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Research on Construction Technology based on Cofferdam in Geotechnical Engineering

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Abstract

With the current social and economic progress, Chinese geotechnical engineering construction technology also presents the development trend of diversification, modernization and science and technology. As the premise of the smooth development and construction of major infrastructure projects, it plays an extremely important role in promoting the development of the whole construction industry in China. The research and application of cofferdam construction technology in geotechnical engineering is also of great significance to the improvement of the construction level of the whole industry. This paper carries out a study for reference.

Keywords

Geotechnical Engineering; Cofferdam Engineering; Construction Technology.

1. Introduction

As the key point of modern civil engineering construction, the construction mode of geotechnical engineering based on the construction technology of cofferdam engineering can promote the construction efficiency of corresponding geotechnical engineering on the basis of ensuring the construction quality of geotechnical engineering to the maximum extent. At the same time, it can fully analyze the whole site information in real time, and select the construction method suitable for the corresponding geotechnical engineering project strictly according to the site situation, which can effectively reduce the overall construction cost of geotechnical engineering, which is a necessary condition for the continuous improvement and improvement of the geotechnical engineering construction technology in our country.

2. Characteristics and Key Points of Geotechnical Engineering Construction

2.1 The Overall Concealment is Strong

Geotechnical engineering itself has relatively strong construction concealment characteristics, for example, it is basically carried out in underground or even underwater and other parts. Once the construction quality problems occur, the follow-up maintenance is extremely difficult, and even due to the engineering characteristics, it is impossible to correctly judge and deal with it. Therefore, the geotechnical engineering must focus on the reliability of the design drawing and the construction specifications and standards, and clarify the various problems that may exist in the construction links to ensure that the construction quality of geotechnical engineering will not be adversely affected by its hidden characteristics.

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2.2 Great Changes in the Construction Process

The construction process of geotechnical engineering changes relatively large, the diversity of the type of rock and soil determines that the construction period is affected by a lot of factors, coupled with the complexity and variability of geotechnical conditions, the requirements for its investigation work is also higher. Such changes during construction will not only affect the construction process parameters, but also have a direct impact on the construction quality of the whole geotechnical engineering. Once the treatment is not in place, the engineering safety and stability can not meet the expected requirements [1]

2.3 Regional Characteristics are Obvious

Obvious regionality is also one of the most common characteristics of geotechnical engineering. For example, different geotechnical characteristics reflected in different regions, such as loess foundation, sandy soil foundation and soft clay foundation, will cause great differences in the quality and performance of corresponding engineering foundation pits. At the same time, the data obtained from exploration often cannot effectively represent the whole picture of soil layer. The test errors caused by soil sample disturbance and stress release during drilling will make the final exploration node only correspond to a certain area. Therefore, it is necessary to set a full range of survey azimuth for the construction section during the practice, so as to ensure that the accuracy and authenticity of the final.

2.4 High Dependence on Science and Technology

Geotechnical engineering construction itself has a relatively high dependence on science and technology, usually the progress of science and technology can maximize the timeliness, stability and safety of geotechnical engineering construction, and save significant effect on engineering cost. Therefore, it is necessary to affirm that the progress of science and technology will certainly produce substantial help to the construction efficiency of geotechnical engineering, but the premise must be that its technology can help solve the practical engineering problems in geotechnical engineering. For example, in the late 1960s, the high pressure jet technology was proposed and applied, which directly made high pressure jet grouting become a common construction technology in engineering practice. Combined with the practice of vacuum pump technology and jet pump technology in engineering, the subsequent optimization and updating of vacuum preloading method specially suitable for geotechnical engineering have greatly promoted the development speed of the whole geotechnical engineering construction industry; As well as the appearance and application of science and technology such as ultrasonic detection, effectively improve the efficiency of geotechnical engineering quality detection. All these technologies have irreplaceable promoting effect on the development of geotechnical engineering. Geotechnical engineering itself has relatively high science and technology, in the actual practice must be based on the specific situation, choose scientific and reasonable construction technology to ensure that the construction quality and construction cost can be effectively controlled throughout the whole process.

3. Key Points of Modern Cofferdam Construction Technology

3.1 Foundation Engineering with Higher Strength and Density Standards

Modern cofferdam project, as a people's livelihood project to improve the ecological environment and promote efficient use of water resources, is extremely prominent in the professional construction technology, during the actual construction period has high requirements for the intensity and density of earthwork foundation engineering standards, must be reached to the relevant national standards and norms. At the same time, the control of each process will also be strictly in the form of declaration on demand, responsibility to person, whole process inspection, so that the construction quality of the whole cofferdam project can fully meet the design expectations.

3.2 Drainage and Concrete Dam Construction Standards are Strong

The construction technology of modern cofferdam engineering has the characteristics of strong

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standardization of drainage and concrete dam construction. For example, the water dropping dam construction in cofferdam engineering (building earth dam according to hydraulic erosion) itself has the advantages of saving time and labor and strong economy, which can maximize the improvement of the ecology of corresponding areas with serious soil and water loss. At the same time, the total amount of earth filling in the dam body is basically equal to the water demand, and the filling method of the dam body is more flexible, and the overall drainage effect is excellent. The construction of concrete dam in cofferdam project itself is reflected by foundation excavation treatment and concrete dam construction. The standardization of engineering preparation, water flow control, foundation excavation treatment, metal structure installation and supporting facilities adopted in this process is also extremely high, which has significant effect on improving the construction safety of the whole cofferdam project [2].

3.3 More Effective Grouting Construction

The grouting construction with stronger effectiveness is also an important characteristic of modern cofferdam construction technology. The grouting of borehole follows the way of consolidation before curtain, so that the compactness of the foundation of the whole cofferdam project can be fully reflected. During the construction of the current cofferdam project, grouting construction is mainly carried out in the way of pure pressure or circulation, among which the pure pressure type is mainly used for the cofferdam project which is dominated by rocks and has small rock gap. During the practice, the grout is pressed into the drill hole once according to the construction machinery and tools, and the continuous pressurization is used to ensure that the corresponding grout can be fully diffused into the rock crevices. Then lay a good foundation for the subsequent construction quality of the whole cofferdam project to fully meet expectations.

4. Advantages of Construction Technology based on Cofferdam in Geotechnical Engineering

4.1 Promote and Improve the Effectiveness of Rock and Soil Mass Excavation Technology

Combined with the above analysis of the key points of construction technology of geotechnical engineering and modern cofferdam engineering, the formation and application of construction technology based on cofferdam engineering in geotechnical engineering has become normal, which has a significant effect on the improvement of the whole geotechnical engineering construction level. In geotechnical engineering, when the construction technology based on cofferdam engineering is reflected in the construction of rock and soil excavation, it directly starts from the level of the utilization of rock and soil mass space, and chooses open excavation or underground excavation according to the actual situation. Usually, deep foundation pit excavation is basically open excavation, while tunnel excavation is basically underground excavation. During the construction period, the rock mass open-pit excavation construction basically selects the technical methods such as differential loose blasting or directional blasting in cofferdam engineering to ensure that the rock mass excavation effect can fully meet the expectations.

4.2 Strengthen the Quality and Standardization of Geotechnical Engineering Construction

To enhance the construction quality and standardization of geotechnical engineering is also an intuitive demonstration based on the construction technology of cofferdam engineering. Cofferdam engineering itself has very high requirements for construction quality, and geotechnical engineering also has high standard requirements for "one-step in place" construction due to the difficulty of follow-up maintenance. The materials used in geotechnical engineering construction itself are mainly reinforcement, cement, mud and admixture, etc. When the material quality control is carried out, the corresponding contractors must be required to produce documents such as samples, supply address information, single price performance of materials, etc., before ordering. When the materials used in the corresponding project enter the site, the positive factory certificate and material test sheet are selected to carry out the whole process of standardized inspection, and the sampling inspection

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method of material quality is defined. In accordance with the "Building Materials Quality Standards and Management Regulations", conduct real-time verification of the grading data of core materials and concrete during the construction period, and ensure that the test standards of the corresponding materials are up to standard when they are formally configured on site, so as to minimize the unqualified rate of construction materials used in geotechnical engineering. Subsequently, the construction quality and construction standardization of geotechnical engineering are comprehensively improved [3].

During the practice, 4 to 5 groups of geotechnical samples are selected from the construction site. Based on the definite foundation thickness, real-time analysis is made on the influence of geographical environmental conditions of soil layer. For example, if the soil layer is loose and affected by rainfall, the soil mass of the geotechnical structure slope will be peristaltic, and reasonable selection must be made according to the soil layer structure. When the creep is within the range of bearable strength of the soil, normal sampling can be conducted, which can guarantee the accuracy and authenticity of the corresponding geotechnical engineering investigation and lay a good foundation for the quality of subsequent geotechnical engineering.

4.3 Improve the Stability of Geotechnical Support System in Geotechnical Engineering

In geotechnical engineering, construction technology based on cofferdam engineering can effectively improve the stability of geotechnical support system. Combined with the actual situation, the excavation of geotechnical engineering will inevitably destroy the corresponding original equilibrium state of rock and soil mass, and the displacement and deformation of the free surface during the excavation will cause the instability of the rock and soil mass. Therefore, it is necessary to carry out real-time support work, which is mainly carried out by temporary support and permanent support. For temporary support and permanent support during excavation and tunneling of geotechnical underground engineering, real-time classification must be done. Temporary support measures are mainly reflected in the protective layer of shotcrete, conduit grouting, steel grates, etc., while permanent support measures are reflected in the reinforced concrete lining, which is almost consistent with the supporting standards of cofferdam engineering. Supporting quality is a key factor to promote the timeliness of geotechnical engineering construction [4].

4.4 Geotechnical Tests of Geotechnical Engineering and Application of Construction Technologies Such as Load Precompression, Vacuum Precompression and Dynamic Compaction

In geotechnical engineering, the geotechnical test based on the construction technology of cofferdam engineering improves the accuracy of the data required for the foundation treatment of geotechnical engineering to the maximum extent, and ensures the feasibility and reliability of the whole geotechnical engineering construction. For example, after investigation and analysis of the actual situation on the site, back drilling is carried out according to the standard of the foundation, and the water level in the corresponding hole is kept slightly higher than the groundwater level. During this period, if the stability of the hole wall is poor, mud wall can be adopted to remove the residue at the bottom of the hole in real time. In the subsequent hammer construction, the free drop hammer method is selected to carry out corresponding operations, so as to reduce the friction between the guide pipe and the hammer body as much as possible, prevent the problem of the deflection of the hammer center and the side roll of the hammer body, and also provide a favorable reference for the geotechnical engineering construction effect to achieve the expected.

For the geotechnical engineering construction of soft soil foundation, the corresponding construction personnel can first carry out a comprehensive analysis of the required construction area, and formulate the corresponding treatment scheme combined with the construction technology of soft soil foundation. In this process, it is necessary to ensure the stability and stability of soft soil foundation and carry out the filling operation after the construction treatment of the foundation surface reaches the corresponding standards to ensure the uniformity of the filling and the perfection of the drainage system. After completion, the water discharge construction is carried out for the soft

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soil foundation with relatively good geology but large water content, so as to ensure that the surface hardness of the whole soft soil foundation area is effectively improved. The construction efficiency and quality of geotechnical engineering can be fully reflected.

This process is mainly reflected by the construction treatment of overburden preloading and vacuum preloading. As a common construction technology of soft soil foundation during the construction of cofferdam project, overburden preloading construction treatment can effectively improve the bearing capacity and pressure resistance of the soft soil in the corresponding area, and prevent the occurrence of settlement phenomenon to the greatest extent. Usually, during the actual construction, the internal pressure and bearing status of the foundation in the corresponding area are calculated and analyzed. Combined with the specific information, certain loads are applied to the settlement status of the area, so as to discharge the water in the pores of the soft soil layer and improve the load force. It is also an effective method to reduce the launching of soft soil base. The advantages of high construction convenience and controllable construction cost are extremely prominent, but at the same time, its construction time is relatively long, and it must be reasonably selected and controlled in real time according to the specific situation of the project during the practice. The vacuum preloading construction treatment is mainly based on the characteristics of soft soil layer and the principle of drainage consolidation to do the preloading setting, to enhance the stability of the corresponding soft soil layer. During this period, the soft soil area is mainly set by means of vertical drainage column tube, and sand layer is laid on the vertical drainage column tube. After covering the sealing film, vacuum equipment is used to fully discharge the air in the plastic film, so that the plastic film is in a vacuum state, and then the pressure difference generated inside and outside the film is applied as load. To ensure that the bearing capacity of soft soil foundation is improved to a certain extent. It has significant effect on the improvement of the construction quality of the corresponding geotechnical engineering.

At the same time, during the practice period, emergency plans and safety precautions should be set according to the actual situation of the site, and the replacement filling method should be selected appropriately, such as the replacement of stone, clay, cement, etc. to do real-time compaction construction, so as to prevent the collapse of soft soil area during the construction of geotechnical engineering to the maximum extent. For the soft surface karst area, the dynamic compaction method can also be adopted to carry out comprehensive compaction in the area in the way of fast percussion with low hammer, and pay attention to the reasonable control of the punching speed to prevent the hole wall from colliding and resulting in hole collapse, so that the safety of the whole geotechnical engineering can be fully guaranteed [5].

4.5 Comprehensive Reinforcement Construction of Geotechnical Engineering

As a construction technology based on cofferdam engineering in geotechnical engineering, the comprehensive reinforcement construction of geotechnical engineering is mainly based on the reinforcement treatment for the deformation or strength of geotechnical mass cannot meet the requirements of engineering standards. From a practical point of view, in recent years, with the increase of project construction scale in the whole engineering industry, the corresponding geotechnical engineering needs for reinforcement treatment of rock and soil mass also show a trend of comprehensive improvement, and the geotechnical reinforcement treatment technology of different rock and soil mass and different engineering conditions has become an indispensable important construction technology content of geotechnical engineering. For example, the application of shotcrete technology is an intuitive representation of the overall reinforcement construction of geotechnical engineering. Shotcrete is essentially a kind of concrete that is rapidly twisted and hardened by using the relevant shotcrete machinery to make use of the compressed space and in accordance with the appropriate proportion to carry out the mixing material configuration and then spray it to the corresponding rock face at high speed through the corresponding pipeline. The construction technology principle is shown in Figure 1.

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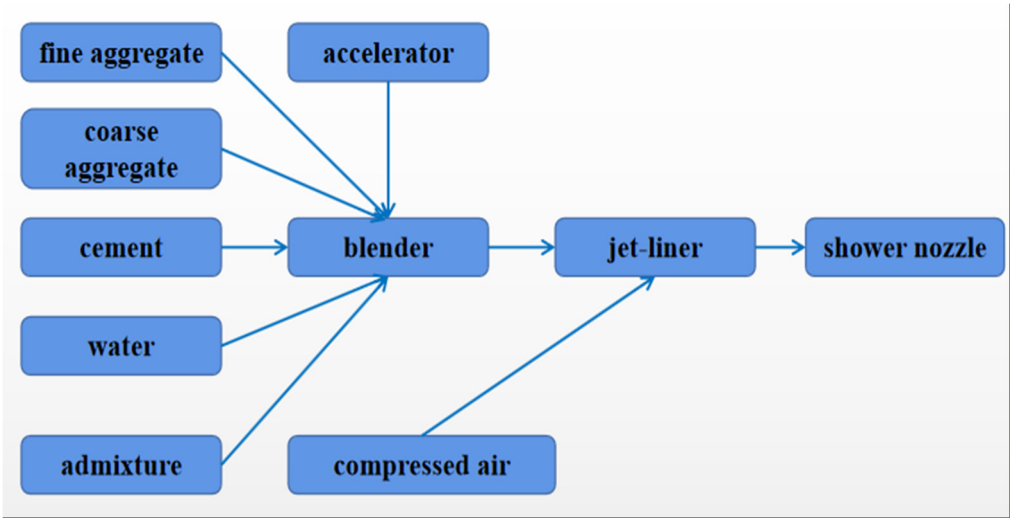

Fig 1. Construction technology principle

When applying shotcrete construction technology to geotechnical engineering comprehensive reinforcement construction, it is necessary to do a full range of surrounding area information integration before shotcrete, and do a good job of real-time training for shotcrete personnel, so that they can fully realize the professional operation of shotcrete construction technology and conclusion. Through the research and analysis of the construction technology based on cofferdam engineering in geotechnical engineering, it can be seen that the geotechnical construction technology based on cofferdam engineering has promoted and improved the effectiveness of the previous geotechnical mass excavation technology, enhanced the construction quality and construction standardization of geotechnical engineering, and improved the stability of the geotechnical support system in geotechnical engineering. It makes the level of geotechnical tests, the application of pile precompression, vacuum precompression, the construction technique of dynamic compaction and the overall reinforcement effect of geotechnical engineering to be enhanced. It is also necessary for the technological level of geotechnical engineering construction to be improved constantly[6].

5. Closing Remarks

In summary, through the research and analysis of the construction technology based on cofferdam engineering in geotechnical engineering, it can be seen that the geotechnical construction technology based on cofferdam engineering has promoted and improved the effectiveness of the previous geotechnical mass excavation technology, enhanced the construction quality and construction standardization of geotechnical engineering, and improved the stability of the geotechnical support system in geotechnical engineering. It makes the level of geotechnical tests, the application of pile precompression, vacuum precompression, the construction technique of dynamic compaction and the overall reinforcement effect of geotechnical engineering to be enhanced. It is also necessary for the technological level of geotechnical engineering construction to be improved constantly.

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