

Commentary on Slope Treatment Methods in Open Dump

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Commentary

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ABSTRACT

The slope treatment methods of open pit dumps can be considered by cutting the slope, pressing the foot, replacing base filling, changing the discharge method, and slope reinforcement. Based on the quantitative analysis of safety factors, this paper compares and analyzes various methods of slope treatment in the dump. In practical engineering practice, the dual thought of technical feasibility and economic rationality is used to evaluate the stability coefficient of slope comprehensively. In this paper, several slope control methods used in open pit dumps are reviewed, the applicable conditions of slope treatment methods are obtained, and the results are compared and commented on.

Keywords: Surface mine; Dump slope; Governance methods; Partial replacement

DESCRIPTION

An open pit dump is a place where mining and stripping waste rock is stored, consisting of the original base and the loose material that is discharged. As a large loose accumulation body, the high slope of the dump is prone to geological disasters such as landslides and debris flow.

Summary of slope treatment methods

The treatment methods for the slope of the dump usually include cutting the slope, pressing the foot, replacing the base, changing the discharge method, and strengthening the sliding surface.

Cutting off the upper part of the slope is called cutting the slope to reduce the sliding force of the slope and increase the safety factor of the slope. This method is often used in sliding deformation landslides, where the pushing action of the upper load is an important cause of slope instability. The pile of waste at the foot of the slope of the dump is the pressure foot to increase the anti-sliding force of the slope. Under normal circumstances, these two methods are used in combination to maximize the utilization of waste materials.

Sliding surface reinforcement refers to the use of slope consolidation grouting. The effect of consolidated grouting is to change the properties of the sliding surface in time. In the slope where the landslide has occurred, the cohesion of rock and soil bodies is weakened, and grouting can improve the shear strength of the sliding surface and thus improve the stability of the slope.

The change of discharge method mainly includes the discharge of large particles with good permeability at the bottom of the dump to reduce the softening of water on the physical and mechanical properties of the slope. To realize the mixed discharge of rock and soil, to ensure that the waste has a good grain distribution; to reduce or eliminate the uneven settlement of the dump site, the weak base part discharges the lower height accumulated particles, and the high strength base part discharges the higher particles.

Foundation replacement is an original method of strengthening weak foundations in our country. After decades of continuous development, it has been widely used in all walks of life. This process is a physical process in which the earth and stone are thrown into the silt, and the silt will be squeezed out by the volume of the stone. With the continuation of the rippling process, the accumulation body with the stone as the skeleton and the silt filling the void of a reasonable structure is eventually formed. At the same time, with the increasing height of the extruded silt, the reverse pressure of the slope foot is formed, which plays a role in strengthening the slope. Later, the replacement filling method gradually developed in China. The idea of this method is to replace the weak basement or even the silt basement with materials with higher strength, such as gravel, sand, etc., to replace the weak basement or even the basement with a thickness below the weak basement. Then, with artificial tamping and other methods, the replacement material chamber is made to improve its compressive and shear strength. The result is a durable artificial base.

Evaluation of slope treatment methods

This paper mainly studies the potential landslide mode of the slope with a weak basement and weak layer to the boundary of the dump and puts forward the most suitable treatment measures for local basement replacement and filling in the deformation area of the slope to the boundary of the engineering practice.

Based on the engineering background of the Guole No. 2 open pit mine in Jilin Province, the physical parameters of coupled soil were determined by numerical simulation, and the relationship between the replacement rate and the stability coefficient of slope was studied and analyzed. The reliability of the method was verified by true three-dimensional numerical simulation.

As for the slope to the boundary of the dump site, the common press-foot method cannot be adopted because of the mining right boundary, and the reduction of slope Angle greatly reduces the amount of soil discharge, which is not conducive to the development of mine mining and discharge planning. In this paper, the method of locally destroying the weak interlayer and replacing the rock and soil with strong mechanical properties can ensure the stability of the slope without reducing the slope Angle, and greatly reduce the amount of engineering, which is in line with the safe and efficient production task of a coal mine.

CONCLUSION

This paper reviews a variety of slope treatment methods of dump, each with its engineering use conditions, corresponding to local replacement methods, which are produced in the face of slope deformation area treatment and for the normal development of follow-up dump, the engineering value of the method is very considerable, but considering the different geological conditions of coal mines in different regions, The influence of formation dip on the stability coefficient of slope and the replacement rate can be added to further expand the applicability of this method for soft rock dump.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AVAILABILITY OF DATA AND MATERIAL

The data used to support the findings of this study are available from the corresponding author upon request.

CODE AVAILABILITY

Not applicable

AUTHORS' CONTRIBUTIONS

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Li Yin, Dong Wang, and Xiaoyu Xing. The first draft of the manuscript was written by Dong Wang, Li Yin. All authors read and approved the final manuscript.