

Application and Evaluation of Slope Treatment Technology in Land Regulation of Loess Plateau

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Abstract

Nowadays, Large-scale trench and hill-cutting and city-building activities in the Loess Plateau have resulted in many bare high and steep slopes that need urgent ecological restoration. This research mainly involves the technology of safety control and ecological greening of slope cutting engineering, the measurement technology of ecological effect of gully and slope control engineering, the technology of slope-vegetation system stability improvement, the technology of slope engineering and vegetation protection and ecological disaster prevention and control, etc. It is suitable for the construction measures of the general slope combination of land management in the Loess Plateau. According to the characteristics and needs of each component, combined with the technical characteristics, an evaluation index system was established to analyze the governance effect.

Keywords

Land consolidation; Slope control; evaluating indicator.

1. Introduction

The site type conditions of gully slope and the suitability of plant growth and development were studied. Different types of technical conditions were established through the effects of ditch location, slope direction, slope gradient, soil type, soil moisture and microclimate factors (annual sunshine, accumulated temperature ($> 10\text{ }^{\circ}\text{C}$) on plant growth and development. Based on the analysis of slope and crop suitability in the study area, the suitable crops and reasonable slope cutting methods under different site conditions were determined, which provided theoretical basis for the layout of vegetation measures in ditches[1].

- (1) Slope-vegetation stability improvement technology: Select grass and shrub species that can improve the stability of soil structure on high slopes.
- (2) Slope body and vegetation protection and ecological control technology: Select the grass-shrub allocation mode which can increase the erosion resistance of slope surface.
- (3) Safety protection and eco-greening technology of slope cutting project: the stability of excavated slope is increased by engineering measures such as drainage ditch, ditch interception, support and so on. At the same time, certain engineering measures are adopted to promote plant growth on excavated slope and promote its eco-greening.

2. Slope Stability Maintenance Technology

Optimum design methods such as slope, grading and platform setting are adopted to reduce slope gradient, length and height, so as to increase slope stability. According to the physical and mechanical characteristics of loess slope soil for ditch-making in northern Shaanxi, through the calculation and analysis of slope stability with different geometric parameters, and considering the restoration and construction of ecological vegetation, it is suggested that the excavation slope should be graded and set up a platform with a height greater than 12 m, and at least a large platform should be set up. The large platform can be set at the boundary of old loess Q₂ and new loess Q₃ (about one third of the slope height).

Based on the above constructed stable slope surface, spraying with special mud matrix of functional microorganisms and algae, sowing dominant bryophyte crust provenances in the project area, and planting common drought-tolerant grass shrubs in the Loess area, adopting a variety of conservation measures, can form a biological crust-grass shrub three-dimensional slope with a certain coverage and height in a short time[2].

The addition of algae and functional microorganisms will shorten the canopy closure time, improve the effect of greening and erosion control on slope, improve water conditions and promote the healthy development of ecological succession[3]. This technical scheme has high engineering popularization value.

3. Combination of Slope Treatment Engineering and Vegetation Measures

For the slope which affects the safety of human settlements, traffic and important facilities, engineering protection measures should be adopted to reinforce the slope. The main engineering protection measures are: masonry retaining wall, masonry slope protection, masonry slope protection and frame slope protection. For the important loess slope with large slope, the protection measures combining engineering with plants can be adopted[4]. The main measures include geogrid grass planting greening, geogrid grass planting greening, hanging three-dimensional net spraying grass planting, frame grass planting protection for slope protection.

Generally speaking, forest and grass measures are the main measures to control soil and water loss on slopes, but the slopes formed by development and construction projects are basically bare slopes, and the stability of slopes and the water, fertilizer, gas and heat conditions of soil are poor. Therefore, in order to restore the vegetation quickly and grow well and prevent the landslide and runoff erosion before vegetation closure, corresponding engineering measures should be taken, such as cutting head and reducing load, anti-sliding pile, anti-sliding retaining wall, grouting anchor column, grid beam and drainage consolidation, slag retaining wall, fish scale pit and water pit to prevent the landslide from sliding[5]. Slope land preparation projects such as level terrace, level ditch and planting hole: 1.Maintaining slope stability, retaining runoff and reducing erosion; 2.Increasing soil moisture and improving local vegetation growth conditions..

4. Technology Implementation Impact Analysis

In development and construction projects, excavation slopes are different from natural slopes in shape and structure. Excavation of slopes is to meet the requirements of mechanical stability and drainage. The slopes are straight and single, and the soil lacks layers. Concrete or stone slope protection is neither water-permeable nor plant-growing. Like insulators, the soil layer of the slope is isolated from the outside world. Individual slope protection is covered with soil-fixing vegetation, but also limited to grass or shrubs. Compared with natural slope, the slope

has no rugged and undulating changes, simple ecological structure, interruption of energy and material flow, which is an ecological degradation from the ecological point of view.

The engineering slope protection measures of excavation slope are deliberately using impervious ground hardening materials to prevent soil erosion. Although they can effectively prevent rain splash erosion and surface runoff erosion, they also change the balance of water budget inside and outside the slope. The hydrological and soil water characteristics of the artificial slope are quite different from those of the natural slope, because the reduction of rainfall infiltration will affect the supplement of local groundwater, resulting in a large amount of surface runoff on the artificial slope, which will cause serious soil erosion on the slope surface and the foot of the slope if not handled properly; if the runoff is concentrated, it will increase the peak flow of the river and reduce the flood carrying capacity of the river. To increase the probability of flood outbreak and increase the burden of flood control.

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