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Analysis of the Advantages of Open Pit Mining

Kaipeng Zhang, Jingxu Zuo and Yiqi Zhai

Shandong University of Science and Technology, Jinan 250031, China

Abstract

In the process of open-pit coal mining, the landslide phenomenon is very obvious, so for the safety of mine personnel and the smooth implementation of the project, studying the stability of the slope angle is an extremely important task. There are many factors that affect the stability of the slope, such as soil quality, climatic conditions, later pressure, etc., this project takes the open-pit mine as the research object, calculates the slope coefficient through geological data exploration combined with program analysis method, and then sets up a soil dump near the mining area, so as to improve efficiency, project safety and planning maximum benefits.

Keywords

Landslide Phenomenon; Open-pit Mine; Slope Coefficient.

1. Introduction

The development of mineral resources will greatly promote economic development, but overexploitation will damage the geological environment of the mining area, lead to geological disasters, and in the long run will pose a threat to the safety of people's lives and property.[1]

Therefore, it is of great humanistic significance to study the stability of the slope in the mining area and design the landslide control method, and the change of the view of slope stability analysis changes with the breakthrough of human theory and the accumulation of practical experience, and it is a process of gradual development from qualitative analysis to quantitative and semi-quantitative analysis. The combination of theoretical analysis and numerical simulation was used to analyze and study the stability of the slope, and the feasibility of the mining scheme was demonstrated.

2. Surface Mining Project Program

2.1. Design Specifications

Through the analysis of the geological conditions and engineering geological conditions of the geographical location of the Harwusu open-pit mine in Inner Mongolia, it is concluded that the site has great mining advantages. In the process of open-pit coal mining, able to calculate the most basic starting cost of the project by using the Swedish strip method combined with rock formation images.

2.2. Analysis of Slope Safety Methods

2.2.1. Swedish Analytical Method

The Swedish analysis method is an important method for analyzing slope, that is, the Swedish arc sliding noodle method, which divides the soil above the assumed sliding surface into n vertical soil strips, analyzes the force and moment balance of the forces acting on each soil strip, and finds the safety factor of soil stability in the limit equilibrium state.[2]

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2.2.2. Program Analysis Method

The program analysis method is based on the R language environment, the method of safety assessment of the engineering site situation, considering the popularity of computers today, and the editors of related programs have done source processing of engineering-related code, using computers to simulate more complex environments is a feasible and efficient choice.

2.2.3. Program Analysis Method

Excel table observation data is more intuitive and more visualized, but limited by the volume and computing power of Excel, many data processing will be cumbersome.[3] The expression method is as follows.

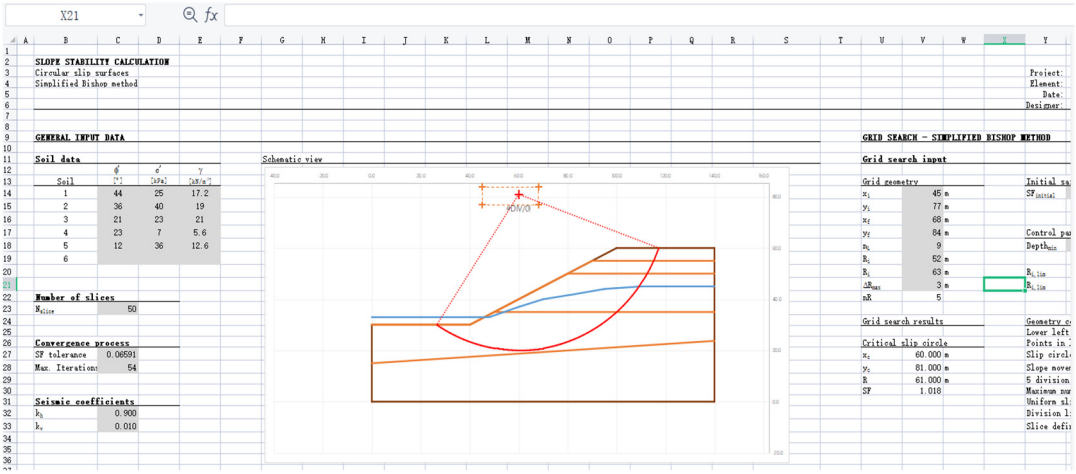

Figure 1. Tabular analysis sample

2.3. Evaluation of Design Concepts

2.3.1. Swedish Analytical Method

There are three mineral materials in the area. They are Mythril, Cavorite, Australium.[4]

Selection criteria: distribution of mineral materials, the value of mineral materials themselves, mining cost and difficulty, etc.

Combined with the exploration data, material 2 is widely distributed and concentrated, and the distribution is shallow, the mining cost is low, and the mining difficulty is low. Material 1 and Material 3 are both difficult.

In summary, the option of mining material 2 as the main and mining material 3 as the supplement.

Material one, material two, material three are shown in the figure. Material 1 is light green, Material 2 is pink, and Material 3 is dark green

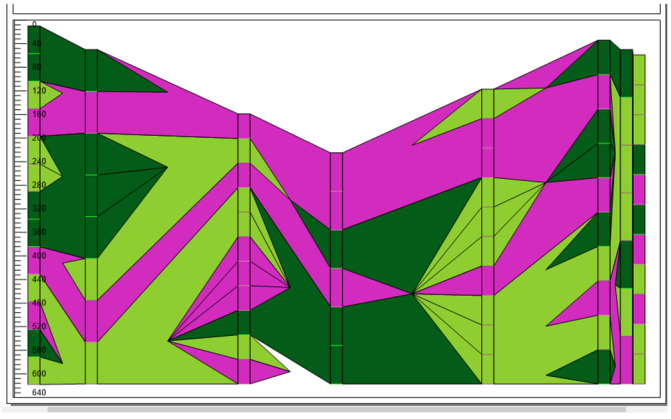

Figure 2. Mineral distribution in borehole

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2.3.2. Disposal of Waste Products

In terms of the disposal of waste products, combined with the relevant technical workers visited and the field visit of the project team, the waste ore that has been mined can be buried in situ if it is not well utilized, and the waste will be filled in the pit where mining has stopped. Before being buried, waste should be preferentially transferred to gentle terrain and away from residential areas and upstream rivers to prevent secondary disasters such as landslides, water pollution, and dust pollution. Minerals that are not targeted for mining and have some economic value can be sold to local stakeholders to obtain additional income to invest in this project, forming a virtuous cycle of capital flow. [5]

2.4. Model

2.4.1. The Model Involved

This project primarily uses a data analysis method model to determine soil distribution and slope stability for each borehole. The relevant data is shown below.

Borehole	Location (m)	high (m)
Borehole 1	305	608
Borehole 2	728	567
Borehole 3	940	458
Borehole 4	1194	392
Borehole 5	1947	500
Borehole 6	2589	583
Borehole 7	2977	567
Borehole 8	3165	558

Figure 3. The data of borehole

2.4.2. The Functionality and Requirements of the Model

The purpose of data analysis is to conduct equilibrium analysis of the force and moment of each soil strip element, and obtain the safety factor under the limit equilibrium state. From the known soil distribution of each borehole, the soil distribution of the entire terrain in the case diagram can be learned in favor of the specific mineral species in the excavation project.

The program is a limit equilibrium theory, which analyzes the stability of the slope by using the soil strength constitutive and the parameters of the reinforced members. At the same time, according to the modeling calculation in the R language environment, the parameters such as slope width, friction angle, and thickness are finally substituted to calculate the safety factor

2.4.3. Model Evaluation

Through the computer program model, a specific value is converted into a specific value to obtain a relevant value. By running the program, the final result area is based on the relevant safety factor. If the safety factor is greater than 1, it is safe; If it is greater than 2, it is more stable.[6]

3. Conclusion

In terms of technicality, the report skillfully integrates cutting-edge technologies and research findings by referencing multiple academic papers. On the scientific front, the relevant data cited undergoes careful validation, ensuring accuracy and reliability. Regarding controllability, the project planning phase incorporates Gantt charts to intricately plan and control each process, ensuring the project is completed within a reasonable development time. Such controllable measures contribute to the smooth progress of the project, enhancing overall execution efficiency.

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