Remote Sensing Study of Sliding Surface of Slopes nearby a Large Tobacco Growing Plantation

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Objectives: A study of remote sensing detection of slip surfaces on man-made slopes in a natural environment nearby a large tobacco growing plantation. Based on the GPR method, the image characteristics of potential slip surfaces on slopes are analyzed based on the change in GPR wave amplitude caused by the water content of the slip surface. The large granularity and permeability of the spoil allows natural precipitation to continue to infiltrate into the bedrock, and the infiltrated water gradually erodes the spoil and forms a water-rich rubble layer with the easily soluble rock mass, which develops into a slip zone and threatens the stability of the slope nearby a large tobacco growing plantation. By analyzing the magnitude of the remote sensing images, the process of water content changes in the soft fracture zone at the bedrock interface of the slope can be efficiently and accurately understood. Ensured the safe operation of the planted tobacco plantation.

Key words: tobacco growing plantation; spoil dump slope; GPR
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According to China's national tobacco planting demonstration for many years, after promoting the use of experience shows that each region cultivation planting out of tobacco varieties are different, there are great differences between the components, because there are many factors affecting the growth of tobacco, environment, climate, rainfall, altitude, etc., such as good performance of tobacco seeds suitable for dry land and paddy field planting, and disease resistant varieties suitable for planting cultivation in sufficient water, fertile land, and disease resistant and adaptable varieties suitable for cultivation planting on multiple types of soil.Because tobacco seedlings are less resistant to drought and flooding, there should be no standing water in the tobacco field, and if there is standing water, it should be drained promptly.

Spoil dump slope was a new artificial slope in construction. It's influenced by human factors, also limited by the bearing capacity of the foundation. And it is probably slipped during the process of construction or project operations[1]. The surface detection technique of the non -disturbance has great

importance to monitor potential slips of the fill slope if it was prior considered. In this paper, the Ground Penetrating Radar (GPR) of non-destructively detecting method was introduced. the slips' space position and fill shape timely and effectively would be detected[2].

GPR is a geophysical method that uses antennae to transmit and receive high-frequency electromagnetic waves to detect the material properties and distribution patterns inside the medium[3-4].

In this paper, the GPR method was used to detect and study the potential slip surface of the spoil dump slope in the absence of artificial disturbance during the COVID-19 epidemic, and to analyze the evolution of the slip surface slopes under natural conditions by comparing before and after the downtime.Ensured the safe operation of the planted tobacco plantation.

MANAGEMENT MEASURES

The characteristics of hydraulic engineering determine the complexity of the prevention and control of the epidemic. As enterprises around the world resume work one after another, the delay in resuming work caused by the epidemic. The restrictions on the return of migrant workers and the requirements of the local resumption policy may slow down the progress of the project. Such as the return of personnel to isolation, and the procurement of epidemic prevention materials, and the enhancement of daily monitoring, and other measures as well as the tight supply of raw materials. This factor making hydraulic engineering shortage in human, physical, financial. The difficulties and challenges posed by the epidemic to hydraulic engineering have only just begun.

Since the epidemic that is still ongoing, Zhen'an Project Department has prepared the Resumption Work Plan, divided the whole project into 30 divisions and sub-projects, which are underwritten by members of the leading team, and divided into three aspects according to the work procedures. Firstly, the subcontracting teams were given a briefing on the implementation plan for the resumption of work before they entered the site; secondly, the project department conducted a safety hazard survey on the working surfaces to be resumed; thirdly, the migrant workers who entered the site were given real name registration, safety education and training, and technical and safety briefings were conducted at the site. The resumption of work will commence after all conditions are in place. See in Figure 1.

Figure 1 Management Measures

Therefore, during the COVID-19 epidemic (2019.12 to 2020.4), the spoil dump slope was continuously shut down, and during this period, the spoil dump slope was not disturbed artificially or mechanically, so it is extremely important to study the process of variation of the potential slip surface of the artificial slope under typical natural environmental conditions. [5-6]

METHODS

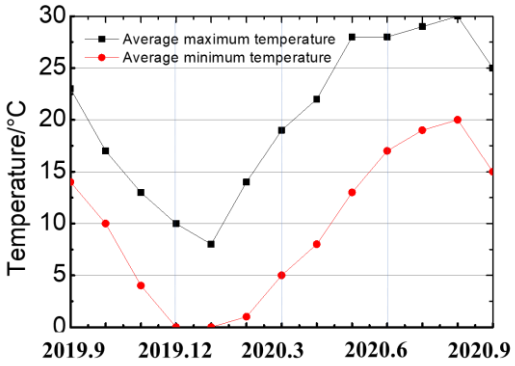
A pumped storage power station is a hydroelectric power station that collects energy by pumping water from a low location to a high location and generates electricity when the power system needs it. It converts excess electrical energy from the grid into water potential energy for storage in the low valley, and converts the water potential energy into electrical energy in the peak load, achieving effective storage of electrical energy and redistribution of electrical energy in time,

effectively regulating the dynamic balance between production, supply and use of the power system.[7]

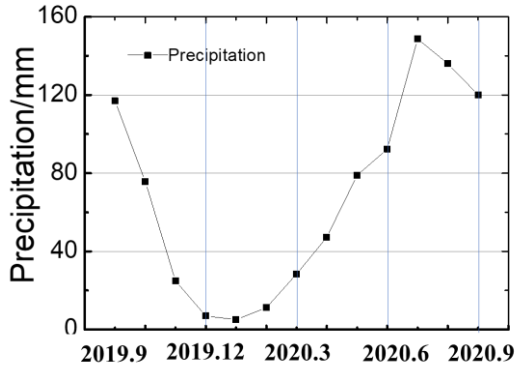
The Zhen'an Pumped Storage Hydropower Project is located in Zhen'an County, Hanzhong City, Shaanxi Province, China, deep in the Qinling Mountains. The artificial slopes are filled in stages with mainly red cliff ditches. The site has a maximum elevation of 1120 m and a minimum elevation of 990 m, with a maximum height difference of 130 m. The slope of the site is approximately 40° to 60°, with a gentle slope up and a steep slope down. The site mainly exposes marble rocks, with a weak weathering depth generally greater than 15 m to 20 m. The rocks are relatively intact and the fissure development is average. Within 1 m of the surface layer, the rock is relatively fragmented and locally weathered in the form of gravelly soil, interspersed with plant roots. Therefore, the potential slip surface formed by the spoil and bedrock is a serious threat to the stability of the slope.

Measures

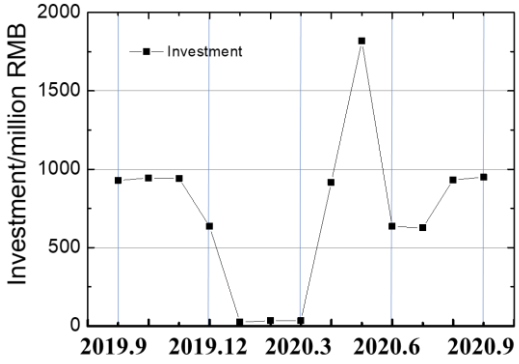
The The main influencing factors are mainly climatic causes, divided into precipitation and temperature. Human causes, divided into investment and progress. The pattern of specific factors (2019.9 to 2020.9) is shown in Figure 2(a)~(d).



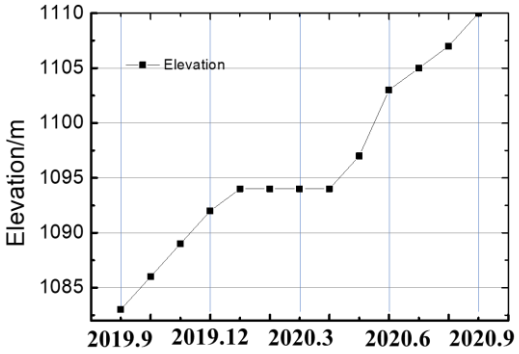
(a) Average monthly temperature



(b) Average monthly precipitation



(c) Average monthly investment



(d) Average monthly progress

Figure 2 ThePattern of Specific Factors (2019.9 to 2020.9)

See in Figure 2(a) and Figure 2(b), average monthly temperature and precipitation in Zhen'an County as in previous years.

See in Figure 2(c), under normal natural conditions, the average monthly investment in the slopes of the slag yard dropped significantly from an average of RMB 9 million per month to an average of RMB300,000 per month, a drop of nearly 97%. See in Figure 2(d), while the fill elevation of the secondary horse track also remained at 1094 m, and the progress of the project was basically 0. Obviously, the drop-in

investment directly affected the construction progress and fill elevation. After April 2020, active measures were taken to resume work, which put the construction schedule on track, but the overall duration was inevitably extended.

Data Analysis

According to the spoil dump slope situation, considering that the internal slip surface should be approximately parallel to the slope surface. Therefore, at the edge of the filling platform and the inner edge, respectively, set up a survey line from east to west. As well as the survey line connecting the edge and the inner edge, to cover the area of the potential slip surface near the slope surface as far as possible. In order to have a more comprehensive understanding of the spatial location of the deeper slip surface of the spoil dump slope. On this basis, the group also carried out a series of detections for the shallow east-west direction of the surface. Aiming to control the surface tension cracks caused by the deep slip. So as to analyze the possible slip surface through the surface tension cracks. See in Figure 3(a).

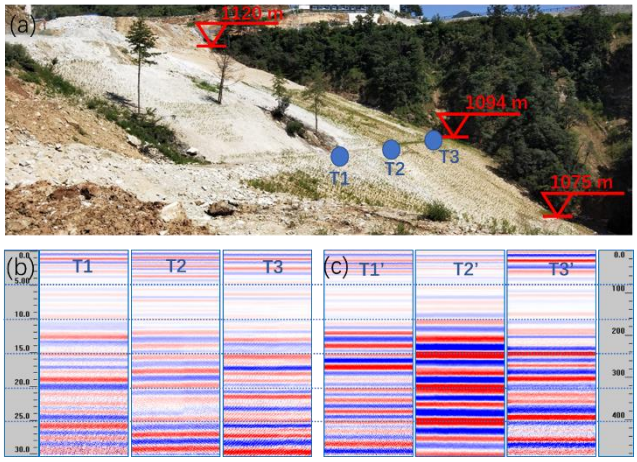


Figure 3 The Pattern of Specific Factors(2019.9 to 2020.9)

RESULTS

According to the basic principle of GPR detection, combined with the basic lithological composition of the site. The basic rules of electromagnetic waves are as follows. In the uniform stratum, the electromagnetic wave trains are gentle. When there are obvious changes in lithology, the wave trains will have obvious reflection phenomenon [8-9]. In the weak structural surface, the wave trains will produce multiple wave phenomena.

See in Figure 3(a). T1~T3 are the measurement points of the first slope (elevation: 1094.0 m), detection direction: from south to north. The detection method is static scanning data, the advantage of static scanning is to exclude the overall interference signal caused by the surface canyon. The basic explanation is as follows.

(1) The range of 0 m ~ 5 m below the surface is filled with mixed granular miscellaneous rocky soil, and there are obvious oscillations and multiple reflections of electromagnetic waves in the images T1~T3, and the lithology in this range is uneven and poorly integrated, which is not conducive to the overall stability of the slope. (2) Within the range of 5 m ~ 10 m below the surface, there is no obvious reflection of electromagnetic waves in the image, and the lithology in this range is relatively more uniform, but with poor integrality.

(3) The reflection interface exists in the range of 10 m ~ 20 m below the surface, and the basic trend that the depth of the reflection interface of the lithology or soft zone gradually increases from north to south can be reflected in the images of T1~T3, so it is recommended to carry out deformation observation for this horse path.

DISCUSSION

Due to the influence of epidemic, without artificial disturbance, experiencing 4 months of natural conditions, and the particles of the discarded slag are larger and more permeable, natural precipitation continues to infiltrate into the reaching bedrock, and the infiltrated water gradually erodes the discarded slag and forms a water-rich debris layer with the easily soluble rock body, which develops into a slip zone and threatens the stability of the slope.

The increase of water content in the non-disturbed fracture zone leads to the change of lithological dielectric properties, and the reflection of electromagnetic waves from geological radar at different lithological interfaces produces different

echo amplitudes, therefore, by analyzing the amplitude information of remote sensing images, the process of water content change in the soft fracture zone at the bedrock interface location of this slope can be efficiently and accurately grasped.

Obviously, Moisture is very important to tobacco[12-14], for one thing, tobacco plants are tall, have wide leaf surfaces and large leaf area coefficients, and transpiration is strong, requiring a high supply of water. Moisture affects the effectiveness of fertilizer. Moisture affects the extension of the leaves. When the water supply is sufficient, the tobacco leaf cell expansion pressure is larger, can fully stretch, tobacco leaves to become longer, wider, loose structure. Water affects the direction of physiological metabolism in the tobacco plant. When the water supply is sufficient, it can promote the carbon metabolism in the tobacco plant, and more sugar is accumulated in the tobacco leaves.

Conflicts of Interest Disclosure Statement

The authors declare no conflict of interest in the authorship or publication of this work. The authors declare no sponsored financial sources for the undertaken study.

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Author Declaration

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