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COMPREHENSIVE ANALYSIS OF FACTORS AFFECTING ROCK AND SOIL STABILITY

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Abstract: With the advancement of construction equipment, materials and theoretical technology, the quality of geotechnical engineering in my country has been greatly improved. However, due to the diversity and complexity of construction conditions and later damage factors, the stability of geotechnical engineering is still It is difficult to meet today's needs. Therefore, it is of great practical significance to systematically study the factors affecting the stability of rock and soil mass and summarize the weak points.
Keywords: Rock and soil mass; Stability; Influencing factors; Construction guarantee

1 INTRODUCTION TO ROCK AND SOIL BODIES

Rock and soil mass is a very common form of geographical environment in human life and is closely related to many people's activities. Especially in the civil engineering industry, construction rock and soil mass, foundation pit rock and soil mass, etc. often appear in various engineering projects. Under construction. With the continuous expansion of economic construction in recent years, more and more rock and soil engineering projects have been carried out, and the stability of rock and soil bodies and their natural disasters have always been hot issues in the engineering field. The development of China's social economy has led to the rise of various construction industries. In the context of economic integration, the construction industry, as one of the important pillar industries of the national economy, has ushered in new opportunities and challenges in construction.

1.1 The Importance of Rock and Soil Stability

Geotechnical engineering involves multiple disciplines, mainly including engineering mechanics, rock mass mechanics, supporting structures, construction management and technology, building materials and measurement, etc. The research requires high cross-disciplinary requirements. At the same time, rock and soil bodies have a tendency to automatically move downward in their natural state. Coupled with factors such as pressure, friction-reducing effects of intergranular fluids, and incompleteness caused by cracks, rock and soil bodies are very prone to instability and collapse. Rock and soil instability can induce a series of natural disasters such as debris flows and landslides, which are very common in mountainous areas. During the construction process, if the rock and soil support is improper, instability may easily occur, which will cause huge losses to people's lives and property and increase social instability. Due to the development of local economy, over-exploitation of land, destruction of vegetation, large-scale mining of rocks, etc., geological disasters of rock and soil have become increasingly common, and the country and people have suffered heavy losses. Due to the complexity of rock and soil management factors and the diversity of action mechanisms, rock and soil management is still a focus and difficulty.

1.2 Classification of Rock and Soil Bodies

The classification of rock and soil bodies is shown in Table 1.

Table 1 Classification of rock and soil bodies

Classification basis	Rock and soil body name	Overview of rock and soil body types
Rock mass type	Rock type building rock and soil mass	This kind of building rock and soil is mostly rock and can be subdivided according to the type of rock mass.
	Soil type building rock and soil mass	This kind of building slope is composed of soil. According to the soil type, there are overlapping soil and stone types, mixed soil and stone types, etc.
rock and soil stability	Stable building rock and soil mass	This type of rock and soil mass has high stability and will not deform. It is a target type of rock and soil mass protection.
	Unstable building rock and soil mass	Local damage has occurred and protective treatment is required
	Unstable building rock and soil mass	The stability of the rock and soil has been completely destroyed and requires thorough protection or re-construction.
	Moderate building rock and soil mass	Slope less than 15°
Slope of rock and soil mass	Medium steep building rock and soil mass	The slope is between 15° ~ 30°
	Steep building rock and soil mass	The slope is above 60°

2 ANALYSIS OF FACTORS AFFECTING ROCK AND SOIL STABILITY

From the perspective of factors affecting the stability of rock and soil masses, they are mainly divided into internal factors and external factors. Among them, internal factors mainly include the basic characteristics of rock and soil masses, such as geological structure types, rock and soil mass structural characteristics, etc. From the perspective of influence time, these influencing factors are often relatively long-term and are also the main factors causing the loss of stability of rock and soil mass. In essence, these internal factors have a decisive influence on the form and scale of rock and soil bodies. Not only that, these factors also have a great impact on the weathering, shape, vibration load, meteorological conditions and plant growth of the rock and soil mass.

2.1 Stratigraphy and Lithology

Differences in stratigraphy and lithology will affect the rock and soil bodies, and differences in time and origin will cause the rock and soil bodies to be destroyed and take on different forms. Because they all have different physical and chemical properties, the reduction in the shear strength of the rock and soil media and the increase in the shear stress will ultimately lead to instability and damage to the rock and soil mass.

2.2 Rock Mass Structure

One of the important factors affecting rock and soil mass is the structure of the rock mass itself. We usually divide the structure of rock mass into multiple aspects, including layered, massive, bulk and fragmented network structures. Their different structural forms will have certain differences in physical properties, and the properties that ultimately lead to the damage to the rock and soil mass are also different.

2.3 Weathering

After being exposed to the natural environment for a long time and being eroded by wind and rain, the rock and soil mass will slowly produce corresponding weathering phenomena, and the stability of the rock and soil mass will also gradually decrease.

2.4 Groundwater

The influence of groundwater on the stability of rock and soil cannot be ignored, including erosion, softening, and dynamic and static water pressure. As the name suggests, groundwater has a buoyant effect on the rock and soil mass, which will reduce the stability of the rock and soil mass and lose its original support, leading to final instability. Groundwater can soften the rock and soil in the sliding zone of the rock and soil mass, reduce the overall strength of the rock and soil mass, and thereby cause instability of the rock and soil mass. The water inside the rock and soil mass mainly comes from rainfall, forming groundwater through infiltration. This groundwater fills the gaps between the rock and soil, increasing the self-weight of the soil mass per unit volume. At the same time, the water pressure in the gaps and pores increases, aggravating the dynamic and static water. pressure, which is another form of groundwater. From the perspective of other effects, groundwater has a lubricating effect on the soil, that is to say, the groundwater forms a complex force on the rock and soil, that is, the interaction between water and rock and soil is formed. In a sense, groundwater is not only the internal cause of instability of rock and soil, but also plays a negative influence in the gradual deformation and destruction of slopes.

2.5 Vibration Effect

Natural earthquakes, man-made blasting and other factors will produce certain vibrations, which will seriously damage the stability of the rock and soil mass. The transverse waves and longitudinal waves generated by various strong vibrations will cause the structure of the rock and soil mass itself to deteriorate. Changes have caused landslides and reduced the stability of rock and soil.

2.6 Basic Forms of Rock and Soil Failure

From the classification of failure forms, rock slope instability can be divided into two types: rock collapse and landslide. Collapse occurs in rock slopes where the rock and soil mass are too steep. Large pieces of rock mass separate from the rock slope and fall forward, or the rock mass at the top of the slope falls off for some reason and rolls down and accumulates at the foot of the slope. It often occurs on slopes. Where the apical cleft develops. It is mainly due to weathering that weakens the cohesion of the joint surfaces, or due to rainwater seeping into the cracks and generating crack water pressure; it may also be caused by changes in temperature, freezing and thawing of loose rocks. Other accidental factors include swelling pressure caused by plant roots, earthquakes, and lightning strikes.

Landslide is the overall sliding of rocks along the weak structural surface in the slope under the action of gravity. The main types of landslides include plane sliding, wedge sliding and rotational sliding. The rock slope sliding process can be roughly divided into three stages: ① Creeping deformation stage. Cracks appear on the slope surface or on the top of

the slope and gradually lengthen and widen. Extrusion occurs on the front edge of the slope. The groundwater level changes, and sometimes there is a sound. ②Sliding failure stage. The rear edge of the slope subsides rapidly, and the rock mass slides downward at a very high speed; ③ Gradually stable stage. The loose sliding body gradually becomes denser, vegetation gradually grows on the sliding body, and the groundwater seepage changes from muddy to clear.

3 TECHNICAL PROBLEMS AND SOLUTIONS FOR ROCK AND SOIL CONSTRUCTION

3.1 Geotechnical Survey

Before carrying out support design for building geotechnical engineering, staff must fully understand the geotechnical properties of the geotechnical mass, and the construction unit should provide geotechnical engineering data. During the survey process, effective supplements should be made based on the characteristics and actual conditions of the rock and soil mass to ensure that the rock and soil survey data meet the needs of design and construction. When carrying out the construction of rock and soil engineering, it is necessary to clarify the purpose, conduct a detailed survey of the hydrogeological conditions and the basic situation of the project, determine the type of rock and soil and possible damage forms, and then make scientific and reasonable decisions on the stability of the rock and soil. evaluate.
The general steps of rock and soil mass survey are: find out the engineering geological conditions of rock and soil mass, determine the category of rock and soil mass, further provide various parameter values required in the process of rock and soil body stability calculation, and propose potential impacts on rock and soil mass stability. Based on the specific treatment plan and measures, the remediation and design considerations of the rock and soil mass can be obtained. For rock and soil engineering projects with safety levels of one and two, it is necessary to draw geological vertical and horizontal sections of the rock and soil mass, and analyze the geology of the entire rock and soil mass. Conduct a detailed survey.

3.2 Soil and Rock Engineering Aspects

The instability of soil and rock mass engineering is the primary problem to be solved in geotechnical engineering. We usually use the following measures to improve the instability of soil and rock mass engineering: ①Plant trees. By adding vegetation measures to the rock and soil mass, the soil slope can be effectively reinforced, and it can also be used in conjunction with other greening, so that the slope can form a more complete protective layer. ② Mortar masonry rubble protection. This method is used for soil slopes with a slope ratio less than 1:1. The thickness of the mortar rubble is generally 0.2 to 0.5 m, and expansion joints and drainage holes should be installed in between. For embankment rock and soil, if the subgrade settlement is unstable, then the masonry rubble should be The method of mortar-laying rubble slope protection should not be used. ③Concrete precast block protection. It is mainly used in areas lacking block stone materials and can achieve a certain degree of aesthetics. ④Face wall protection. For rock formations with severe surface weathering, including chlorite schist, dry schist and other similar soft rocks, the protection of the protective wall is particularly important. The main external force it bears is its own gravity and does not bear other loads, including the wall. The subsequent earth pressure. The excavation slope for protection of the protective wall should meet the ultimate stability requirements of the rock and soil mass. The bottom width of the protective wall is generally required to be 0.4 ~ 0.6 m, the top width is 0.4 ~ 0.6 m, and the wall height is H/ 10 ~ H/20.

3.3 Geotechnical Engineering Safety Monitoring

At present, for the monitoring of geotechnical engineering, there are many types of monitoring instruments available. The main monitoring methods include geodesy, ground photogrammetry, electromechanical measurement and internal deformation monitoring. The instruments selected for each monitoring method Not exactly the same, and so is the accuracy. During the implementation of geotechnical engineering, blasting, excavation, loading and meteorological conditions need to be strictly recorded. When monitoring blasting projects, the possible impact of blasting on the surrounding environment must be fully considered. For earthwork projects, it is necessary to ensure that horizontal and vertical displacement monitoring meet the requirements during monitoring, and the monitoring time should be no less than 3 years. When carrying out geotechnical engineering construction, the design unit should put forward monitoring requirements, and the construction unit should entrust a qualified unit to prepare monitoring methods. The next step of construction can only be carried out after passing the review. 4 Conclusion
There have always been rock and soil stability problems in engineering construction. Landslides and collapse disasters caused by rock and soil instability often bring huge losses of life and property. There are many factors that affect slope stability, and the situation is also relatively complex. In During project construction, it is necessary to analyze the impact of the engineering environment on the stability of the rock and soil mass to provide reliable guarantee for the construction of the project.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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