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Analysis of the Qualification Development of Natural Hazards at Geoecological Monitoring of Landslide Hazardous Territories

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ABSTRACT: This paper presents the classification analysis landslide territories, basic natural and technogenic dangers are allocated at conducting geoecological monitoring of the given territories. Principal review of works was spent for studying of dynamics of landslips on a slope and complex precautionary actions are allocated.

KEY WORDS: Landslides, hazardous processes, thermodynamic, hydro chemical, anthropogenic, processes, freezing, natural, landslide process, deformation of slopes, technological hazards.

I.INTRODUCTION

Three types of processes can be distinguished in the classification of natural and technological hazards caused by landslides: atmospheric, hydrospheric and lithospheric. These three classes, in turn, are divided into three groups: natural, natural, man-made (anthropogenic) and combination. Types of natural processes are distinguished by genetic characteristics and leading factors in their development.

The division into subtypes is carried out when taking into account the leading factors in the development of hazardous processes, such as: changing the thermodynamic and hydrochemical conditions of the environment; gravity wind direction and strength; freezing and thawing of rocks; surface water and groundwater activities.

The study and classification of natural hazards are the subject of numerous studies set forth in the works of [1], [2], [4], [5] and other researchers.

On the territory of Samarkand, despite the great variety of natural processes, the natural hazards on the slopes are of paramount importance, which manifested in the form of landslide phenomena and processes caused by groundwater.

Both natural and technogenic impacts can lead to the development of landslide processes with subsequent deformations of the foundations of structures and their constructions , located in areas of development of dangerous landslide processes. Among the dangerous geological processes and phenomena in the world, landslides occupy an important place. The growth of cities with modern buildings due to the lack of free space in many cities is mainly carried out close to the edge of the slopes and often along the slopes, as a result of which old landslides are activated or new deformations of the slopes are developed. Deformations are the main indicators, the development of which in time characterizes the actual implementation of the landslide process.

Landslides represent a cohesive movement of earthen or rock masses occurring on a certain sliding surface (it is a landslide bed). Landslides differ from avalanches in that during the whole process the displaced masses do not lose contact with the bed, whereas at landslides these masses pass part of their way in the air.

II. SIGNIFICANCE OF THE SYSTEM

The article focuses on the fact that both natural and man-made impacts can lead to the development of landslide processes with subsequent deformations. A study of the literature study in Section III, the Methodology is explained in Section IV, Section V contains experimental research results, and Section VI provides future studies and conclusions.

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Landslides are one of the exogenous slope processes and are a manifestation of the violation of the stability of the geological environment and are caused by a certain steepness of the slopes, mountains and coastal areas, lithology, watering of the constituent rocks, the presence of clay quicksand. Landslides can be in a calm, stabilized, and shifts occur as a result of exogenous geodynamics, and are triggered by endogenous processes, such as earthquakes, volcanic activity, etc., as well as man-caused activity of people (construction, slope pruning, etc.). It should be noted separately that massive activation of landslides is observed under special meteorological conditions – the heavy rainfall. A special problem of landslide activation is that their catastrophic manifestations can not only cause huge economic losses due to the destruction of engineering structures and communications, but also cause the death of hundreds and thousands of people in all parts of the world. The following examples are given in work [3]: so as a result of a landslide in China, about 100 thousand people died in 1920; in Peru, in 1970, 18 thousand people died; in 1974, the largest landslide in the world descended in the Andes with a volume of 1.6 km3, where 450 people died.

In most cases, the slope creep is a lengthy process in which two stages can be distinguished:

1) the preparatory phase, when very slow movements such as creep occur in a certain deep zone and a potential sliding surface forms; this stage is called the deep creep phase;

2) a catastrophic stage , when much faster, sometimes even noticeable by eye movements along the formed sliding surface occur [2].

The conditions for the emergence and development of landslides are very diverse, although in each case, among many factors, only one, the most important, can be singled out, which is taken as the basis for the characteristics of this landslide. However, there are many different opinions regarding the number of factors affecting rock stability on slopes. This has led to the fact that there is currently no single universally recognized classification of landslides. Most classifications are based on the genetic principle of isolating processes based on the main active forces (agents).

Therefore, from a large number of classifications of landslides, we give only those that which are currently used by specialists involved in the measurement of displacements on landslides.

Classification of landslides:

a) by nature:
- bias development;
- capture of the slope;
- capture of rocks;

b) by structure:
- landslide slope and position of the displacement surface: sequential, consequent and insect
- landslide bodies and the scale of the phenomenon;

c) - by types of rock deformation - by the displacement mechanism;

d) - by their age and developmental phases;

d) - according to their morphology for the purposes for geotechnical mapping

From the classification of landslides it can be seen that there are many types of landslides that differ in size and shape, capture depth and shape of the sliding surface, the nature of the displacement of earth masses, their speed, frequency, surface condition, visibility condition, etc. The most typical, but morphologically different types of landslides are earth flows (translational landslides) and rotational landslides. When creeping, a certain complex of relief is formed ; a landslide circus limited by a landslide disruption wall (landslide ledge), a landslide block, characterized in most cases by overturning of the upper area (landslide terrace) towards a landslide slope with a steep ledge facing the river or lake along the direction of the landslide. The landslide separation surface has a spherical shape, tending to approach a circle.

III. LITERATURE SURVEY

Landslides can occur on one high level - single-tier or on several - multi-tier. Multi-level landslides are observed in the mountains and less often on the plains, mainly where the slopes reach a height of 100 - 200 meters. By the time during which the landslide process occurs, landslides are simultaneous, periodic and constant. Slow displacements are not catastrophic. They are called draggings, creeping displacements of loose deposits, as well as gliding. Indeed, displacement is a creep, since its speed does not exceed several tens of centimeters per year and it is recognized by specific forms of relief, by the bending of the layers and the surface, the so-called collapse of the layers.

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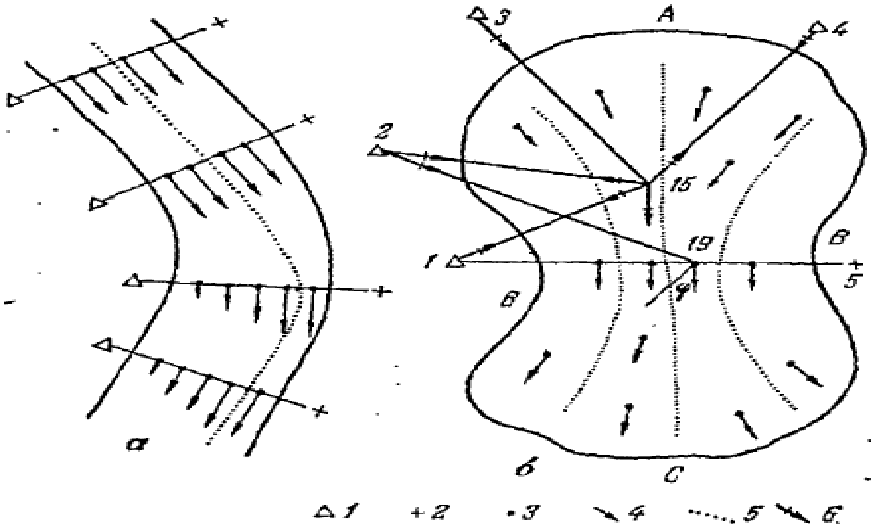

Fig. 1. Types of offsets:
a) - earthen stream; b) - rotational landslide; 1- reference frame;
2 - reference sign; 3 - landslide point; 4 - displacement vector;
5 - trajectories of movement; 6 - direction of the target beam

Earth flows (Fig. 1, a) are long narrow strips of moving soil, stretching down the slope along the lowering of the relief. The speed of movement of the material in the earth flows is subject to fluctuations depending on the moisture, which is seasonal in nature.

In straight sections, the displacement occurs with uniform speed; in curved sections, the "jet" moves to the concave bank. In the phase of deep creep, sharp seasonal fluctuations in the displacement rate are observed; In the phase of catastrophic sliding, rapid displacements occur.

Rotational landslides are soil masses of a rounded shape in the plan (Fig. 1., b). In the process of creeping, they make rotational movements around a certain axis. The landslide body is outlined by cracks, indicating various displacements: in the upper part of the slope A - with a separation and a shift down; in the middle part of slope B - with horizontal shift and displacement; in the lower part C - with compression and displacement up. In most cases, the displacement of earth masses in landslides of this type occurs by rotation around a certain axis of rotation. At the stage of deep creep, such rotational movements make points forming the creep zone, and in the catastrophic phase, the rotation occurs along a circularly cylindrical sliding surface. In more rare cases, glide occurs on curved surfaces, the curvature of which is approaching. In more rare cases, gliding occurs along curved surfaces, the curvature of which, as it approaches the bottom of the slope, either increases or decreases.

The two typical landslides described are relatively simple; these include many small landslides. Large landslides are much more difficult. Due to the nature of the geological structure, displaced earth masses are usually irregular in shape. The landslide bed of many large landslides has a complex underground relief. In such cases, earthly bodies break up into separate blocks that make complex movements; landfalls appear on the ledges. Some large landslides are tiered; the creeping masses form several tiers located one above the other and shifted at different speeds and along different trajectories.

It should be noted that landslide-forming factors do not appear in all landslide areas at the same time and do not act to the same extent; often a landslide outbreak forms in the landslide body, which then spreads offensively, that is, down the slope, or backward up the slope. On a landslide, a combination of different types of movement can occur; thus, for example, block displacements in the upper part of the slope can lower into earth flows, etc. Finally, landslide movements in the phase of deep creep are often superimposed with comparable displacements of the surface layer such as surface creep or solifluction [2]. The same overlap occurs in multi-tier landslides. For the analysis of this whole situation careful and systematic observations are required.

IV. METHODOLOGY

To study the dynamics of landslides on the slope, the following types of work are carried out:

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1) comprehensive monitoring of engineering and geological processes, the effectiveness of engineering protection, state of structures and territories on the basis of geodetic control over the movement of a network of landslide points (ground rails) installed on the surface of landslides;

2) development of a mathematical model of landslide processes based on the results of geodetic measurements;

3) studying the deformed state of a landslide body using the AMKOD hardware complex (Automated Magnetometric Control of Landslide Deformations);

4) monitoring the displacement of the soil at a depth and determining the position of the sliding surface;

5) surveying landslide cracks and monitoring the progress of their development;

6) analysis of the deformation of engineering structures on the slopes (deformation monitoring).

To compile operational forecasts of landslide processes on the territory of the Samarkand oasis for the purpose of geoecological monitoring of landslide-hazardous territories, two process-hazardous processes were established - hydrological and meteorological.

V. EXPERIMENTAL RESULTS

Geodetic works and the mathematical analysis based on them allow making forecast maps on the basis of a mathematical model of a specific type of landslides using the existing survey cartographic material — maps of landslide risk assessment. The compilation of such maps makes it possible to outline areas of the maximum manifestation of landslide processes, as well as rationally plan economic development of the territory, conduct anti-landslide measures and monitoring observations.

Observations have shown that catastrophic displacements never occur suddenly; they are preceded by a stage of insignificant displacement rates increasing over time, which are a phenomenon of deep creep of slopes. Most landslides have a constant, although they have an uneven, movement. The periods of great intensification of landslide activity, which cause catastrophic consequences, are replaced by periods of extinction, when displacements imperceptible to the eye occur, measured in centimeters or millimeters per year.

The study of the deep creep stage of slopes with high accuracy can be performed by modern technologies. Such research makes it possible to rationally direct the landslide activity, which is the most effective at this stage. With increasing accuracy, it becomes possible to apply the results to the study of the internal mechanics of landslides.

VI. CONCLUSION AND FUTURE WORK

The most effective protection against landslides is to prevent them. Slope areas must be avoided, but this is not possible under our conditions. At the present stage of scientific and technological progress, comprehensive preventive measures have been developed. When the landslide has already begun, it is too late to carry out preventive work. To avoid slipping, you must not allow:

1) overload of the upper part of the landslide;

2) undercutting of the base (by river, reservoir, engineering structures);

3) additional wetting of the entire slope.

Water is the main reason of creeping, and the first stage of conservation work should be the collection and disposal of surface water. In a landslide hazardous area, drainage using underground drainage is recommended. Of great importance is the artificial transformation of the relief. In the separation zone, it is necessary to reduce the load on the slope, thereby weakening the effect of gravity. All this will lead to an increase in the adhesion force of rocks. To date, a whole range of recommended technical operations has been developed, such as: anchoring slopes, destroying sliding planes, injecting reinforcing solutions, fixing slopes by using piles and construction of support walls. The most important is the degree of preparedness and speed of action, since at later stages the fight against landslide processes will require much more effort.

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