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ARTICLE

Study on Hydrological Engineering Geological Conditions and Anti-leakage Measures

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ABSTRACT

With the continuous development of economy and society, people's ability to transform society has been improved. To break the constraints of hydrological and climatic conditions, some hydrology and water conservancy projects were constructed to meet the needs of human activities. In the construction of hydrological engineering, geological conditions are first surveyed to determine whether there are significant geological structure problems, in order to enhance the stability of hydrological engineering and reduce the probability of hydrological engineering leakage.

1. Introduction

Hydrological engineering geological investigation is an important preparatory work in the construction of modern large-scale projects. The hydrogeological conditions of the project area were investigated in detail to prepare for the engineering design and subsequent construction. Therefore, in the actual situation, the quality of the survey work of hydrogeological geological conditions will directly affect the quality of the project construction. This requires relevant personnel to pay attention to the importance of hydrological engineering geological investigation work, clarify the purpose of hydrological engineering geological investigation, and have a basic understanding of the relevant precautions in the exploration process [1]. After completing the exploration of the hydro-engineering geological conditions, the anti-criteria operation in the engineering construction process is discussed for specific hydrological conditions.

2. Basic Methods

Generally, the basic methods used in the detection of hydrogeological conditions are mainly pumping test and test pit seepage test. The pumping test is mainly used to measure the water content of a certain area and the substances contained in the water. This test method is generally used in water wells or in boreholes, and the pumped water is brought to the laboratory for testing to clarify the various substances contained in the water, so as to provide a reference basis for the use of subsequent hydrological resources. First, infiltration test refers to the excavation of a certain size of water holes on the surface, with underground water layer underneath the puddle. Then, the water

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in the puddles is allowed to slowly seep into the aquifer, and the amount of water permeable over a period of time is recorded. Finally, using mathematical knowledge, functional relations are established for calculation, so as to obtain the required data, and provide a reference basis for the subsequent engineering activities [2].

3. Types of Hydrological Engineering Geological Conditions Investigation

In practice, hydrological engineering geological investigation can be divided into three types according to the purpose of the hydraulic engineering geological conditions investigation.

3.1 Comprehensive Hydrogeological Investigation

Comprehensive hydrogeological investigation mainly refers to a more detailed survey of all hydrogeological conditions in the area, which is mainly carried out for the construction of a specific project in the area. For example, the construction of an agricultural base requires a comprehensive understanding of the hydrogeological conditions of the base area before the start of the project, thus exploring the feasibility of building an agricultural base in the area. Therefore, comprehensive hydrogeological investigations are mainly to provide a basis for measuring the construction conditions of a particular project in the region, such as agricultural production activities and construction of tourist attractions.

3.2 Specialized Hydrogeological Investigation

Specialized hydrogeological investigation mainly refers to the specific exploration of several hydrogeological conditions in the area for a specific problem. For example, when investigating whether groundwater in the area is suitable as drinking water for local residents, it is often necessary to conduct surveys on specific hydrogeological conditions such as water quality and water source distribution. Therefore, the specialized hydrogeological investigation is highly targeted. In addition, in order to better solve the corresponding problems, the data accuracy and comprehensive requirements are higher.

3.3 Engineering Geological Investigation

Engineering geological investigation is an important task in the preparation stage of construction engineering. It mainly refers to the exploration and measurement of the hydrogeological conditions of the construction site before the concrete construction of the project begins, the inspection of the completed and unfinished parts during the construction process, and the investigation of the completion status of the overall project during the completion stage. Engineering geological investigation is an indispensable part of the construction of large-scale engineering projects. According to the different objects of hydrogeological engineering measurement, engineering geological investigation is divided into several types: a) Building engineering survey is mainly aimed at the hydrological engineering survey of large buildings in cities; b) Water conservancy engineering survey is mainly aimed at hydrology engineering survey of water conservancy engineering construction project. The range of measurement is often wide and the measurement is difficult; c) Hydrological engineering surveys of transportation infrastructure projects are mainly for hydrological engineering surveys of roads, bridges, tunnels and other engineering projects. The measurement range is relatively wide; d) Hydrological engineering survey of mining construction project is mainly aimed at field environmental conditions; e) The hydrological engineering survey of municipal construction projects is mainly for hydrological engineering surveys carried out by municipal engineering projects, which are generally in a complex urban environment; f) The hydrological engineering survey of military project construction is aimed at the hydrological engineering survey of military building construction, which has higher requirements in precision; g) Hydrological engineering surveys of marine development projects are mainly for hydrological engineering surveys of related offshore construction projects during the development and utilization of marine resources, such as the construction of offshore oil wells [3].

4. Significance of Hydrological Engineering Eeological Conditions Investigation

At present, the number of hydrogeological projects in China has increased significantly, and the types of projects have become more diverse. In different hydrogeological projects, the focus of hydrogeological surveys is different due to different construction environments and construction requirements. However, in essence, the significance of most hydro-engineering geological surveys is similar, which is mainly reflected in the following aspects:

4.1 Improvement of Accuracy of Setting Out

Construction design drawing is an important reference for modern construction. Although some large buildings have been designed on the construction drawings and most relevant engineering parameters have been confirmed, due to the limitations of the actual environment and the technical level of the construction team, it is often necessary to

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make appropriate adjustments in the actual construction to ensure the construction quality. Therefore, in the field construction, the actual standard is followed. In addition, the installation management of construction equipment and confirmation of construction project process also need corresponding hydrological engineering geological conditions investigation data as the basis.

4.2 Settlement Observation of Auxiliary Deformation

In construction engineering, settlement and deformation within a certain range will not affect the construction quality and service life of the building. However, once the prescribed limit is exceeded, it will cause serious damage to the building, bring serious economic losses to the construction enterprises and owners, and even affect the personal safety of the construction personnel and construction users. Therefore, the safety of the building structure must be guaranteed. The deformation and settlement of the construction project are monitored comprehensively and accurately, which provides the basis for the examination and appraisal of the construction quality and improves the construction quality.

4.3 Comprehensiveness of Topographic Map Drawing

Prior to the formal construction of a construction project, the construction unit can dispatch surveying and mapping professionals to the field for on-the-spot observation. According to the relevant engineering construction standards and surveying and mapping information processing methods, the hydraulic engineering geological conditions investigation data of the project is calculated and sorted. After observing and measuring the mountain lakes, road construction and house construction in the construction area of the construction project, a comprehensive scale map is drawn. With the support of relevant digital means, the final result is displayed. This provides a complete and accurate design drawing and related information support for the smooth construction of all stages of the construction project.

5. Information Exploration Technology for Hydrogeological Conditions

At present, in the exploration of hydrogeological conditions, China has initially realized the development and application of various information technologies. The common hydrogeological conditions exploration techniques are as follows:

a) Geological radar technology. The technology uses the judgment of the frequency and amplitude of electromagnetic waves to collect relevant geological information;

b) GPS technology. The technology uses satellite signals to achieve accurate positioning of hydrogeological conditions;

c) Remote sensing technology. The technology uses the spectral resolution of remote sensing images to achieve effective analysis of geological information, and is currently the most widely used technology in hydrogeological exploration. It can be used not only for the collection of geological information, but also for the prevention of geological disasters, urban garden construction, environmental protection detection and other aspects;

d) Carrier phase difference technique. This technique sends and corrects differentials through the base station for more accurate positioning results. The application of these information technology can effectively improve the efficiency and quality of China's hydrological engineering geological investigation, to provide the necessary technical support for engineering construction.

6. Anti-leakage Measures for Hydrological Engineering

6.1 Inspection of Leakage Water

In order to ensure the efficiency and quality of the engineering anti-leakage work, the leaking water is checked. There are three specific ways:

a) Macroscopic leak detection is mainly for the case where the leakage is relatively serious, and the leakage position can be directly found by the naked eye;

b) Leakage detection with dry cement powder is mainly for the case of small leakage. By spraying a layer of dry cement powder in the leakage area, wet spots or wet lines on the cement surface are found;

c) Leak detection with glue. At the location of the leakage, the cement slurry is smeared, and then the dry cement powder is sprinkled, and the wet spots or wet lines on the cement surface are found.

6.2 Drainage and Sealing of Leaking Water

At present, in the engineering construction, if there are problems of groundwater leakage, the common treatment methods are mainly drainage and combined with water shutoff. In the specific operation, it is mainly divided into two parts: the drainage and the water shutoff. In drainage, there are three specific measures: a) The open drainage mainly refers to digging a collecting funnel at a certain depth at the leakage site of the project and installing a drainage pipe below the funnel; b) The underground pipe-

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line drainage mainly refers to the cutting of the Y-shaped groove to the drainage ditch along the leakage of the crack, and the water diversion channel is arranged at the bottom of the groove, and the waterproof sealing layer is arranged on the surface of the channel with mud, paint or the like; c) The combination of underground pipeline drainage and open drainage is mainly based on the combination of the above two measures. In water shutoff, there are the following methods: a) Repairing means directly using the waterproof material to perform a water shutoff on the leaking position; b) The plastering surface mainly refers to the arrangement of a rigid waterproof layer in a large area of leakage; c) Shelling-out mainly refers to the arrangement of flexible waterproofing layer in large-scale leakage position; d) Grouting refers to pouring a waterproof material into the gap of the leaking position.

6.3 Application of Leakage Water Treatment Technology

In underground hydrological engineering, it is necessary to focus on the discharge of water flow and the water shutoff to improve its anti-leakage ability, that is, to discharge the leakage in the rock as far as possible. At the same time, the leakage path is sealed to enhance the anti-leakage performance of hydrology engineering from the root. Specifically, the drainage is mainly for the case of a large amount of leakage water. For example, if there is a problem of inrush current in the project, a corresponding drainage ditch can be set at the water leakage range of the hydrological project to discharge the leakage water. Open drainage is a better processing technique that can be used in this situation. However, if there is leakage crack in the hydrological project or leakage of the Y-shaped groove, it is necessary to use the underground pipeline drainage treatment technology to vent the fissure water. When all leaks have been drained clean, the surfaces of these leaks are coated with a waterproof mortar to seal off the leaks. In order to reduce the workload, it is necessary to combine the two drainage methods when seepage occurs in the hydrological engineering site. In addition, in the water shutoff treatment, the treatment technology can be used mainly include repair, plaster, brush, pressure and paste, etc. Repair is mainly aimed at the leakage of cracks and voids which are relatively small, and the waterproof coating can be used directly. When large-area leakage problems occur, the moisture-proof layer should be plastered to enhance its rigidity. In this case, brushing treatment may also be used.

6.4 Strengthening of the Repair of Water Leakage

In hydrological engineering, for the problem of leakage that has already occurred in a large area, it is first necessary to face it cognitively. The place where the leak occurred in the project was inspected to accurately find the leak point. Then, the water seepage condition at the leak point is analyzed and the leak point is cleaned. The effectiveness measure was taken to carry out the water shutoff. After the water shutoff treatment, the surface of the hydrological project should be reinforced in time, such as applying crack-resistant mortar on the surface. The surface of the hydrological engineering is to be treated to avoid water leakage problems and enhance the anti-leakage capability of hydrological engineering.

When dealing with relatively large hydrological engineering cracks, it is necessary to timely pour grout with relatively fast coagulation speed into the cracks, fill the cracks, and reinforce and maintain the cracks, so as to avoid the recurrence of cracks and affect the overall performance of hydrological engineering. In the hydrological engineering anti-leakage treatment, the protective measures taken at different leakage points are different. When processing the detailed structure of the project, the slurry is first poured and then the water strip is filled. The waterproof material is applied to the surface of the crack and cured. The above treatment method can effectively avoid the re-leakage problem of hydrological engineering and enhance the anti-leakage performance of hydrological engineering.

6.5 Foundation Pit Supporting

The foundation pit support technology is mainly referring to the underground engineering construction through the form of pre-set support structure to avoid engineering leakage. On the one hand, the stability of the foundation pit structure is effectively improved, and the orderly development of the engineering construction is guaranteed; on the other hand, groundwater leakage is effectively avoided. The following is an example analysis of foundation pit support.

6.5.1 Project Overview

Taking the construction of a high-rise building as an example, the building covers an area of 24,000 square meters, with 26 floors above ground, 96.5 meters high, and two and a half underground. It is mainly used as a parking lot. The building is based on Φ800mm rock-filled reinforced concrete bored piles. The excavation depth of the foundation pit is 9.9m, and the area can reach 13.2m. The building is located in the urban area, and the construction environment of the foundation pit is relatively complicated. In order to ensure construction safety and avoid en-

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gineering leakage, the foundation pit support technology needs to be adopted.

6.5.2 Application of Foundation Pit Supporting Technology

According to the specific hydrogeological geological conditions' analysis, the foundation pit support method adopted by the construction unit is specifically twelve pillars of the horizontal beam supported by the pit. The Φ700mm bored pile is used, and the pile is placed 7.5m below the bottom of the pit, and the reinforcement is 8×Φ18mm. A ring-shaped steel plate is placed at the junction of the column and the foundation cap, and the steel cage is placed at the same time. The annular water stop plate is welded when the platform is poured to prevent the groundwater from penetrating upwards to avoid leakage of the construction.

7. Problems in the Treatment of Leakage in Hydrogeological Engineering

Hydrogeological engineering has certain specialities and the construction environment is also complicated. To ensure the overall quality of the engineering leakage treatment, geological surveys prior to construction must be performed. On the one hand, when conducting geological surveys, the relevant personnel should fully understand the local hydrogeological problems; on the other hand, they must also pay attention to the underground rock formations and soil characteristics. Specifically, the following questions should be noted: First of all, the basic situation of the groundwater level should be noted, and the fluctuation of the local groundwater level in recent years should be understood to provide a reference for the construction of the project [4]. Secondly, the local natural geographical conditions should be focused on, including topographic features, landform types, monsoon, rainfall, etc. Finally, the characteristics of aquifers should be fully understood, including the flow direction between adjacent aquifers, types of water resources, storage conditions, etc.

8. Conclusion

The investigation of hydrogeological geological conditions is an important preparatory activity in the construction of large-scale projects. To ensure the quality of the project construction, engineering project design and construction must be carried out on the basis of comprehensive and detailed hydrogeological investigation.

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