Research on Design of Civil Engineering Structure Combining Computer and Foundation Reinforcement Technology

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Abstract. Generally speaking, the structural design of civil engineering depends on the foundation reinforcement technology, such as the soil "reinforcement method" which can improve the tensile strength of the soil. Geosynthetic materials, sand well preloading and plastic drainage belts to promote soil drainage consolidation; "Dynamic compaction" and "vibration flushing", etc. The development of computer technology provides a new way of thinking for structural design of civil engineering. The purpose of this paper is to study how to realize the combination of computer technology and foundation reinforcement technology in the structural design process of civil engineering.

Keywords: Civil Engineering Structure, Foundation Reinforcement, Foundation Stronger

1. Introduction

Due to the different sizes of buildings, the requirements for the strength of the foundation are also different. The design of the foundation must consider three requirements from the actual situation. Sometimes only one aspect needs to be considered, and sometimes two or three aspects need to be considered. If the above requirements are not met, the foundation design scheme shall be modified or treated accordingly (the soil layer in the foundation shall be treated with physical or chemical technology, such as surface compaction, soil pile compaction, vibroflotation, preloading, chemical reinforcement and pile mixing in place, etc.), so as to improve its structural properties and meet the requirements of the building for the foundation design[1].

In architecture, the foundation treatment is very important, whether the superstructure is firm or not has an irreplaceable role. The foundation of the building is not good enough, and the superstructure is likely to collapse, which can not be overemphasized. The main purpose of foundation treatment is to
adopt various foundation treatment methods to improve the foundation conditions\cite{2-4}. The objects of foundation treatment are soft foundation and special foundation. The code for design of building foundation (gbj7-89) clearly stipulates that "soft foundation refers to the foundation mainly composed of silt, muddy soil, alluvial fill, miscellaneous fill or other highly compressible soil layers". The special land base has regional characteristics, including soft soil, collapsible loess, expansive soil, red clay and frozen soil\cite{5-6}.

2. Improvement measures for foundation

2.1. Improve shear properties

The shear failure of the foundation is manifested in the insufficient bearing capacity of the foundation of the building; the instability of the structure or the slope during the earth excavation; the uplift of the adjacent foundation or the pit bottom during the excavation of the foundation pit. Therefore, in order to prevent shear failure, it is necessary to take measures to increase the shear strength of the foundation soil.

2.2. Improve compression

The high compressibility of the foundation is manifested in the settlement of the building and the large differential settlement, so measures should be taken to improve the compression modulus of the foundation soil.

2.3. Improve water permeability

The permeability of the foundation is manifested in the leakage of the foundation caused by the foundation of the dam and the house, and the quicksand and piping are produced during the excavation of the foundation pit. Therefore, it is necessary to study and take measures to make the foundation soil impervious or reduce its water pressure.

2.4. Improve dynamic characteristics

The dynamic characteristics of the foundation are as follows: during the earthquake, the silt and sand will liquefy; because of the traffic load or pile driving, the adjacent foundation will vibrate and sink. Therefore, it is necessary to study and take measures to prevent liquefaction of the foundation soil and improve the vibration characteristics to improve the seismic performance of the foundation.

3. Improvement method of foundation performance

The above is the basic improvement measures. If there is to be a solid foundation, it is necessary to select the appropriate treatment method according to the actual situation. The following several foundation treatment methods are more practical. As Figure 1.
1) Replacement method: when the bearing layer under the building foundation is relatively weak and cannot meet the requirements of the superstructure load on the foundation, the replacement cushion is often used to treat the weak foundation. It is to excavate the soil layer within a certain range under the foundation, and then backfill with sand, gravel or lime soil with high strength, and compact them to be dense.

2) Preloading method: preloading method is an effective method for soft soil foundation treatment. The essence of this method is that before the construction of a building or structure, the equivalent load should be applied on the proposed site first or by stages, so that the pore water in the soil can be discharged, the pore volume becomes smaller, the soil is dense, and the bearing capacity and stability of the foundation can be improved. The treatment depth of surcharge preloading is generally about 10 m, and that of vacuum preloading is about 15 m.

3) Dynamic compaction method: dynamic compaction method is a foundation reinforcement method initiated by L. Menard of France in 1969, that is to use dozens of tons of heavy hammers to fall from a high place, repeatedly ramming the ground for many times, and carry out strong compaction on the foundation. The practice shows that the bearing capacity of the foundation after ramming can be increased by 2-5 times, the compressibility can be reduced by 200-500%, and the influence depth is more than 10 m.

4) Vibroflotation method: vibroflotation method is the abbreviation of vibroflotation method. According to different soil types, it can be divided into vibroflotation replacement method and vibroflotation compaction method. The vibroflotation method mainly plays the role of vibroflotation replacement in the cohesive soil, and the pile formed by the replacement filler and the soil form the composite foundation; in the sand, it mainly plays the role of vibration compaction and vibration liquefaction. The treatment depth of vibroflotation is about 10 m.

5) Deep mixing method: in the deep mixing method, cement and soil are forced to mix in the foundation by using cement or other curing agent through a special mixing machine, so that the soft soil is hard to form a whole, forming a cement soil pile or underground continuous wall with water stability.
and sufficient strength, and the treatment depth can reach 8-12m. Construction process: positioning - sinking to the bottom - shotcrete mixing (rising) - repeated mixing (sinking) - repeated mixing (rising) - finished

6) Sand and stone pile method: vibrating pipe sinking sand and stone pile is the abbreviation of vibrating pipe sinking sand pile and vibrating pipe sinking gravel pile. The vibrating sinking pipe sand gravel pile is to drive the casing into the specified design depth under the vibration of the vibrator. After ramming the pipe into the soil, the soil around the casing is compacted, and then the sand and stone are put in, and then the sand and stone are discharged into the soil. The vibration is dense and the pile is formed. After many cycles, the sand gravel pile is formed. The method of sinking pipe by hammering can also be adopted. The composite foundation is formed by the soil between pile and pile, which can improve the bearing capacity of the foundation and prevent the sand from vibration liquefaction. It can also be used to increase the overall stability of soft cohesive soil. The treatment depth is about 10 m.

7) Soil or lime soil compaction pile method: the soil pile and lime soil pile are made of the method of pipe sinking, impact or explosive expansion to squeeze soil into a hole in the foundation, and then rammed with plain soil or lime soil into the hole to form a pile. When the hole is formed, the soil around the pile hole is extruded laterally, so that the soil around the pile can be densified. Soil pile and lime soil pile compaction foundation is a composite foundation composed of soil pile or lime soil pile and compaction soil between piles. The characteristics of soil pile and lime soil pile are: local materials, soil treatment, in-situ treatment, deep densification and low cost.

4. Summary

In addition, the development of modern industry provides a powerful means of production for foundation engineering, such as the production of heavy tamping hoisting machinery weighing up to tens of tons; the emergence of submersible motor brings the construction machinery of vibroflower in the vibroflostation method; the advent of vacuum pump can establish the vacuum preloading method; the production of compressed air machines with a pressure greater than 200 atmospheres leads to the "high-pressure jet grouting method"

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