Research on Informatization Construction Technology of Deep Foundation Pit Engineering Based on Deformation Control

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Abstract: Although the deep foundation pit supporting project is a temporary construction structure, it needs more funds and takes up a long time. Once the supporting structure fails, it will cause great economic losses and adverse social impacts. Informatization is a scientific construction management method. It continuously obtains the dynamic information of foundation pit deformation from the process of foundation pit excavation, so as to judge the safety of the supporting structure and the stability of the supported soil, so as to modify and supplement the original foundation pit supporting design and ensure the success of foundation pit excavation and support. In the deep foundation pit excavation technology of high-rise buildings in cities, it is an important research direction in engineering deformation monitoring and information construction that how to monitor them with concise methods, appropriate precision and effective analysis and early warning means. This paper analyzes the information construction technology of deep foundation pit engineering from the angle of deformation control, hoping to bring some help to the safe and smooth construction of deep foundation pit engineering in China.

1. Introduction

With the development of industry and urban construction, urban ground space is becoming more and more tense. As an underutilized resource, underground space has begun to be valued and developed [1]. In the deep foundation pit excavation technology of urban high-rise buildings, how to use concise methods, appropriate accuracy and effective analysis and early warning means to monitor it is an important research direction in engineering deformation monitoring and information construction [2]. Although the deep foundation pit support engineering is a temporary construction structure, it needs more funds and occupies a long construction period. Once the supporting structure fails, it will cause great economic losses and adverse social impact. The essence of information construction is dynamic optimization design and construction decision [3]. Therefore, it is required that the deformation monitoring data of the slope top of deep foundation pit support must obtain open and effective information interaction with the project site designer, constructor, supervisor and owner in time and accurately [4]. During the excavation of foundation pit, advanced instruments and equipment and reasonable measurement methods are used to scientifically observe the supporting structure and surrounding conditions of foundation pit and obtain reliable data [5]. Then calculate and analyze the data to judge the current safety state of foundation pit engineering through each monitoring data.

With the rapid development of the national economy, high-rise buildings and underground transportation projects all over the country are developing rapidly, and the foundation pit engineering technology is also developing rapidly [6]. Today, with the accelerating process of urbanization in China, projects requiring deep foundation pit construction, such as high-rise buildings and underground transportation projects, have sprung up in various cities in China. In the process of foundation pit excavation, the soil inside and outside the foundation pit will change from the original static earth pressure state to the passive and active earth pressure state. The change of stress state will cause the deformation of soil. Even if soil retaining and support measures are taken, the deformation of soil retaining and support structure is inevitable [7]. Due to the existence of

some uncertain factors, it is difficult to formulate a set of standard mode for the design and construction of foundation pit engineering. How to do well in the monitoring of foundation pit engineering is an important task in front of engineering technicians [8]. Information construction is a scientific construction management method. It continuously obtains the dynamic information of foundation pit deformation from the process of foundation pit excavation, so as to judge the safety of support structure and the stability of supported soil, so as to modify and supplement the original foundation pit support design and ensure the success of foundation pit excavation and support.

2. Deformation Monitoring Technology for Deep Foundation Pit Construction

During the construction of deep foundation pit excavation, the soil inside and outside the foundation pit will change from the original static earth pressure state to the passive and active earth pressure state. The change of stress state will cause soil deformation. Even if support measures are taken, a certain amount of deformation is always difficult to avoid. In order to better complete the specific research on deformation monitoring of deep foundation pit in information construction, we first need to deeply understand the deformation monitoring technology of deep foundation pit construction. Deep foundation pit excavation works are often carried out in the bustling city center. There are buildings and underground pipelines around the construction site. The soil deformation caused by foundation pit excavation will directly affect the normal state of these buildings and underground pipelines. When the soil deformation is too large, it will cause damage to adjacent structures and facilities. In order to complete the deformation monitoring of specific deep foundation pit engineering, inclinometer, pressure sensor, reinforcement stress gauge, total station and level gauge also need to be used. Among them, inclinometer, pressure sensor and reinforcement stress gauge are responsible for analyzing the main factors leading to deformation, while total station and level gauge are responsible for ground macro deformation monitoring [9]. In the specific application of deformation monitoring technology in deep foundation pit engineering, its main application purposes are to find unstable factors in time, verify the design and guide the construction, protect the owner and relevant social interests, and analyze regional construction characteristics. In the process of deep foundation pit construction, only by comprehensively and systematically monitoring the foundation pit support structure, the soil around the foundation pit and adjacent structures, can we have a comprehensive understanding of the project and ensure the smooth progress of the project.

3. Necessity of Deformation Monitoring in Deep Foundation Pit Construction

Due to the complexity of site geological conditions and surrounding environment, the limitation of design scheme and the uncertainty of construction process, on-site monitoring has become an important link in the successful implementation of foundation pit engineering. Through the analysis of on-site real-time monitoring data, we can reasonably evaluate the working characteristics of the foundation pit and the influence of construction on the surrounding environment, predict the development trend, find out the possible unfavorable factors in the construction process as early as possible, judge the safety of the project, and deal with the problems in time. Excessive displacement of the supporting structure and the supported soil will cause the adjacent buildings to tilt or crack, and the adjacent pipelines to leak, sometimes causing a series of disastrous consequences. If there is careful monitoring and control, it will undoubtedly help to take emergency measures and avoid or mitigate the consequences of damage to a great extent. The monitoring of foundation pit will further deepen the understanding of the whole working state of foundation pit. By comparing the field monitoring results with the theoretical predicted values, more reasonable design parameters are obtained by back analysis method, which provides guidance for effectively adjusting the design scheme and carrying out information construction, and provides basis for verifying and perfecting the design theory. In the process of construction, the construction unit and the design unit should cooperate with each other to obtain the feedback deformation information. If the deformation information has a sudden change or exceeds the deformation standard, both parties shall

immediately organize personnel to discuss and then make a dynamic design, that is, place the design in the dynamic process of time and space, and make necessary adjustments to the original design along with the information collection and feedback in the construction process.

4. Dynamic Design and Information Construction

Dynamic design refers to the use of relevant field measured data, data processing, reverse analysis and other research methods to dynamically derive the relevant information of simulated rock and soil and deep foundation pit structure as much as possible. Based on this information, the designer gradually and reasonably modifies and adjusts the design parameters, optimizes the design scheme, and reduces the project cost under the important premise of ensuring the safety of the foundation pit project. Through real-time monitoring of deep foundation pit, a large amount of data can not directly reflect the changes of displacement field and strain field. The collected data must be processed, analyzed and classified, and compiled into charts and other forms, so that people can obtain relevant information more directly, concretely and effectively. In the foundation pit engineering, because of the multifarious influencing factors, the existing calculation theory can not fully reflect the various complex changes of the engineering. Although the design of the foundation pit supporting structure has been calculated as detailed as possible, the disconnection between design and construction is still inevitable [10]. Because of the complexity and variability in geotechnical engineering, the existing theoretical basis can not fully reflect all kinds of complex changes in engineering construction. Although detailed calculation and analysis have been carried out to the greatest extent in the structural design of foundation pit, the design and construction are still out of touch in different degrees. The data relational model of project management based on task-resource is shown in Figure 1.

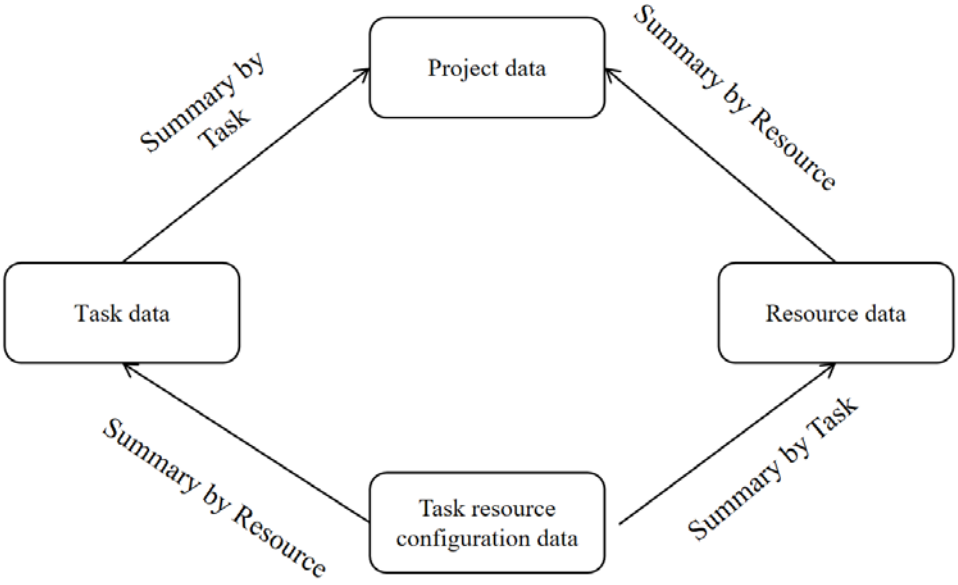

Fig.1 Project Management Data Relationship Model Based on Task-Resource

In the process of deep foundation pit construction, the monitoring data are analyzed quantitatively and qualitatively according to different properties. According to the present situation of foundation pit, the possible problems and development trends are predicted, so as to achieve the purpose of safe construction, and at the same time, it provides an important basis for verifying and improving the design theory and construction technology of deep foundation pit engineering. Because of the complexity of geotechnical engineering and the lag of research on engineering properties, the design theory of foundation pit supporting structure in China is still in the state of semi-theoretical experience. In this state, it is necessary to monitor the construction process, comprehensively analyze the field monitoring data, judge whether the previous construction meets the expected requirements, and determine and optimize the next construction parameters, so as to

realize the information construction. Although the analysis and arrangement of monitoring data are two different data processing processes, they are complementary and inseparable. In the process of data collation, data analysis is often accompanied, and data analysis needs to rely on the results of data collation. Dynamic design runs through the whole process of foundation pit engineering, and the construction information fed back from each stage is effectively utilized, so that the design and construction process are closely combined, and the design scheme is perfected and the design quality is improved through repeated design revision and adjustment.

5. Conclusions

With the development of economy and the improvement of people's living standards, the state began to attach importance to the construction of infrastructure, and a large number of high-rise and multi-storey buildings emerged. In the basement construction process of high-rise and multi-storey buildings, it is inevitable to encounter the construction of deep foundation pit. Ground deformation caused by foundation pit excavation leads to local collapse of foundation pit slope, which will cause certain losses in construction funds and construction period. For deformation monitoring of deep foundation pit in information construction, the construction unit must ensure that this work runs through the whole construction process if it wants to give full play to its own functions. Informatization refers to the adjustment of the original construction scheme through data processing, analysis and comparison with the previous data, relying on a large amount of information, such as real-time monitoring data from the site and previous survey data. The monitoring of foundation pit is an important guarantee of information construction. In case of dangerous or abnormal situations in the monitoring process, timely feedback should be given, and effective and feasible emergency measures should be taken quickly, so as to ensure the safety of the project. With the continuous development of information technology and deformation monitoring technology, the engineering monitoring data will become increasingly large, so the construction unit must attach great importance to the deformation monitoring of deep foundation pit engineering to ensure the safety and stability of construction.

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