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Plaxis Finite Element Modeling And Analysis Of Soil Nailing Support For Deep Foundation Pit

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ABSTRACT. *Through the design of the supporting structure of deep foundation pit project and excavation of the corresponding research and analysis, and from the results and conclusion to the security and stability of the whole structure construction process and in real life more convenient in construction and economic and reasonable structure, such as excavation and supporting of deep foundation pit engineering, and take this opportunity to more and more, such as excavation and supporting of deep foundation pit engineering to build a good construction conditions.*

KEYWORDS: *deep foundation pit, soil nailing support, Plaxis finite element*

1. Introduction

Deep foundation pit engineering is one of the oldest in geotechnical engineering, involves engineering geology, hydro geology, and the engineering structure mechanics and soil mechanics, and so on many kinds of mechanics and engineering technology, and combining the theory of soil mechanics, the finite element software simulation analysis, construction equipment and a variety of monitoring instruments and the development of the excavation and supporting of deep foundation pit engineering and research, and in this paper, the research of deep foundation pit supporting technology is applied to land excavation and slope stability of a mechanical structure, it has the advantage of construction safety, quick, and simple, in a deep foundation pit engineering in our country develop rapidly,Soil nailing support technology of deep foundation pit is a very important support technology[1].

2. Project Overview

The site of a project is a stable site, suitable for the construction of the project. The groundwater can be divided into pore water, pore confined water and bedrock

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fissure water[2]. The ground water of the site is slightly corrosive to the concrete structure and the steel bars in the reinforced concrete structure;The underground soil of the site is slightly corrosive to the concrete structure and the steel reinforcement in the reinforced concrete structure, and very weakly corrosive to the steel structure.It is suggested to adopt pile foundation and soil nailing to support the foundation pit[3].At the same time, a relatively complete foundation pit drainage system was established, and the surrounding buildings were monitored for deformation, taking full account of the impact on the surrounding environment[4].

3. Finite Element Simulation Analysis

The software Plaxis USES for finite element analysis in geotechnical engineering is used to solve the stability, deformation, groundwater seepage and other problems in geotechnical engineering. It is a tool for calculating and analyzing the present and future complex geotechnical engineering problems.

Step 1: input the geometric model graph, input the structural construction stage of soil and soil, load and other conditions, and we can use this geometric model to generate the finite element mesh.

Step 2: the finite element software can automatically generate grids, and then optimize the overall and detailed grids. Sometimes thousands of grid cells can be generated.

Step 3: the program calculated by the finite element software is to estimate the horizontal displacement and vertical displacement caused by the actual stress, as well as the settlement of the foundation pit.

Step 4: the output function of the finite element software can be used in the later stage to analyze and display the calculation results using geometric curves.

The selected block of the deep foundation pit of the project looks like a standard rectangle as a whole, so we conduct the simulation analysis of the model based on the principle of rectangle. Plaxis finite element software was used for 2d simulation analysis. Because of deep foundation pit of soil nailing technology belong to the three dimensional space problem in principle, but due to create a 3 d simulation analysis of space model to analyze soil nailing supporting is very not unreasonable economic, and simulated analysis requires a lot of time, because time is limited, this article so this project adopts the method of two-dimensional simulation is analyzed, because in the past many engineering examples in the two-dimensional method has been validated by fully, it is in accordance with the needs of practical engineering, so this article USES the two-dimensional simulation plane analysis method.

The excavation size of the model is the most reasonable according to 5 to 6 times of the actual project. The excavation depth of the foundation pit in this project is about 5.85 meters, so the selected depth is 30 meters.The width of this block is 32.50m. In the simulation, the soil mass with a width of 50m and a depth of 30m is selected as the model to carry out the corresponding analysis and research.So the size of the model is 50m 30m (X Y).

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For the boundary conditions of displacement calculation in the calculation, relevant assumptions are made: for the convenience of the calculation in this paper, the right and left boundary of this model are zero for the horizontal displacement; And it can be deformed in the vertical direction; But for the bottom boundary of the model, the deformation is zero in either direction. The left and the right, the displacement in the X direction and the Y direction is zero, and the displacement in the other direction is free. The excavation size of the model is the most reasonable according to the selection of 5 times to 6 times of the actual project, because the excavation depth of the foundation pit of this project is about 5.85 meters, so its depth is about 30 meters. Because the width of this block is 32.50m, in the simulation, in order to facilitate the calculation and analysis, we selected soil 50m wide and 30m deep as the model to carry out the corresponding analysis and research. So the size of the model is 50m 30m (X Y).

According to the shape and size of the foundation pit, the quadrilateral element is used for calculation below, in order to make the simulation and calculation results more close to the reality. In the calculation and analysis, the pile row is calculated as the diaphragm wall, because from the perspective of mechanics, the pile row and the diaphragm wall have a similar form of stress. In the Plaxis finite element software, the pile section is equivalent to the plate thickness according to the principle of equal bending stiffness, and the result calculated by this method is relatively safe and reasonable.

The advanced element node can be applied to the soil. Its stress is evenly distributed, and the failure of load can be accurately judged. It can be divided into a triangular element with 6 nodes and a triangular element with 15 nodes, etc. In this way, the axial symmetry can be well analyzed and studied. Due to the unit triangle with 15 nodes, its calculation accuracy is obviously higher than that of the unit triangle with 6 nodes, but the calculation of each node of 6 is relatively fast. To sum up, this paper selects the unit triangle with 15 basis points for calculation.

First open the Plaxis finite element software into the input interface, draw the finite element software interface and software interface is very similar, his calculation accuracy can be set in the input interface, input interface window has a variety of choices, each choice for different parameters, the input before, we need to determine the type of each parameter, and then to the establishment of the project, we first set up the deep foundation pit project as the title, this model is a two-dimensional plane strain model, the six nodes and 15 units in the node to select 15 unit node, input length in size, time and stress etc, Then, the spacing between grids was set at 0.05 and the spacing between partitions was set at 1, and then the next step was confirmed. After the establishment of this geometric model, the corresponding definition of the initial conditions was required, covering the initial stress, initial pore pressure and drainage conditions.

In this project, for the excavation process carried out in each stage, the ratio between the maximum value of lateral deformation of the pit wall and the excavation depth is between 1.63‰ and 2.33‰.According to the measured data abroad can know: the United States is 1 ‰ to 3 ‰, France is 0.7 ‰ ~ 3 ‰, the UK

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is 2.5 ‰ ~ 3 ‰, Germany is 1.5 ‰ ~ 3 ‰, showed that soil nailing project will not bring very large lateral deformation, also illustrates the soil nailing system, the article takes the step-by-step excavation process of giving play to the role of come out, they Shared characteristics can be formulated into the following several:

(1) after the soil nail is put in, along with the continuous increase of its excavation depth, the soil will experience deformation. The strain level of this soil part is lower than that of its plain soil slope under the same load condition, thus delaying the formation and development process of the cracked area.

(2) under the condition that the soil body has deformation, the surrounding stress of the soil nail will transfer to the soil nail, and the soil nail will exert the influence of skeleton constraint and have a certain anchoring effect. First of all, the friction force on the contact interface between the soil nail and the soil body also ACTS as a binding force, which makes the soil nail be subjected to passive tension. Moreover, the phenomenon that the soil body is restrained and strengthened by the tension makes it more stable. Secondly, due to the common role of soil nails and soil mass, a flexible structure with supporting function is formed. It takes on the side pressure of the soil mass at the periphery of the foundation pit together. In addition, it also carries out maintenance work for the stability of the foundation pit, changing the passive support into active support.

In the whole process of deep foundation pit excavation, the monitored data in the foundation pit all indicate that the soil mass or horizontal displacement of the foundation pit and the horizontal displacement obtained by calculation theory are gradually increased, and the results of finite element software simulation analysis are also gradually increased. Through finite element analysis simulation obtained after excavation, there is the biggest displacement nephogram knowable its horizontal displacement is 13.26 mm less than 0.0025 H = 14.625 mm (H = 5.85 m), so meet the requirements of design and specification, and the process of deep foundation pit in the project engineering construction, the actual observed the maximum horizontal displacement is 18 mm, carries on the comparison to both to know, between measured values and the value of simulation is relatively close, are within the scope permitted by specification, this time, The simulation results are satisfactory.

4. Conclusions

The modeling of finite element Plaxis software is simple and fast, which makes it convenient for users to quickly generate geometric models and finite element grids according to representative sections. In the aspect of foundation pit excavation and support, the displacement and internal force of each construction as well as the plastic area and the situation of the change of soil surface settlement after the pit are analyzed and studied, and the change of supporting axial force and the effect of pre-adding axial force on the surrounding structure are analyzed. In order to make the earthwork excavation process for the engineering pile and tower tower steel lattice column protection measures related to improve, refine pit pit construction and other

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work to lay a foundation. Through continuous learning and reading literature, access to the corresponding information, and continuous improvement and improvement.In addition, I made field visits to the corresponding high-rise building construction projects and made continuous summary and analysis, expecting to obtain more rigorous structural design blueprints in future construction projects, and to make reliable research values for the excavation and support of deep foundation pits.

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