

The Effecton Analysis of Geotechnical Investigation on Foundation Pit Supporting Construction

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ABSTRACT

With the continuous development of the construction industry, the density of engineering construction and the difficulty of underground construction are also increasing. As an important construction protection measure, foundation pit support construction is widely used in underground construction. Starting from the characteristics of foundation pit support construction, this paper analyzes the influence of geotechnical investigation on foundation pit support construction, and analyzes the problems that need to be paid attention to in the survey process.

1. Introduction

Foundation pit support is an effective and popular construction method that can ensure the safety of underground structure construction and surrounding environment of foundation pit by supporting, reinforcing and protecting the side wall of foundation pit and surrounding environment. As the supporting structure of buildings, the construction quality of foundation pit supporting construction determines the performance of ground buildings. For this reason, the rationality and scientificity of foundation pit supporting construction should be fully considered in the construction process. Before the foundation pit construction, the first step is to excavate. In order to ensure the foundation pit support construction can be carried on smoothly and

guarantee the construction quality of the whole construction, the staff must master a large number of soil and hydrological data by means of a comprehensive geotechnical investigation, so as to be able to adopt the protective measures in a targeted way and improve the safety and quality of foundation pit support construction. The main contents of geotechnical engineering investigation include: field drilling, laboratory test, undisturbed soil sampling and in-situ test. In the process of geotechnical investigation, the constructors carry out detailed investigation on the soil conditions, geological conditions and hydrological conditions of the area the project located, and then formulate a set of scientific and orderly construction scheme. Through a series of rigorous and scientific geotechnical investigation, it lays a good foundation for the follow-up construction.

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2. Concept and Characteristics of Foundation Pit Support Construction

2.1 The Concept of Foundation Pit Support Construction

Foundation pit support is a measure to further strengthen, support and protect the side wall of foundation pit and surrounding environment on the premise of ensuring the safety of underground structure and surrounding environment^[1]. By utilizing foundation pit support construction, we can ensure the stability around the foundation pit, prevent structural collapse, landslide and other phenomena, in the meanwhile, we can effectively protect the adjacent buildings and underground pipelines from damage during construction.

2.2 The Construction Characteristics of Foundation Pit Support Construction

2.2.1 Regional

The construction of foundation pit support engineering has significant regional characteristics. Different construction sites have different engineering geological and hydrogeological conditions, which cause great differences in the practical operation of foundation pit engineering. There are also differences in different areas of the same city, so engineers should adjust measures to local conditions and make building plans according to local conditions^[2].

2.2.2 Comprehensiveness

Foundation pit supporting construction is a systematic project with strong comprehensiveness. Foundation pit supporting construction involves the knowledge of Geotechnical engineering and structural engineering^[3]. At the same time, it is also affected by many complex factors in the actual operation. It is necessary to comprehensively consider the structural characteristics and properties of buildings, adverse geological phenomena, groundwater depth conditions, etc. In order to standardize the construction, the relevant departments of construction have formulated the relevant construction regulations of foundation pit supporting construction, classified the safety level according to the severity of the damage consequences, and systematically standardized the foundation pit support engineering, which has become the main normative document of construction.

2.2.3 Uncertainty

The construction of foundation pit support project has uncertainty^[4], the main reasons are as follows: first of all,

the geotechnical survey data and raw materials are inaccurate and incomplete; the second is that the practical experience and technical level of foundation pit designers also determine whether the foundation pit support type is reasonable and effective; thirdly, the changes of surrounding environment and seasonal changes will lead to the form of foundation pit support different, therefore in the construction of foundation pit support engineering, we should analyze the specific problems and attach importance to the combination of theory and practice.

2.2.4 Temporary

On account of the foundation pit needs to excavate the ground structure, in order to prevent the collapse or large settlement displacement of the soil around the foundation pit, it is necessary to set up the foundation pit support system^[5]. The foundation pit support system is a temporary structure, which is no longer needed after the underground engineering construction is completed. Generally speaking, the safety reserve of foundation pit support system is small and has a great risk. Monitoring shall be carried out during the construction of foundation pit project and emergency measures shall be taken. In case of danger in the construction process, it is necessary to rescue in time.

3. Concept and Main Objectives of Geotechnical Investigation

3.1 Concept of Geotechnical Investigation

Engineering investigation is an important link in the process of engineering construction, which refers to identifying, analyzing and evaluating the geological conditions, environmental characteristics and geotechnical engineering conditions of the construction site according to the requirements of the construction project. After the engineering investigation, the detailed data obtained after the survey should be sorted into the survey report according to the actual geological conditions of the project, so as to provide detailed and reliable data support for the foundation pit design^[6]. Therefore, in order to ensure the rationality and scientificity of foundation pit design, the investigation work must be done well.

3.2 Main Objectives of Geotechnical Investigation

3.2.1 Accurate Description of the Properties of Rock-Soil Mass

It is an important aspect of the preliminary work of geotechnical investigation to deeply and accurately understand and describe the properties of Rock-Soil Mass.

Geotechnical investigation is a complicated as well as special investigation work. The main investigation indexes include the distribution, distribution area, mechanical properties, hydrogeological conditions of the overall construction environment and the corrosiveness of Rock-Soil Mass

3.2.2 Find out the Groundwater Burial Condition

It is also necessary to find out the buried situation and type of groundwater, the change of groundwater level and its amplitude and law, the permeability of each soil layer, and analyze the hydrostatic pressure, hydrodynamic pressure and buoyancy of groundwater and their influence^[7]. The underground water level directly affects the stability of foundation pit engineering, which may cause sudden gushing, quicksand or piping and other emergencies. Therefore, it is necessary to comprehensively grasp the underground water situation of foundation pit and put forward corresponding prevention measures.

3.2.3 Understand the Influence of Excavation Construction and Meteorological Factors

The construction of the project may be affected by external environmental factors, including not only natural factors but also human factors. Finding and obtaining relevant information about the possible impact of these factors in time will help to avoid related unfavorable factors through scientific methods in the later construction, and minimize the adverse impact^[8].

4. Influence of Geotechnical Investigation on Foundation Pit Supporting Construction

Geotechnical investigation is the foundation and prerequisite of construction. Before foundation pit supporting construction, the first technical link is to carry out foundation pit excavation. In order to ensure the safety of the foundation pit support construction, it is necessary that construction personnel could fully grasp the geotechnical conditions of the construction site, including engineering characteristics, structural characteristics, hydrogeological conditions, and the distance of the survey area. This requires attention to the control of the following processes: one is the geological environmental factors of the survey; the second is the rationality of the foundation pit support plan; the third is the scientific formulation of a plan for groundwater treatment. After mastering the above elements, a scientific and reasonable foundation pit support plan based on the research results can be formulated. In addition, for areas with dense underground pipeline net-

works, it is also necessary to investigate the pipeline layout, burial depth, layout range, etc., and obtain data that can provide guiding opinions on construction engineering design and foundation pit design. At the same time, the construction groundwater level and distribution are also the focus of the survey. Following according to the characteristics of foundation pit supporting construction, we analyze the influence of geotechnical investigation on foundation pit supporting construction which are mainly reflected in the following aspects:

4.1 The Influence of Geotechnical Conditions on the Foundation Pit Support Construction

The soil quality of the foundation pit is the key content of geotechnical investigation, and it is an important foundation for subsequent survey work, and an important basis for selecting survey methods and supporting technologies. The main content of the survey includes the distribution of rock-soil mass and the characteristics of the geological section of the distribution area^[9]. The difference in soil quality will directly affect the selection of the survey method and the support technology adopted for the foundation pit support. For example: when the soil layer is a soft soil layer, it is demanding for survey technology requirements. After the excavation of the foundation pit, the survey report should be checked carefully. It is also necessary to check whether there are ancient wells or ancient tombs and other cultural relics underground to avoid soil damage caused by the agitation of the soil. On the other hand, the drainage of the foundation pit is also need to be checked, in order to avoid problems that affect the safety and stability of foundation pit construction, such as softening or freezing of the soil layer due to insufficient drainage.

4.2 The Influence of Hydrological Conditions on the Foundation Pit Support Construction

The survey of hydrological conditions in the process of geotechnical survey includes the conditions of the groundwater level and the conditions of aquifers. The groundwater level directly determines the stability of the foundation. First of all, in the process of geotechnical survey, the groundwater level should be surveyed. The law of water level changes, the reasons for the rise and fall of the water level should be grasped and found. So as to provide guiding opinions for the development of survey work. Secondly, aquifers are also the focus of investigation. Investigation elements including: the burial depth of water layer, water level and the formation conditions of the water layer, the type, direction and speed of each water layer.

4.3 The Influence of Slope Stability on the Foundation Pit Support Construction

Slope is an important structure for project construction, and its stability directly affects the stability of project construction^[10]. From the perspective of foundation pit support technology, the slope stability survey should also include the stability of the anti-heave performance of the bottom of the foundation pit^[11], the permeability of the pit base and side walls and the nature of the slope structure. In addition, attention needs to be paid to deformation problems during construction.

4.4 The Influence of Actual Operation on the Foundation Pit Support Construction

The existing actual operation problems of foundation pit support construction mainly include the following two aspects. On the one hand, due to the change of construction period, the influence of building materials and the influence of human factors, there will be differences between the foundation pit design plan and the actual construction plan. The main reasons for the large error are: construction units rush to the construction period and cut corners; the knowledge of construction designers is limited, the design scheme is improper, and unrealistic, etc. On the other hand, because the slope repair is not in compliance with the specifications, during the design support construction, the foundation pit support slope repair does not meet the design requirements owing to the operator's technique and construction technology. In the process of foundation pit excavation, there are problems of over-excavation and steep excavation, which do not meet the design requirements. These problems resulting in irregular engineering procedures, which in turn leads to potential safety hazards. In recent years, the causes of foundation pit accidents such as collapse of foundation pits and gushing soil are all due to factors such as vicious competition, which have led to inadequate implementation of geotechnical investigation and inaccurate survey reports, which leaves serious security risks to subsequent foundation pit design and construction.

5. Technical Points for Supporting Foundation Pits of Different Types of Geotechnical Engineering

5.1 Supporting Technology in Support System

Support system support technology is mainly aimed at the rational application of support systems based on building materials to enhance the effect of foundation pit support. Popular materials are: steel, steel pipe, reinforced

concrete and reinforced concrete composite supports, etc. With the help of supporting building envelope of underground mixing piles, cement mixers and bored piles to limit the displacement of the enclosure structure, thus can achieve the target of enhancing the compressive resistance of construction and effective support.

5.2 Supporting Technology in Water Retaining System

The supporting technology in the water retaining system can effectively block the external seepage water. Popular materials are: deep cement mixing piles, jet grouting piles, compaction grouting, underground connecting walls and locking steel sheet piles. Reasonably using water retaining system support technology can avoid system leakage during construction and ensure the stability of the foundation pit support system.

5.3 Supporting Technology in the Earth Retaining System

The earth retaining technology of the retaining system is to form a supporting row of piles or a retaining wall to block the earth pressure outside the pit. Commonly used building materials are: steel sheet piles, reinforced concrete slab bricks, deep cement mixing piles, bored piles and underground continuous walls.

6. Precautions for Geotechnical Investigation and Foundation Pit Support Construction

6.1 Improved Support Measures for Deep Foundation Pits

First of all, it is very important to apply designers with strong professional ability and comprehensive quality to carry out design work. The complete professional knowledge of construction personnel can ensure the overall project quality; Secondly, it is needed to strictly review the quality of construction materials, various equipment, purchase and transportation of construction materials^[12]. The quality control of the link can ensure the construction quality at the source; the last is the scientific and reasonable use of construction equipment. The quality, accuracy and performance of various advanced equipment directly affect the construction quality, and the stable operation of the equipment lays a good foundation for the smooth construction.

6.2 Reasonable application of geotechnical investigation

Firstly, we must strengthen the scientific nature of the

construction technology before construction. On the bases of the analysis of various basic data, using advanced survey technology and comprehensive application of information technology, we can optimize the survey and design plan, improve the level of survey design and improve the foundation pit support, ultimate, protect the quality of construction.

7. Improving the Quality of Geotechnical Investigation Work and Foundation Pit Support Construction Plan

7.1 Project Management and Standard Work Process

The process of geotechnical investigation starts from the signing of the contract and extends to the project delivery stage. The degree of standardization determines the quality of the project^[13]. Therefore, it is necessary to standardize the geotechnical survey work process and strengthen project management to effectively achieve standardization and scientific surveys. The accuracy of the exploration work requires not only on-site investigation, but also analysis and verification of indoor tests to ensure the accuracy of the survey data^[14]. Strengthening project management is divided into original data management and project evaluation management. The original data should be properly kept. The contents of all survey reports should be reviewed to analyze whether the data and surveys can actually meet the needs of the project itself. Emphasis on project management. After each stage of geotechnical investigation work is completed, review should be carried out. In the final inspection, after the indoor test stage, only review and modification has been carried by the engineering review and evaluation team can the final project delivery be carried out.

7.2 Formulate the Most Reasonable Foundation Pit Support Plan According to Local Conditions

Before carrying out the foundation pit supporting work, the corresponding foundation pit supporting implementation plan shall be formulated according to local conditions. Taking a deep foundation pit project as an example, the excavation depth of less than 6 m generally will not fail, but once the excavation depth exceeds 6 m, the geological issues and the original municipal underground pipe network design must be considered comprehensively. Areas with different geological and soil conditions require different foundation pit support schemes. The designer should use the geological survey report and the foundation pit excavation sideline, basement structure, surrounding

environment map and other reference materials provided by the design unit to conduct an overall analysis of the engineering geotechnical parameters, determine of profile soil parameters, determine the section soil layer parameters, and formulate reasonable, economic and safe foundation pit support plan, and finally optimize and adjust the plan.

7.3 Establish a Responsibility System to Strictly Grasp the Quality of Foundation Pit Support Construction

In order to avoid the problem of uneven quality of foundation pit support engineering caused by human factors, relevant government departments should urge the construction unit to establish a responsibility system that the person in charge of the project is the first responsible person. If problems occur, they will be severely punished. A strict review system and random inspections of construction should be conducted. In addition, the construction unit should also take safety production as the first element, strictly grasping the quality of the foundation pit support project to ensure the orderly and safe development of the project, and be a construction unit with conscientious production and construction.

7.4 Strengthen Personnel Training

Whether it is geotechnical investigation work or foundation pit support construction, it is a technology-oriented work. Upgrading technology can effectively improve construction quality^[15]. It is important to continuously strengthen personnel training and improve professional quality. In this way we can improve the accuracy of survey and the quality of foundation pit support. Social progress will drives the development of science and technology, and the scientific and technological research and development of scientific research departments will promote the development of 8. Conclusion

In recent years, the construction industry of our country has developed vigorously, the scale of construction projects is constantly expanding, and the technical nature of construction projects is also increasing. In this context, the quality of construction projects has received more and more attention. As the most important construction link in the modern construction process, foundation pit support construction should improve the level and quality of construction technology to ensure the overall construction technology and construction quality problems. Geotechnical investigation work is the prerequisite of foundation pit support construction, which directly affects the quality of foundation pit support work. In order to improve the

construction quality of foundation pit support construction, increasing the intensity of geotechnical engineering investigation is the key. Through detailed geotechnical engineering survey, it can ensure the smooth development of foundation pit support construction and ensure the quality of the project. This article analyzes the influence of geotechnical investigation on the construction of foundation pits, hoping to promote the overall development of the construction of foundation pits.

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