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Analysis of slope instability factors and protection

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Abstract
This paper analyzes the factors that influence slope stability, and the use of the corresponding protective measures to protect the slope stability, provide a comfortable and safe environment for the road operator.

Keywords: Slope Stability Factor Protection

1. Introduction
Slope for highway projects is an important part, in order to ensure the stability of the roadbed, built on both sides of the embankment slope has a gradient. Nowadays, with the development of national economy, the state expanded the urban, mountain and other transportation planning, roads rank higher and higher, there will be a large number of vertical and horizontal extension of the long slope, thus the comprehensive improvement of the proposed highway slope high demand.

2. Influencing factors of slope stability
There are many factors that affect the stability of slope, which can be divided into internal factors and external factors. From the internal, there are factors of geology: rock genetic types, the mineral component composition, geotechnical and structural strength. The slope is composed of hard rock and soil compaction, mineral stability, good weathering resistance, high strength, its stability is generally good, and poor. The structure type of rock mass, the shape of the structure surface and the relationship with the slope surface are the controlling factors of rock slope stability, and sometimes there are discontinuities in the rock mass, which is easy to improve the stability of the slope. From the environmental aspects to consider there will be weathering, rain, earthquakes and other effects. Shear strength of rock are weakened by weathering, fractured increased, expanded, affected the shape and sloped gradient, and water permeability increases, so easy to surface water intrusion, changing the dynamics of groundwater. Rainfall is the main factor that causes the slope to be destroyed. It is easy to soften the soil, reduce the intensity, increase the surface porosity, and reduce the stability of the slope. Earthquake leads to decrease of the slope stability is mainly the additional horizontal earthquake force generated by the earthquake, when the direction of action of the additional horizontal earthquake force is adverse, slope sliding force increase, sliding surface anti slide force decreases. Meanwhile, the hydrological conditions also have impact on the geology, groundwater mainly by acting on the vertical fracture, producing horizontal thrust, the rock slope to the bottom, buoyancy also causes reduced stability, reduce friction, rocky are deteriorated, and decreasing the stability.

The external cause is human activity. Currently slope of improper use can cause changes in topography and natural vegetation, slope gradient are steepened due to digging, filling, coupled with deforestation of natural vegetation, resulting in slope to loss of soil and water conservation function, will accelerate the occurrence of slope collapse accident. When slope in slope order or on the crest of the hill there are improper loading will lead to increased downside force, when more than their own and protection facilities can provide resistance, easy to form of slope failure. In the development of sloping land, the slope backfill is often used to facilitate the development and the filling area without rolling compaction, the interior of the soil will lose, so it is easy to produce uneven settlement or deformation. When building the fill section above, will cause cracking, displacement, skew or dumping and other disasters. In improper excavation on the foot of the slope, the rock mass shear strength will be decreased, when other factors triggering, the possibility of failure is immediately. General development of the slope are required to meet the specification of soil and water conservation, according to the provisions of the slope ecological protection, or the addition of drainage systems and retaining facilities, etc.. When these slope protection facilities are not improper or poor maintenance, it will directly affect the stability of the slope.

3. Analysis Method Research
Some analysis methods are used in the study of the factors influencing the stability of slope. Qualitative analysis method, mainly by means of engineering geological survey and other means to analyze factors influencing slope stability. Influence of the above mentioned geological conditions, hydrological conditions, tectonics, geomorphology, climate and human engineering activities on the slope stability are using qualitative analysis method to analyze and to qualitatively determine the slope failure possibility and the possible failure mode.

Usually in the study of slope stability factor considering cohesion and angle slope higher will use the method of quantitative analysis, mainly in the analysis of limit equilibrium method and the finite element analysis method, this is from the perspective of more subtle to analyze the degree of influence factors on slope stability influence. Orthogonal design method, which overcomes the defects of traditional single factor analysis method, based on the shear strength reduction finite element method, on the slope stability safety factor is calculating and the statistical analysis, and the influence factors of slope stability sensitivity ranking. Through the orthogonal design method, we can from the finer, deeper perspective to understand the factors influencing the slope

stability. Embankment slope stability influence factors of the sensitivity is different of cutting slope, both the common features is the shear strength parameters, slope height, slope angle on the slope stability is most sensitive, bulk density, and other factors influence is very small. In the design and construction should try to avoid the high filling and excavation, and should slow down the slope and, in practical engineering according to the specific circumstances may also consider the impact of groundwater, seismic load and excavation method and non-uniform.

4. Protection of Slope Stability

Nowadays, the slope stability in highway engineering occupies an important position, slope engineering is to ensure the slope stability, maintain and restore the ecosystem balance, improve the important projects along the landscape, the slope protection and governance, is indispensable. The slope of the protective measures to be taken to strengthen the effective tips to deal with the instability of the slope, the first is to do the slope protection work: First, the grass, because the slope is relatively stable, and the erosion of the slope is small, the grasses grown in soil Highway Cut Slope and embankment among the surface in order to achieve the prevention of soil erosion, improve embankment stability and consolidation of topsoil. At the same time, it can also take the sod ways to further strengthen the stability of its construction. The second is to plant trees, mainly in the soil, fissured clay, rock slope protection, combined with the actual highway substructure side slope planting trees, can effective reinforcement of highway substructure, and assisted the grass and shop turf shall cooperate with, slope to form an effective protective layer, to achieve the purpose of effective protection. Three is plaster or the hammer surface, mainly used in serious weathering, rock cutting slope softness, should adopt the mixed material plaster treatment in the use process, for prone to erosion and weathering of the rock slope protection, it is best to take material mixed plaster. The second to do the substructure slope erosion and protection. Do support wall protection work is to deal with the broken rock and soft rock slope excavation work of coverage and the construction of the wall, mainly in the more severe weathering of soft rock to achieve the desired purpose of weathering. Common retaining wall aperture type, entity type, assist type, arch and. Among them, aperture type retaining wall mainly used in the slope ratio of less than 1: 0.75 slope, mainly selected beat surface or dry stone flakes, the entity type retaining wall is mainly used in conventional soil and broken rock and soil slope, assist the retaining wall is mainly used in the intact strata and steep slope, arch retaining wall mainly used in the intact rock and the lower part of the slope and need protection in the upper part of the slope.

Soil substructure often due to rain erosion caused the slope soil is relatively soft, which caused the accident of slope stability, so in the serious peeling rock slope protection should be dry rubble protection, dry rubble slope protection single thickness of 15 cm. Take double paved the way, the upper and lower thickness should be 15-30 cm and were 15-25 cm, chosen cushion as the bottom surface of the layer of paving. The common cushion materials are gravel and gravel mixture. For the prevention and control of slope failure, it should do a good job of intercepting and drainage works, including the ground drainage works and underground drainage works. Surface water drainage works mainly exclude surface water within the scope of the slope. Surface drainage ditch shall be used masonry mortar, in order to prevent leakage and erosion. Underground drainage engineering use blind ditch, to which prevent slope failure and other types of roadbed disease have a good effect. Slope can use rubble retaining walls, pile, bolt, cable, etc. retaining, in order to ensure slope stability and to prevent the occurrence of collapse.

5. Conclusion

At present, there is a considerable level and scale in the research of slope stability. We still need to theoretical research inputs to practice to, careful analysis and summary of the causes that affect the slope stability, and take effective skills in processing, maximum to ensure the quality of highway slope protection, also hope to establishment and perfect the highway environment protection legal system and management mechanism, effects of effective control of highway construction on the environment, the protection of natural environment, and to realize the comprehensive utilization of land, take the road of sustainable development, to ensure the highway construction in a healthy and orderly development.

6. Reference

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