Rapid Support Construction Technology for Large Area Deep Foundation Pit Engineering in Soft Soil

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Abstract: With the continuous progress and development of the society, the number of urban infrastructure construction projects has increased year by year, and the uncertainty of the construction site has also led to the increase of construction difficulty, especially for some soft soil areas, the construction difficulty and protection measures of deep foundation pits. The difficulty is getting bigger and bigger. Therefore, the supporting construction technology for large-area deep foundation pit engineering in soft soil has become an important topic for many engineering construction enterprises to study and discuss in depth.

1. Introduction

Soft soil has the characteristics of large natural void ratio, high compressibility and high natural water content. These soil properties also have a direct impact on the construction of deep foundation pits and support construction. In order to solve this problem, engineers and technicians are striving to find new ones. Technology and innovative construction methods create economic and social value for enterprises under the premise of ensuring the quality and safety of construction.

2. Basic requirements for deep foundation pit engineering support technology

The deep foundation pit project refers to the construction project with excavation depth of more than 5 meters. With the rapid growth of urban population, the construction height of residential buildings and commercial buildings has been improved. The original shallow foundation pit construction technology has been unable to Applicable to the current construction of the project, therefore, in recent years, the majority of engineering and technical personnel actively innovate construction technology, creating a construction miracle in the construction field of deep foundation pit engineering.

2.1 Compliance with design requirements and optimization of construction plans

Before the construction of deep foundation pit support, it must refer to the relevant design requirements, fully consider the surrounding geological conditions, basic elevation and other factors. The construction plan is determined by the excavation depth of the foundation pit and the progress of the ecological environment project. The engineer is responsible for strict examination and approval, and reports to the chief engineer for signature verification. The preparation of the construction plan must comply with the national, industry, laws, regulations and standards. No individual can arbitrarily adjust and modify the content of the plan to ensure the accuracy and feasibility of the construction plan. In addition, the construction plan of deep foundation pit support should further refine and optimize the construction schedule, construction personnel configuration, construction essentials and construction process supervision, so that personnel configuration meets construction needs, construction essentials are fast and efficient, and construction progress is steady. Advance [1].

2.2 24-hour monitoring mechanism for groundwater extraction

The construction technology of deep foundation pit is different from that of shallow foundation

pit. Especially for the extraction of groundwater, an effective construction scheme must be formulated. The height of the groundwater level directly determines the rationality of the extraction scheme. At present, for groundwater in deep foundation pits, light well point pumping is usually adopted to effectively reduce the groundwater level to less than 1 m at the bottom of the foundation pit. During the extraction process, the construction company must have special care for 24 hours to carry out the pumping process. Tracking the whole process and recording the point and time of pumping. If the drainage of the open channel is adopted, the continuity of the drainage should be ensured during the construction period, and the intermittent drainage should not occur. When the structure does not have the anti-buoy force condition, it must not be halfway. Stop draining to avoid partial or overall damage to the structure.

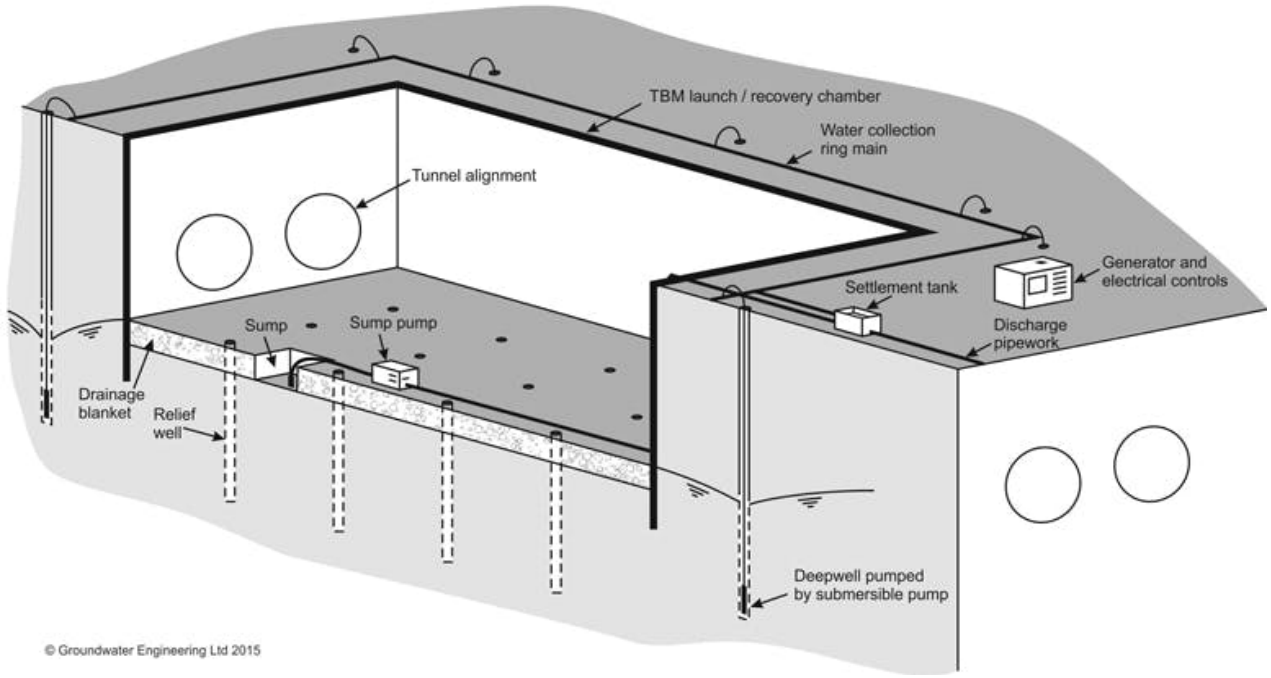

Figure 1. Groundwater extraction in soft foundation construction

2.3 Foundation pit excavation and earthwork lifting

After the construction company enters the construction site, it should first check the integrity of the construction machinery and whether it can operate normally to ensure the construction needs. When the excavation plan of the deep foundation pit is determined, the distance between all the excavators must be more than 10 meters, and the spacing should not be artificially shortened, which brings many inconveniences to the construction process. In the excavation process of the foundation pit, follow the layer-by-layer progressive excavation method, and it is not allowed to dig into the end directly, which not only affects the overall excavation effect of the deep foundation pit, but also brings economic losses to the enterprise. At the top or bottom of the deep foundation pit, the temporary ladder or support ladder should be set up in strict accordance with the standard requirements to provide convenient conditions for the construction workers to access the foundation pit. Except for the surrounding area of the foundation pit other than the ladder, no on-site construction personnel should step on it at will. In order to ensure the personal safety of the construction personnel, a safety guardrail should be placed around the foundation pit and a prominent warning sign should be posted.

When the excavator cooperates with the manual earthmoving, it must check whether the joint of the lifting tool is firm. The lower part of the lifting bucket is strictly forbidden. The safety personnel at the construction site should stick to the post in this process, and the heart is bright and clear, and the safety hazard is discovered in time. Eliminate it in time [2].

2.4 Rainy season construction and foundation pit backfilling

During the construction period, it is often rainy season. In the case of deep foundation pit construction, relevant drainage facilities and equipment must be installed around the foundation pit, or effective drainage measures should be taken according to the actual situation to prevent rainwater from having surface. The filling of water affects the construction progress. When the rainy season comes, the excavation earthwork should keep the soil of 30 cm above the elevation of the foundation pit, and then excavate the foundation pit when it is sunny. At the same time, the materials and construction machinery temporarily piled up at the edge of the deep foundation pit should be kept at a certain distance from the edge of the excavation when moving as a whole to prevent the occurrence of side slip or pit accidents. The departure distance is 0.8 meters or more, and the height must not exceed 1.5 meters.

When the deep foundation pit is backfilled by earth, it should follow the principle of symmetrical and uniform backfilling. It cannot show the situation of one side, and at the same time do the layering and compaction of earthwork to avoid the phenomenon of leakage.

2.5 Safety measures are in place

Construction safety is the top priority of all work on the construction site. For deep foundation pit engineering, the requirements for construction safety are higher. Therefore, on-site engineering technicians and safety management personnel should further enhance safety awareness and safety at any time. Hidden dangers must be resolutely eliminated in the bud. For each sub-project, division project and even every point of construction, safety management personnel should conduct on-site inspection and supervision to ensure the personal safety of the construction personnel. In addition, on-site construction personnel should have anticipation and preventive measures for the dangerous source parts in the construction process of deep foundation pits, and ensure the feasibility of the scheme.

3. The practical application of rapid support construction technology

Through the unremitting efforts of the vast number of engineering and technical personnel, the application and innovation of a variety of large-area foundation pit support technology methods, corresponding to the soft soil characteristics of different textures, the corresponding construction technology, to ensure the construction progress and quality, while ensuring the construction progress and quality, it also brings economic benefits to construction companies.

3.1 Construction method of combined support of back pressure soil and gravity retaining wall

The application condition of this method is that the excavation depth of the foundation pit is above 6 to 8 meters. When the open space around the foundation pit is large, the reserved working space is relatively wide, but the width of the working surface cannot reach the construction condition of the slope. This method can be selected for construction. For example, the deep foundation pit project in the underground parking lot is a representative example. The remarkable feature of the underground parking lot project is that the construction schedule is tight. The construction period from excavation, piling, underground attachments and surrounding greening should not exceed six months. Due to the large excavation area of the underground parking lot project, the traditional Supporting schemes, large investment, poor results, and time-consuming labor in the disassembly and assembly of the supporting body, delaying the construction period, making the progress of the project seriously lag. Therefore, the conventional support method cannot be applied to the construction of underground parking lots, but the construction method of back pressure soil combined support and gravity retaining wall should be adopted.

During the construction process, the water curtain is generally formed by adopting three rows of grid-type cement-soil mixing piles. At the same time, there is a lot of silt in the construction area of the foundation pit, for the entire supporting surface, in case when the back-pressure soil falls due to the penetration of the water curtain, the entire block structure will correspondingly lose the support of the back-pressure soil, resulting in a serious safety accident. For the three-row lattice cement-soil

mixing piles, it must be ensured that the curtain penetration occurs in order to effectively avoid this serious consequence. Practice has proved that through this method of underground parking lot construction, the foundation pit support effect is significant, and the safety performance is relatively stable [3].

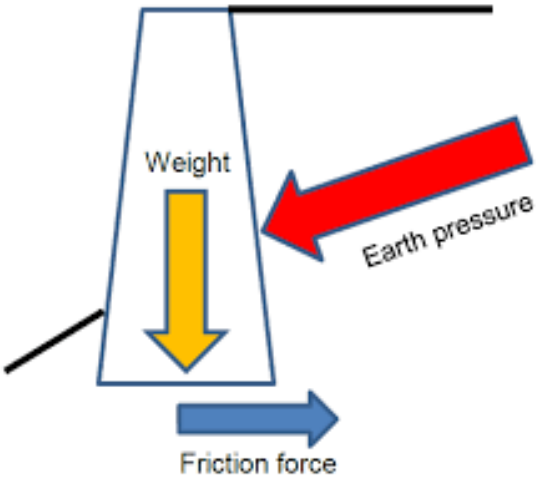

Figure 2. Construction principle of gravity retaining wall

3.2 Supporting method of combined support of back pressure soil and underground continuous wall

This method belongs to the cantilever support form of double-row piles. In fact, by applying this method, a gravity retaining wall with a small surface thickness can be formed, and the wall of the retaining wall has high bending resistance. With the tensile capacity, the maximum support height of this support method can reach more than 9 meters, and it is more suitable for excavating large foundation pits with a depth of more than 10 meters.

Especially for areas with dense residential and commercial buildings, it is most suitable to use the support method of back pressure soil combined support and underground continuous wall. For the construction work area, the foundation pit includes artificial filling layer, Holocene lower group marsh sediment layer and Holocene middle group marine sedimentary layer from top to bottom. For such a large-scale construction project, it is necessary to first analyze the surrounding environment, conduct centralized inspection of the surrounding traffic conditions, and important auxiliary facilities such as underground communication cables and gas pipelines, and then carry out construction operations according to the construction plan. The main feature of this kind of construction operation is that the scale of the project is particularly large, and the capital investment of the foundation pit project is particularly large. Therefore, during the construction, the interests of the enterprise should be considered as much as possible, and the workload of the support should be minimized, and the construction safety should be ensured. The construction can be carried out by means of cantilever excavation as much as possible, which can effectively reduce the construction cost and save more expenses for the enterprise. Due to the large excavation area of the foundation pit, under the premise of taking into account the safety construction, how to ensure the progress of the project and shorten the construction period is an important consideration for the engineers and technicians of the enterprise.

In the actual construction, the surrounding area between the commercial area and the residential building can be set according to the operation plan or the continuous wall supporting structure can be adopted. For the conditional construction unit, the supporting structure of the double-row pile can be adopted. A certain amount of back pressure soil is reserved at the edge of the foundation pit, and the interior of the foundation pit is entirely exposed to the bottom of the foundation pit. After the internal main structure is completed, the back-pressure soil around the foundation pit is removed, and reinforced concrete or steel pipe support is applied to the main basement space and the surrounding envelope structure in layers, and the temporarily installed support is removed.

When performing on-site work, focus on the direct or indirect impact of the shield construction on the overall support structure. When the main structure inside the pit enters the end, remove the back-pressure soil in the edge area of the foundation pit. At the same time, additional support is applied to the construction of the edge. After the excavation of the foundation pit, only a part of the back-pressure soil is left in the periphery. At this time, the working state of forming the retaining pile and the back-pressure soil should be fully considered. This method is used for on-site construction, and the deformation control effect of the back-pressure soil is better, and the main facilities in the city and the road surface around the foundation pit are not damaged.

3.3 Construction method of secondary joint support

For the basement construction of some high-rise buildings in the city, the construction work of the foundation pit project is generally carried out by the secondary joint support method. Especially for soft soil areas with high water levels, in order to ensure the construction effect and ensure the progress of the project, this method is most suitable. In the formulation of the supporting construction plan for the foundation pit, important factors such as the construction period should be fully taken into account. In the analysis and comprehensive comparison of the construction methods, it is found that the conventional process of setting the horizontal support of large-area reinforced concrete has the disadvantages of high cost, long construction period and delayed completion date of high-rise buildings. In order to realize the requirements of rapid support, rapid excavation and rapid construction of high-rise buildings in large-area deep foundation pits in soft soil areas, construction enterprises should effectively implement the secondary joint support construction method for single-row piles and double-row piles. Applied to engineering construction.

When adopting this method, it must be satisfied with the relevant standards of the country and the industry as well as the requirements of environmental protection. During the construction, the surrounding environment cannot be damaged, and the normal life of the residents cannot be affected. Therefore, when designing and preparing the construction plan, these constraints should be incorporated to ensure the optimization of the construction plan [4].

3.4 Construction method of combined support of back pressure soil + double row pile

The excavation depth is large, and the periphery of the support pile of the foundation pit is the main traffic road of the city, and the heavy-duty vehicle travels frequently, and the double-row pile back-pressure combined support method is adopted due to the limitation of the construction space on the construction site. When the on-site construction is carried out, when the width of the reserved soil is a constant value, the appropriate increase of the reserved soil height and width can significantly reduce the maximum horizontal displacement and the maximum bending moment value of the front and rear rows of the double-row pile. The larger the reserved soil width, the smaller the maximum horizontal displacement and the maximum bending moment value, and the two are inversely proportional to each other. However, due to the stability of the reserved soil, there is no limit to the amount of reserved soil. During this period, corresponding measures must be taken to ensure the stability of the reserved soil. Usually, the reserved soil is soiled. Nail support, or surface hardening of the slope of the reserved soil. During the construction process, the higher the height of the reserved soil, the greater the construction difficulty.

4. Conclusion

With the increasing number of urban infrastructure projects, there are more and more projects for large-scale deep foundation pits in soft soil. Faced with this situation, construction enterprises are also adopting high application value on the premise of meeting national and industry-related policies. Construction technology can not only control the cost, but also ensure the construction progress. In the actual construction of the project, higher requirements are also imposed on these methods for different geological conditions and different surrounding environments. Therefore, the construction enterprise will further strengthen management, meticulously organize and optimize the

construction plan, and analyze various constraints. Give full play to the advantages of innovative construction methods.

References

[1] Chen huiyong, long wei, gu weiheng, et al. Design practice of deep foundation pit support with deep soft filling in complex environment. Guangdong building materials, Vol. 12 (2017) No.18, p. 50 - 52.

[2] Qin jiwei. Design and construction of deep foundation pit support in coastal soft soil drainage pipeline project. Architectural technology, Vol. 11(2017) No.48, p. 1204 - 1207.

[3] Wu hua, yan airong. Design and construction technology of deep foundation pit support for a project. China real estate industry, Vol.1 (2016) No.17, p. 127 - 128.

[4] Xiao lei. A case study of foundation pit support engineering in deep soft soil area of Zhuhai. Western resources, Vol. 3 (2018) No.15, p. 112 - 113.