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松软地层中基坑工程的复合型土钉支护

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摘要　复合土钉支护作为一种基坑支护型式，由于变形较小、工程造价低廉，近年来在工程实践中得到了广泛应用。总结了各种复合土钉支护的型式，并着重阐述了松软土层、高水位地区复合土钉支护的变形机理和稳定分析研究。根据现场观察，复合土钉支护的变形按照裂缝产生的位置、规模和先后次序可以分为3个阶段。对每个阶段裂缝的产生机理做了分析，并提出了针对措施，以确保基坑稳定。同时对3个裂缝阶段之后产生的2个破坏阶段亦加以描述和分析。提供了2种计算复合土钉支护稳定性的分析方法：双圆弧滑动法和强度折减法。双圆弧滑动法是基于简单条分法的一种改进方法。该方法考虑了复合土钉支护的滑裂面不是一个完整的圆弧，基坑边坡与坑底是2个半径不同的圆弧，并在搅拌桩处光滑连接。该方法经过大量的实践证明是可行的。分析复合土钉整体稳定性的另一种方法引入了边坡稳定性分析中采用的强度折减法，不考虑土钉－土体接触面的强度折减，仅考虑土体强度折减。同时，指出按照传统方法计算复合土钉支护的抗倾覆、抗滑移稳定性没有必要。

关键词　岩土工程；复合型土钉支护；变形机理；双圆弧滑动法；强度折减法

分类号

APPLICATION OF COMPOUND SOIL-NAILED WALL TO FOUNDATION PIT IN SOFT SOIL

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Abstract

The compound soil-nailed wall(CSNW) is a new style of support of foundation pit. This method is widely used in the project practice in recent years because of the excellent behavior and cheap cost. The styles of different CSNWS are introduced，and the research of the deformation mechanism and analysis of global safety of the CSNW employed in soft soil is emphasized. According to the observation of many CSNW projects，it is concluded that the process of crack development on the slope can be divided into three main phases，and the explanation for the cause of each crack phase is described. The countermeasure for dealing with each crack phase is recommended to secure the stability of the excavation. Two methods for calculating the global stability of the CSNW is introduced. One is the “double-circle” slice method，which is a modified method based on the traditional one. The proposition that the failure surface is composed of two circular surfaces is introduced. These two circular surfaces connect smoothly in the position of deep mixing pile. With this proposition，the anti-slide attribution of the soft clay in the passive region is considered properly. This method has already been employed to design a lot of CSNW project. Another method to calculate the global safety factor is shear strength reduction method. This method is getting more and

more popular in the region of slope stability analysis. The region of CSNW，the strength of the interface between the soil and nail is not considered. A project calculated with shear strength reduction method is described. It is also pointed out that the method employed in gravity wall analysis is not suitable for CSNW.
Key words geotechnical engineering；compound soil-nailed wall(CSNW)；deformation mechanism；double-circle slice method；strength reduction method

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