Application of Diversion Construction Technology in Hydraulic Engineering Construction

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Abstract. Since the reform and opening up, China's various construction undertakings have developed rapidly, especially the water conservancy engineering undertaking. As a basic industry for national economic development, it has achieved leapfrog development. Water conservancy projects play an important role in the development of China's industry, agriculture and people's daily life, it can promote the development of production and life, and improve people's quality of life. Diversion construction technology is a widely used and important construction technology in basic water conservancy projects. It can reduce the impact of water flow during the construction process by using related technical measures, while ensuring the quality of water conservancy projects and improving the construction efficiency of the entire project. And other aspects have played an important role that cannot be replaced. This paper started with a brief description of diversion construction technology, and then studied the application of diversion construction technology in water conservancy projects.

1. Introduction
In recent years, the continuous development of science and technology improve people's living standards, China's water conservancy construction industry has also made rapid development in the context of this rapid economic development, especially in the construction technology and materials of water conservancy projects. The construction technology of water conservancy projects is the key to the development of water conservancy projects [1]. The construction technology of water conservancy projects in China has been greatly developed in recent years, especially the widespread application of diversion construction technology in water conservancy projects, which has quickly promoted water conservancy projects The speed of construction has increased the scale of water conservancy projects, promoted the development of water conservancy projects in China, and promoted the further development of China's national economy [2].

Construction diversion is an important part of the design of water conservancy and hydropower construction organization, and is also a general term for river flow control during construction. The construction of hydropower projects is constrained by changes in river water flow. The role of construction diversion is to control the water flow and form a dry land for the project. It runs through the entire construction process [3]. Relevant practice has confirmed that the quality of diversion construction technology would directly affect the construction quality of water conservancy projects. Applying it to water conservancy projects can effectively mitigate the impact of water flow on water conservancy projects during the construction process, which will make water conservancy projects change more capable good construction. Therefore, in the construction process of water conservancy projects, reasonable and scientific application of diversion construction technology can effectively
improve the quality of the project [4].

2. Diversion construction technology
In the construction of water conservancy projects, diversion construction technology refers to a kind of hydraulic guidance technology, that is, the use of this technology to divert the water flow in the construction area, which aims to provide a favorable construction environment for water conservancy construction and to avoid the impact of water flow on construction operations. The application of construction technology can effectively raise the construction quality and construction efficiency of water conservancy projects into a new level.

2.1. Diversion of the entire cofferdam method
In water conservancy projects, if the difficulty of segmented diversion is more difficult, the commonly used diversion technique is the full-section cofferdam method. During the construction process, the full-section cofferdam method takes a one-time interception of the main river channel, and at the same time, it is necessary to build drainage facilities on both sides of the river channel to timely divert the intercepted water flow. The three most commonly used cofferdam diversion methods in hydraulic engineering construction are described below [5].

(1) Open channel diversion
Open channel diversion construction technology usually digs some channels at the river bank, and then uses these channel foundation pits to cofferdam upstream and downstream of the river water, allowing the river water to drain in real time through the corresponding channels to achieve the purpose of diversion. Generally, in the construction of rivers or valleys in plain areas, open channel diversion is often used as a construction technique. Since the riverbed in these dam sites is generally narrow or the river water is shallow, the use of open channel diversion can not only ensure Construction quality and effective control over construction costs [6]. In addition, in the actual water conservancy construction, the application of open channel diversion construction technology should pay attention to the scientific and reasonable excavation of the open channel lead, the axis setting of the channel, and the construction of the entrance and exit positions, so as to ensure the safety and reliability of water conservancy construction quality. As shown in Figure 1.

(2) Culvert diversion.
Culvert diversion refers to the construction of some drainage structures through reinforced concrete. This construction technology method greatly improves the strength of water conservancy projects to a certain extent, not only effectively saving material investment costs, but also very cost-effective. However, due to the difficulty of constructing reinforced concrete in water conservancy construction, the culvert diversion technology is generally mainly used in some earth dam projects or rockfill dam
projects. At the same time, the technology is mostly used in the dry season or in the construction environment with small water flow. Application designed to ensure the overall quality of hydraulic construction.

(3) Tunnel diversion.

Generally, in the construction of water conservancy projects in mountainous areas where the terrain is relatively complicated and the water flow is relatively small, tunnel diversion construction technology is applied more often. Compared with the previous two types of full-scale cofferdam diversion technology, the tunnel diversion technology has a relatively high construction cost due to its harsh construction environment, and its diversion capacity is not very good. Therefore, in some water conservancy projects that need to be discharged during the flood season, the method of submerging the foundation pit should be adopted first to carry out the construction work, rather than the diversion construction technology.

2.2 Diversion by section cofferdam

Generally, in the early stage of construction, the river flow is discharged by reducing the width of the river channel, and then the drainage structure is used to discharge. This method is generally applied to the construction environment with large river water flow, long construction cycle or large groove width. At the same time, when the section cofferdam method is used for drainage, the river water flow needs to be investigated in advance, especially for some drainage. In addition, during the construction process, a reasonable division of labor should be carried out according to the actual construction cycle plan to ensure that the construction of water conservancy projects is carried out in an orderly manner within the prescribed period of the project to prevent water impact from affecting construction equipment, as shown in figure 2.

![Figure 2. Diversion method of segmented cofferdam](image)

2.3. Selection of diversion scheme

A complete diversion scheme is constrained by many factors. Technical and economic comparisons must be made and determined after repeated demonstrations. These factors are shown in Figure 3.

![Figure 3. Factors Influencing Diversion Scheme Selection](image)
Hydrological conditions. The magnitude of river flow, the characteristics of the flow process line, the extent of water level changes, the duration of floods and dry water, and the drift ice and freezing conditions in winter are all important factors that directly affect the selection of diversion schemes. For example, rivers with large water level changes sometimes need to use water cofferdams to allow the foundation pit to be flooded for short-term flood diversion. For rivers with drift ice in winter, full consideration must be given to the issue of drift ice release.

Terrain conditions. The riverbed and cross-strait topography in the construction area have a significant impact on the diversion scheme. For example, if the river is wide and navigation, it is required during the construction period, staged diversion should be used. For riverbeds that are narrow, bank walls steep, and river valleys deep, tunnel diversion should be used.

Engineering and hydrogeological conditions. When selecting a construction diversion scheme, the economic rationality of the tunnel or open channel diversion, the possible narrowness of the river bed, the structure and construction method of the cofferdam, and the measures for drainage of the foundation pit must all take into account the engineering geology and hydrogeology. For example, for deep overburden and highly permeable riverbeds, the issues of cofferdam foundation's impact resistance and seepage prevention must be properly solved. Under the navigation conditions, the beam narrowness of the riverbed during staged diversion is allowed to be larger.

Comprehensive utilization of rivers. During the construction period, in order to meet the requirements of navigation, log crossing, water supply, drainage, irrigation, etc., the construction diversion problem was complicated. For example, in the case of diversion by stages, the narrowed river channel must meet the requirements of navigable flow velocity, slope drop (longitudinal slope, transverse slope, local slope drop), flow regime and current flow connection, and sometimes a temporary lock is required; When storing water in the hole, paying attention to the downstream navigable water level and the normal water needs for irrigation, water supply, hydropower stations, etc. For fishery production, fish facilities must be considered.

Construction schedule, construction method and site layout. When selecting a diversion scheme, it is necessary to consider factors such as social impact, supply of construction equipment and building materials and construction experience, and strive to simplify construction diversion projects, reduce costs, and shorten construction periods on the premise of ensuring safety. For important construction diversion projects, necessary model tests or computer simulation calculations must be carried out, sufficient comparison and demonstration must be made.

3. The main factors affecting the diversion of water conservancy projects

3.1 Hydrological factors
Hydrological factors are one of the most important natural factors affecting diversion, because the main object of diversion construction technology is to control and divert water flow, and the direct effect is water flow. Therefore, the natural hydrological environment will directly affect the use of diversion construction. During the construction process, construction technicians must have professional quality and ability to make accurate judgments on water flow characteristics such as water quality and depth, so that the diversion construction technology can be more effectively used. If the influence of hydrological factors is ignored, it will cause serious, and the loss will even threaten the life safety of construction workers.

3.2 Terrain and geomorphic factors
Terrain and geomorphic factors will also affect the diversion construction in water conservancy construction. Therefore, the investigation of terrain and geomorphology is also critical. Before diversion construction, the ideal construction environment should be selected. If the terrain and landform are not reasonable, it will greatly increase the difficulty of construction. So, before construction, the local topography and landform features, rock hardness, narrow river bed and steep slope, etc. should be investigated. The construction requirements of the diversion technology should be mastered, and the
selection of appropriate operation methods can reduce the impact of the topography.

3.3 Geological factors
During the construction of diversion technology for water conservancy projects, one of the important factors affecting its construction is the geological factor. The geological environment will have an influence in all aspects of the construction, and this effect will make the direction and size of the diversion difficult. This effect is difficult to overcome. Therefore, it is necessary to conduct a detailed survey before construction, and research and solve the trouble caused by such geological factors in advance, so that it can be found in a timely manner when a hazard occurs.

4. Improving the technical route of diversion construction

4.1 Increase investment and innovative technology
In the continuous development and reform of water resources and hydropower projects, the technology is continuously progressing. In different geographical environments, different diversion technologies can be used to guide and control the flow of water in accordance with different construction requirements, so that the quality of water conservancy projects can be protected from water flow. With the development of water conservancy and hydropower projects today, we must continue to study better diversion technology and apply more advanced equipment to the diversion technology to provide guarantee for the quality of water conservancy and hydropower projects. Government departments should attach great importance to the research of diversion technology, invest more manpower, material resources and financial resources for research, so that this technology can be more efficient, suitable for more environments, learn advanced experience from developed countries, and carry out this technology.

4.2 Cultivating talents and mastering knowledge
The quality of talents restricts the development of society. Similarly, talents also affect the overall construction level of water conservancy projects. It is necessary to strengthen the training of water conservancy talents. In the water conservancy engineering industry, there is a lack of high-tech talents, and the diversion construction technology stays at the original level. Therefore, we must pay attention to the training of talents, mobilize the enthusiasm of technical backbone talents, give play to subjective initiative, lead employees to learn diversion construction technology and other letter construction experience, and promote innovation in water conservancy technology.

5. Conclusion
Diversion construction technology plays an important role in the construction of water conservancy projects. The full use of diversion construction technology in the construction of water conservancy projects is conducive to the construction enterprises to improve the quality of water conservancy projects, reduce the cost of water conservancy projects, and increase the construction units Economic benefits. Strengthening the analysis of the diversion construction technology and the detailed introduction of the applicable conditions and layout of the diversion can give a more scientific and clear understanding of the application of the diversion construction technology, which is conducive to the further development of the water conservancy cause. Advanced science and technology determine the overall strength of a country. Therefore, we should make full use of advanced science and technology, introduce more water conservancy scholars, and develop diversion construction technologies that are more in line with China's national conditions.

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