rock islands and sandbar geological conditions on the riverbed, the construction of sub-cofferdam method shall be adopted to realize the diversion of water conservancy projects to effectively promote the cofferdam diversion. This method is most suitable for the arrangement of longitudinal cofferdams. When the construction conditions are steep on both banks, the upstream section of the river is wide and the downstream section is narrow, and the overall structure has hard rocks, and it cannot be started in stages in this area, tunnel diversion can be used for construction. Finally, the plains or the banks of the river are flat, and the old rivers left by history can be used to take advantage of geographical advantages for construction. And the construction can be carried out smoothly by directly adopting channel diversion.

#### **5. Application of Diversion Technology in the Construction of Water Conservancy Projects**

The application of water conservancy projects is beneficial to the people, and each project must ensure its quality. When constructing, we should make reasonable use of the geographical location and its characteristics, clarify the construction plan, review the distribution of nearby buildings and the amount of water inventory and water in the lives of the surrounding people, and divide the appropriate water conservancy channels.

##### **5.1 Diversion outside the Riverbed**

The external diversion of the riverbed is the whole section of cofferdam. It contains three diversion techniques, namely channel diversion which can greatly reduce the construction cost and improve the construction efficiency; tunnel diversion with high construction cost and low discharge. A kind of engineering technicians spend a lot of energy on combining it with a permanent tunnel, which can also achieve the effect of low cost and engineering volume; culvert diversion, named as diversion of cement pipes, which are suitable for low water flow or use in dry seasons. It can greatly improve the efficiency of water transportation and reduce water loss. The cost of this technology is small, but the quality of construction and materials should be strictly controlled to achieve a

positive effect<sup>[6]</sup>.

## **5.2 Diversion within the Riverbed**

Diversion within the riverbed is the segmented cofferdam. It is used to maintain buildings in running water and takes time and batches. And it is generally used in water conservancy projects with large water flow and wide containers and long construction periods, which can provide many conveniences for other constructions, and then the constructed drainage buildings will be discharged.

## **6. Effect of Application Diversion Technology in the Construction of Water Conservancy Projects**

The construction technology of water conservancy projects is also changing with the development of the times. The national construction of water conservancy is due to the needs of social development, and diversion construction technology is the core part of water conservancy projects. Only by continuously improving the comprehensive quality and innovative ability of technical personnel can the working team actively forge ahead, innovate, and comprehensively improve the construction technology to promote the sustainable development of water conservancy projects in China. The country attaches great importance to science and technology, and has invested heavily in it. It has always firmly believed that science and technology is the primary productive force. Only with funds can we provide support for scientific researchers to study technology from other advanced countries and learn from other advanced cases to improve the development of water conservancy construction technology in China. In addition, the training of professional talents should also be paid attention to. Technicians need to enhance their professional knowledge and professional accomplishment, and accumulate working experience in continuous learning and practice. The long-term cycle of step-by-step working mode will form the inertial thinking, which is not conducive to the cultivation of innovative thinking of professional talents. We should take more effective measures to the construction of water conservancy projects, do publicity for the water conservancy specialty, and recruit talents and change a layer of constant construction style, to promote the development of water conservancy projects.

## **Conclusion**

At present, the development of water conservancy projects in China is becoming more and more perfect. Diversion technology can effectively promote the completion of water conservancy projects and ensure their quality. The current development is far from enough. Only by continuously introducing innovative thinking and technology, can the construction of water conservancy projects be continuously developed. In addition, we need to continuous learn and think to improve the comprehensive quality of professional talents and promote the development of water conservancy industry.

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