

Original research article

Problems and countermeasures of double row pile support structure of deep foundation pit in geotechnical engineering

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Abstract: With the development of geotechnical engineering, the double row pile support technology of deep foundation pit in geotechnical engineering has also been improved. However, at present, there are still problems, which affects the quality and safety of the whole geotechnical engineering, and requires measures to deal with them. This paper first describes the characteristics of double row pile support of deep foundation pit in geotechnical engineering, then analyzes the problems laying in it, and finally puts forward some countermeasures.

Keywords: geotechnical engineering; double row pile support for deep foundation pit; issues and responses

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1. Double row pile support structure of deep foundation pit

The double-row pile support structure refers to the installation of two rows of parallel piles in the foundation soil, the star-shaped or plum-shaped arrangement of the front and rear rows of pile body, and the connection of two rows of piles with rigid crown beam along the pit wall parallel direction to form a gate-shaped spatial structure. This structure has large lateral stiffness and can effectively limit the deformation of foundation pit. In general, two rows of supporting piles are cantilever.

2. Problems of double row pile support of deep foundation pit in geotechnical engineering

2.1. Inconsistency between the actual force and design force of double row pile supporting structure of deep foundation pit

The design of double-row pile support structure of deep foundation pit adopts the theory of limit balance, so the soil is often destroyed because of instability in practical engineering construction. Instead of static equilibrium state, the actual engineering soil after excavation is in dynamic equilibrium state.

2.2. Inconsistency between double row pile support structure and soil excavation in deep foundation pit

The scientific and technological content of deep foundation pit in soil excavation is relatively low in the construction of deep foundation pit support in geotechnical engineering^[1]. However, the rock and soil engineering deep foundation pit slope support needs more strict construction operation technology, which also brings some difficulty to the construction management work. In the course of double row pile support construction of deep foundation pit in geotechnical engineering, many earthwork construction enterprises blindly shorten the construction period to improve their economic benefits, but ignore the quality. There are

some construction companies that want to speed up progress. The main reason for these problems is that the soil excavation and slope support of the deep foundation pit cannot be carried out in coordination, and there is a lack of comprehensiveness of the two projects and the lack of timely communication during the construction of the deep foundation pit support. In addition, in the construction management of double row pile support of deep foundation pit in geotechnical engineering, there is a lack of information and dynamic management of construction information, which is also an urgent problem to be solved.

2.3. Emergency response of double row pile supporting structure of deep foundation pit

Because of the uncertainty of double row pile support of deep foundation pit in geotechnical engineering, some construction problems will have a serious impact on construction schedule and quality. For example, in the construction of mixing pile, if the amount of cement is too small, it will affect the strength and durability of the supporting pile, and even lead to cracks in the supporting pile. At the same time, the construction personnel also play an important role in the foundation pit support construction. For example, their improper operation will affect the foundation pit support engineering quality, time limit and so on; some construction personnel with low construction level and poor quality often cannot operate strictly in accordance with the construction code in the concrete construction. There is a great randomness, which makes the quality of foundation pit support difficult to guarantee. In addition, the construction procedure of deep foundation pit must be strictly controlled from excavation to support construction. Although most construction units pay attention to this at present, it is difficult for them to carry out in the concrete construction, which results in the actual construction and the design are not consistent, which affects the overall quality of the construction.

3. Concrete measures on the double row pile support structure of deep foundation pit in geotechnical engineering

3.1. Strengthening the control of force of double row pile support structure in deep foundation pit

According to the current situation, problems easily occur in the anti-pull force of deep foundation pit support, the index of which is related to the development of each work. The control of the anti-pull force of deep foundation pit is suggested from the following aspects^[2]:

1) It's necessary to limit the anti-pull force to a certain standard range, strengthen the protection of the surrounding environment, and objectively reduce the impact on the construction of civil foundation. The current civil foundation construction, has gone deep into the interior of the city, requiring effective safety management measures and active implementation in the construction process.

2) In the construction process, the quality of the construction must be improved. When there is a contradiction between construction efficiency, costs and quality, the construction quality should be regarded as the main index, and the others as the secondary index to clarify the importance of quality. For example, the selection of anchor rod and the application of traditional measures must ensure that the quality is up to standard, and the resistance of double row pile support in deep foundation pit should be kept within the scope of demand.

3) It is necessary to do a good job of environmental protection, to deal with chemical pollution and noise pollution effectively, to set up a barrier inside and outside the construction site to reduce the expansion of pollution.

3.2. Selection of the support structure scheme of double row pile in deep foundation pit

In the design of deep foundation pit^[3], engineers and technicians should take full account of all kinds of reasons, including the following aspects: hydrogeological conditions, underground lines and surrounding pipelines, drainage conditions, load force of foundation pit, technical requirements of equipment, safety grade, construction time, selection and period of supporting structure, economic rationality and technical effect. Engineering designers should consider these factors synthetically and reasonably select the deep foundation pit support scheme.

3.3. Measures taken on the emergency of double row pile support structure of deep foundation pit

3.3.1. Strengthening the real-time observation on the support deformation of double row pile of deep foundation pit

This process is mainly to observe the deformation of underground pipeline and deep foundation pit slope and the influence of surrounding buildings. Through real-time observation to fully understand the excavation and support of earthwork, the actual situation and the differences between the design scheme are carefully analyzed, and then the design parameters and schemes can be adjusted in time^[4]. In addition, strengthen the monitoring of deep foundation pit support engineering construction, at the same time improve the alarm system of deep foundation pit monitoring, prevent the occurrence of safety accidents or emergencies, and ensure the safety of deep foundation pit construction. In addition, in order to be able to deal with emergencies in a timely manner, it is also necessary to build the emergency plan of deep foundation pit support project of vertical geotechnical engineering so as to minimize casualties and economic losses caused by sudden accidents. Therefore, the construction unit should comprehensively consider the construction environment and conditions, formulate a scientific and effective emergency plan for excavation and support of deep foundation pit, fundamentally control the occurrence of engineering safety accidents, and minimize the harm and loss caused by engineering accidents.

3.3.2. Improving the supporting quality of deep foundation pit in geotechnical engineering

1) To improve the safety and retaining function of the retaining system of deep foundation pit in sub-soil engineering and to keep the slope around the deep foundation pit stable^[5].

2) Whether in the construction stage or post-construction of deep foundation pit, it is necessary to ensure the safety of buildings and underground pipelines near deep foundation pit without serious damage phenomenon.

3) In the process of deep foundation pit excavation, when there is groundwater, the measures of precipitation and drainage should be taken in time to ensure the stability and convenient excavation of deep foundation pit slope. When the head pressure of the bearing water is too large, sand gushing will likely occur, which will cause the cracking of the foundation soil in the deep foundation pit.

3.3.3. The whole process control of double row pile support structure construction of deep foundation pit

Process control is the key point of the construction quality control of double row pile support in deep foundation pit of rock and soil^[6,7]. Once there is a problem in the process control of engineering construction, it is very difficult to correct and remedy after the event. Therefore, the construction unit must carry on the strict control management to the deep foundation pit construction process, organize construction strictly according to the deep foundation pit design plan, in order to guarantee the deep foundation pit construction quality. Before the construction of the project, the management and construction personnel should be

familiar with the engineering geological data of the site of the project, the intention of the engineering construction design drawings and the environment around the construction site, in addition to doing a good job.

4. Conclusion

Through the above analysis, it can be seen that the support of double row pile of deep foundation pit in geotechnical engineering is uncertain, regional, systematic and complex, and at the same time, there are some hidden safety problems in the construction process. Therefore, based on the problems existing in the double-row pile support construction of deep foundation pit in China at present, it is necessary not only to consider the engineering geology comprehensively in the concrete construction, to innovate the foundation pit support construction design, to perfect the construction plan, to improve the construction quality of double-row pile support in deep foundation pit strictly according to the relevant design standards and specifications, so as to lay a solid foundation for the development of geotechnical engineering in China.

Conflict of interest

The author declares no conflict of interest.

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