PROTECTION OF RAILWAY TERRITORIES AGAINST ROCKSLIDES, SCREES AND LANDSLIDES IN MOUNTAINOUS AND MOUNTAINOUS REGIONS OF UZBEKISTAN

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ANNOTATION

This article discusses the issue of protecting railway territories from landslides, screes and landslides in mountainous and mountainous regions of Uzbekistan. Particular attention is paid to the protection of mountain areas from avalanches, deep landslides, main forms of negative impact of industrial development of mountains.

Keywords: Landslide, buttresses, railway transport, rescue operations, assistance to victims, drainage, environment.

Mountain falls, screes and landslides are common occurrences in many countries. They arise as a result of the collapse of steep slopes and are accompanied by the formation of rubble.

АННОТАЦИЯ

В данной статье рассматривается вопрос о защите территорий железной дороги от обвалов, осыпей и оползней в горных и при горных районах Узбекистана. Особенно выделено вниманием защиты горных районов от снежных лавин, глубинные оползни, основные формы отрицательного воздействия промышленного освоения гор.

Ключевые слова: Оползень, контрфорсы, железнодорожный транспорт, спасательные работы, помощь пострадавшим, дренажи, окружавшая среда.

INTRODUCTION

Landslide- This is the detachment and sliding displacement of masses of rocks down a slope under the influence of gravity, mainly without loss of contact between the moving and stationary rocks. They are formed when the balance is disturbed or the strength of rocks is weakened, caused both by natural causes (overmoistening of soils, erosion of the base of a slope, seismic tremors, etc.) and human intervention (construction and road work, deforestation, improper agricultural practices, etc.). Landslides most often occur on the slopes of river valleys, the shores of seas, lakes, and reservoirs. Landslides actively participate in the mudflow formation process.

Deep landslides, By blocking river valleys, they create conditions for the subsequent breakthrough of dammed lakes and the occurrence of mudflows. Surface landslides provide the solid component of mudflows, and at high displacement rates (slides) can directly transform into a mudflow.

Landslides can destroy individual objects and endanger entire settlements, destroy agricultural land, create a danger for the operation of quarries, damage communications, tunnels, pipelines, telephone and electrical networks, and threaten water management structures (dams).

The main causes of landslides are:

excessive slope steepness (more than 45-50°C);

overloading the slope with dumps and engineering structures;

violation of the integrity of slope rocks by trenches, ditches, ravines;

trimming a slope or its base;

moisturizing the bottom of the slope;

wetting of rock bedding planes with groundwater.

Typical places (conditions) for landslides to occur can be: natural slopes of hills and river valleys (on slopes), slopes of excavations consisting of layered rocks, in which the fall of the layers is directed towards the slope or towards the excavation.

The main anti-landslide measures that ensure slope stability include:

drainage of surface water flowing to the landslide area by constructing upland ditches and drainages;

unloading landslide slopes (slopes), terracing slopes;

planting tree and shrub vegetation in combination with sowing perennial turf-forming grasses on the surface of landslide slopes;

straightening river beds and periodically operating watercourses that erode the base of landslide slopes;

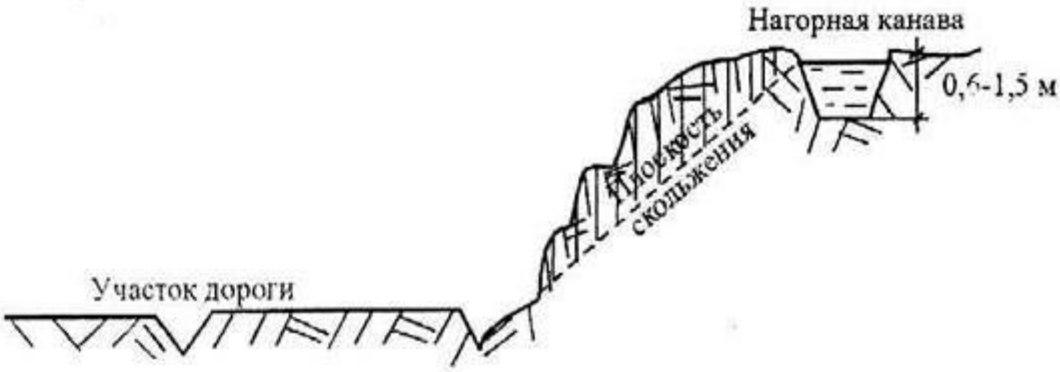
construction of bank protection structures (groins, bottom breakwaters, stream-directing devices, protective plantings, etc.) at the base of eroded landslide slopes;

backfilling (alluvium) of earthen (sand, gravel, stone) counter-banks at the base of landslide slopes;

installation of retaining walls;

construction of buttresses, pile rows, etc.

Schemes of the upland ditch for draining surface water from the landslide area and the construction of terraces for unloading landslide slopes are shown in Fig. 1 and 2, respectively.



Rice. 1. Upland ditch for draining surface water from the landslide area

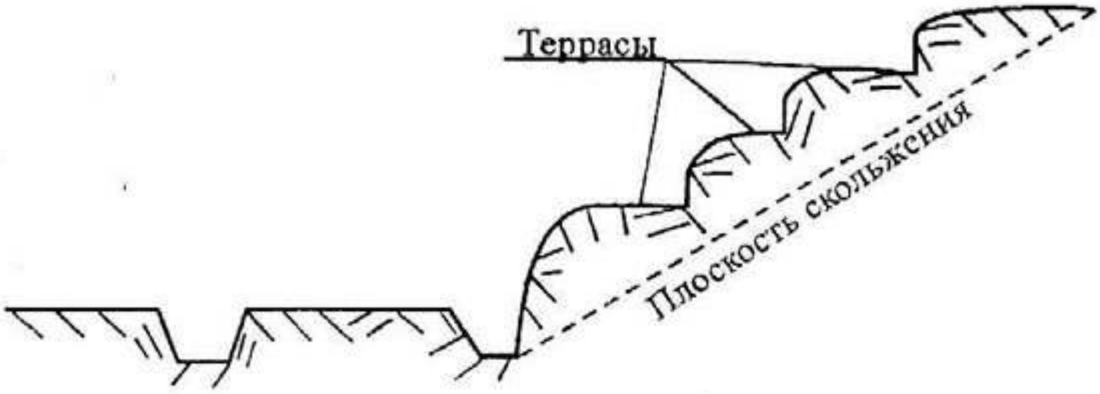


Fig.2. Layout of terraces for unloading landslide slopes

Retaining walls are installed in case of relatively small landslides on slopes where their stability is compromised (undercutting, undercutting, loading the slope, etc.). They are usually built from precast concrete or well-fired brick and stone. To increase the stability of retaining walls, wall drainages are installed.

Counter banquets are a fairly effective event. They are located at the base of landslides and with their mass prevent the mixing of landslide soil. The length of the counter-banquet is determined by the size of the landslide, and the width and height depend on the stability of the landslide mass. They are usually built from soil and stone. When constructing from non-draining and poorly draining soils, it is necessary to provide for groundwater capture. On the surface of the counter-banquets, measures must be taken to drain surface water and combat soil erosion, grass sowing, etc.

Buttresses are retaining structures that hold the soil of slopes and slopes from shifting, and cut their soles into stable layers of soil. They are built from masonry with cement mortar, concrete or rubble concrete. At the base, for drainage, it is advisable to lay drainage pipes (asbestos, ceramic, concrete) with a diameter of 150 - 200 mm.

Pile rows (dowel piles) are used, as a rule, during the period of temporary stabilization of landslides that have a small (up to 4 m) thickness of the displaced body. Piles (reinforced concrete, concrete, metal) are driven in a checkerboard pattern in 2-3 rows to a depth of 2 m into non-displaceable rock. To avoid breaking the stability of the slope during driving, it is advisable to install piles in pre-drilled holes. Pile rows must be placed in the neutral or passive (buttress) part of the landslide.

A fairly effective anti-mudflow measure is slope drainage. By design, drainages are of four types: horizontal (tubular) barrier drains; drainage galleries; vertical and combined drainages. Horizontal drainages are usually used when the aquiclude is shallow (up to 4-8 m), since they are laid in open trenches. The diameter and type of pipes must be determined by hydraulic calculation depending on the aggressiveness of groundwater. To check the operation of the drainage, inspection wells are installed along its route. Such drainages are installed on stopped landslides or in places where they are not threatened by landslide displacements. To remove water contained in cracks and voids of a moving landslide body, it is advisable to arrange the simplest fascine drainage structures. The diagram of a horizontal drainage barrier is shown in Fig. 1&2.

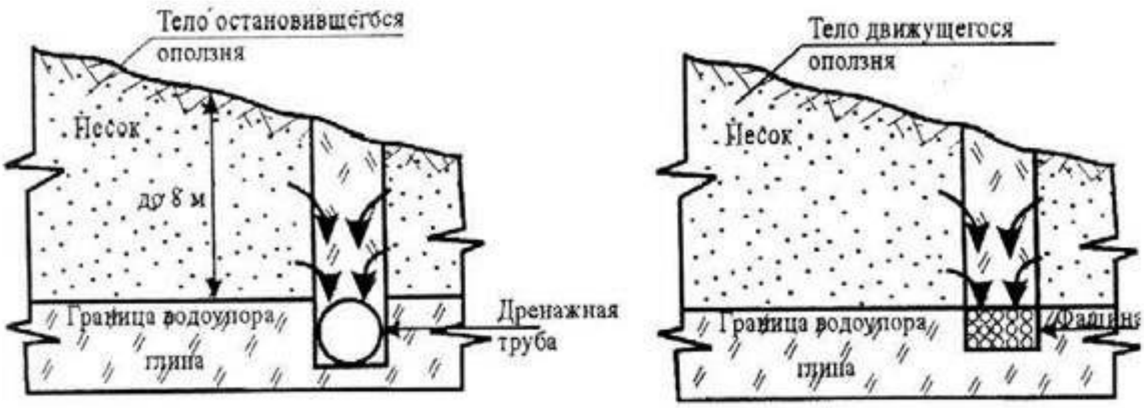


Fig.3. Horizontal drainage barriers

Drainage galleries are usually used in places where there is a deep aquifer that feeds the landslide slope with water. They are effective when there is significant water abundance and good soil drainage.
Vertical drainages (boreholes or mine wells) are used for draining one or more aquifers at great depth. Water is drained from vertical drains into special drainage galleries.
Combined drainages are a combination of horizontal and vertical drainages combined into one system. They are used on landslide slopes with several deep-lying aquifers separated by impermeable layers.

Features of protecting mountain areas from avalanches

Avalanches pose a serious danger in mountainous areas. An avalanche is a mass of snow that has slid down a mountain slope and moves under the influence of gravity. At the same time, it carries away more and more new masses of snow along its path. The volume of even relatively small avalanches is about 20 thousand m3 or more. Avalanches fall at a speed of 90 - 100 km/h. They destroy houses, railways and highways, bridges, communication and power lines, mining facilities and other environmental assets, uproot trees, block entire areas, and can also cause floods with a dammed reservoir volume of up to several million cubic meters of water. The destructive effect of avalanches is enhanced by an air wave that moves ahead of the snow mass and, by itself, even without an avalanche impact, causes significant destruction. Avalanche activity often leads to the accumulation of mudflow material, since rock mass, boulders and soft soil are carried away along with the snow.

Avalanches are possible in all mountainous areas where snow cover is established. The possibility of avalanches is determined by the presence of a favorable combination of avalanche-forming factors, as well as slopes of steepness from 20 to 50° with a snow cover thickness of at least 30-50 cm. Fig. 4.

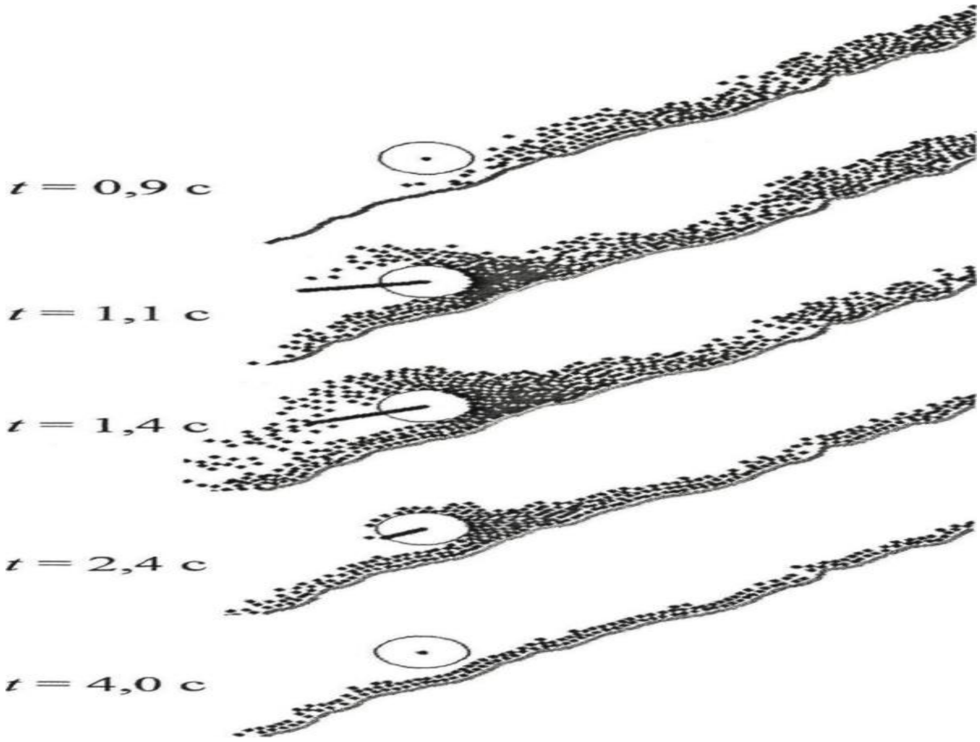


Fig.4. Snow avalanche-forming situations

Avalanche-forming factors include:
snow depth;
snow density;
snowfall intensity;
snow cover subsidence;
temperature regime of air and snow cover;
snowstorm distribution of snow cover.

In the absence of precipitation, avalanches can be a consequence of intense snow melting under the influence of heat, solar radiation and the process of recrystallization, leading to the destruction of the snow layer (up to the formation of a fine snow mass in the depths of this layer) and a weakening of the strength and bearing capacity of individual layers.

In order to protect against avalanches, avalanche cutters and galleries are installed to protect roads from avalanches, and wind shields are installed to regulate blizzard flow on mountain slopes. To artificially cause an avalanche, those places on the mountain slopes where snow accumulates are fired from cannons, mortars or small rockets. In places where avalanches pose a great threat to industrial enterprises and transport communications, avalanche stations are organized, and there is a service to rescue people.

The main forms of negative impact of industrial development of mountains are as follows:

1. Destruction of the upper layer of the weathering crust by earth-moving mechanisms and especially blasting operations (mass explosions to release high concentrations of explosives)

during road construction, stripping operations in mines, quarries, etc. Such types of intervention deprive the destroyed areas of soil and vegetation cover, exposing and subjecting the upper layers of bedrock to intense erosion and thus preparing material for the solid phase of mudflows. Often, blasting operations lead to an unstable state of significant areas and volumes of rocks, causing the instantaneous development of dense and deep fracturing, i.e., in a fraction of a second they destroy mountain ranges more severely than centuries-old weathering processes. In many cases, cutting the lower part of slopes when laying roads causes a sharp intensification of landslide and scree processes - potential suppliers of debris from mudflows.

2. Random accumulation of waste rock dumps in steep riverbeds and riverine zones of mountain slopes. Such dumps of waste rock, which are in a state of unstable equilibrium, begin to move, as a rule, when they are liquefied or washed away by flood waters (from rainfall, snowmelt and other reasons) and form very concentrated mudflows.

3. The destruction of soil and vegetation cover on mountain slopes also occurs as a result of poisoning of the area with harmful gases - waste from enrichment and chemical industries. This entails the formation of mudflows where there were none before. Similar mudflows have been registered in the area of Perm, on the southern coast of Lake Baikal.

4. Incorrect placement of certain objects that create obstacles in the mudflow transit zone, with their location, size and design, sharply increase the scale (volume, flow, speed) and, consequently, the damage from the passage of mudflows. Enormous damage is caused to railways and main canals at those crossings through mountain watercourses of mudflow nature, where the design and size of mudflow openings do not correspond to the size of mudflows. In such areas, mudflow jams form, the subsequent breakthrough of which greatly increases the flow and concentration of mudflows, as well as their harmful effects.

Cases have been repeatedly noted when the channel anti-mudflow structures themselves, especially dams, with their unsatisfactory design and poor connection with the banks, are a source of mudflow congestion. The breakthrough of such dams leads to a sharp increase in the flow rate and power of the mudflow.

Experience shows that reasonable economic activity when developing mountain slopes leads to positive results and significantly reduces the risk of mudflows. First of all, it is necessary to preserve and develop vegetation cover on mountain slopes.

Numerous examples show that even simple preventive measures dramatically reduce the risk of mudflows. Streamlining livestock grazing, correct agricultural technology, limiting construction in potentially mudflow-prone areas, prohibiting the cutting of trees and shrubs - all these are measures to prevent mudflows. Afforestation of bare areas of slopes, construction of terraces, especially in combination with forest plantings and flow regulation, hydrophobic coatings in mudflow centers, biological fixation of screes, hydraulic structures and other measures can ultimately also lead to the attenuation of mudflow activity.

Domestic and foreign practice has developed such measures as strengthening riverbeds, riverbed afforestation, systems of anti-mudflow retaining dams

Finally, humans can control hydrometeorological processes that cause the formation of mudflows. The practice of fighting mudflows has already been enriched with such measures as the artificial division of spring rain and snow floods by accelerating or slowing down seasonal snowmelt, the creation of smoke screens over glaciers in order to reduce the intensity of ablation, etc.

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