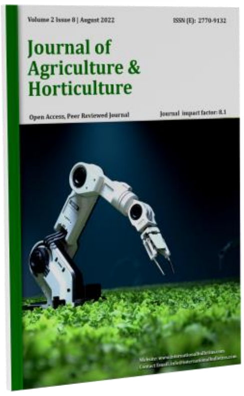

PROTECTION OF RAILWAY TERRITORIES AGAINST CAVES, SLIPS AND LANDSLIDES IN MOUNTAIN AND NEAR MOUNTAIN AREAS OF UZBEKISTAN

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https://doi.org/10.5281/zenodo.7637878

ANNOTATION
This article discusses the issue of protecting the territories of the railway from collapses, scree and landslides in the mountainous and mountainous regions of Uzbekistan. Particularly highlighted by the attention to the protection of mountainous areas from snow avalanches, deep landslides, main forms of negative impact of industrial development of mountains.
Key words: Landslide, buttresses, railway transport, rescue operations, assistance to victims, drainage, environment.

Rockfalls, screes and landslides are frequent occurrences in many countries. They arise as a result of the collapse of steep slopes and are accompanied by the formation of blockages.

Landslide- this is the separation and sliding displacement of rock masses down the slope under the action of gravity, mainly without loss of contact between moving and immovable rocks. They are formed when the balance is disturbed or the strength of rocks is weakened, caused both by natural causes (waterlogging of the soil, washing out of the base of the slope, seismic tremors, etc.), and by human intervention (construction and road works, deforestation, improper agricultural practices, etc.). Landslides most often occur on the slopes of river valleys, the shores of the seas, lakes, and reservoirs. Landslides are actively involved in the process of mudflow formation.

Deep landslides, blocking the river valleys, create conditions for the subsequent breakthrough of dammed lakes and the emergence of mudflows. Surface landslides provide the solid component of mudflows, and at high displacement velocities (slush slides) can be directly transformed into a mudflow.

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

The main reasons for the formation of landslides are:
excessive slope steepness (more than 45-50°C);
overloading the slope with dumps and engineering structures;
violation of the integrity of the rocks of the slope by trenches, ditches, ravines;
trimming the slope or its sole;
moistening of the sole of the slope;
wetting of rock bedding planes by groundwater.

JAH | Volume 3, Issue 2, February

Typical places (conditions) for the occurrence of landslides 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 the stability of the slopes include:

diversion of surface water flowing to the landslide area by means of upland ditches and drains;

unloading of landslide slopes (slopes), terracing of slopes;

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

straightening of riverbeds and intermittent streams that wash away the base of landslide slopes;

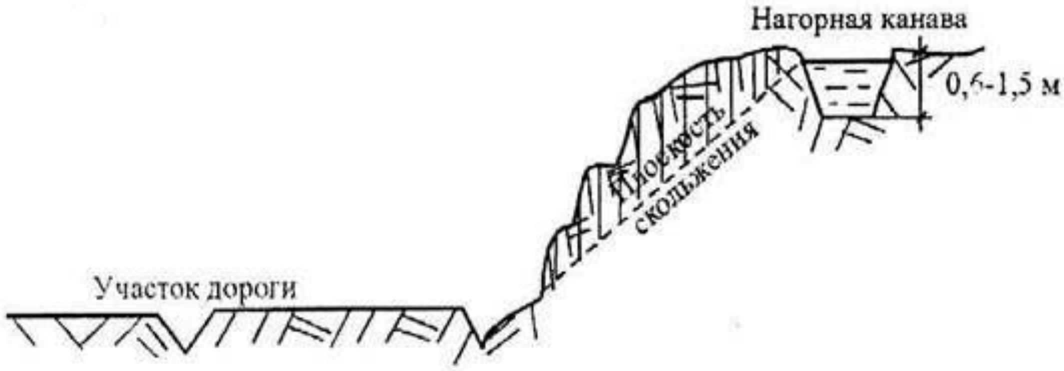
erection of bank protection structures (bunions, bottom breakwaters, jet guides, protective plantings, etc.) at the base of eroded landslide slopes;

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

retaining walls;

construction of buttresses, pile rows, etc.

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



Rice. 1. Nagornaya ditch for the removal of surface water from the landslide area

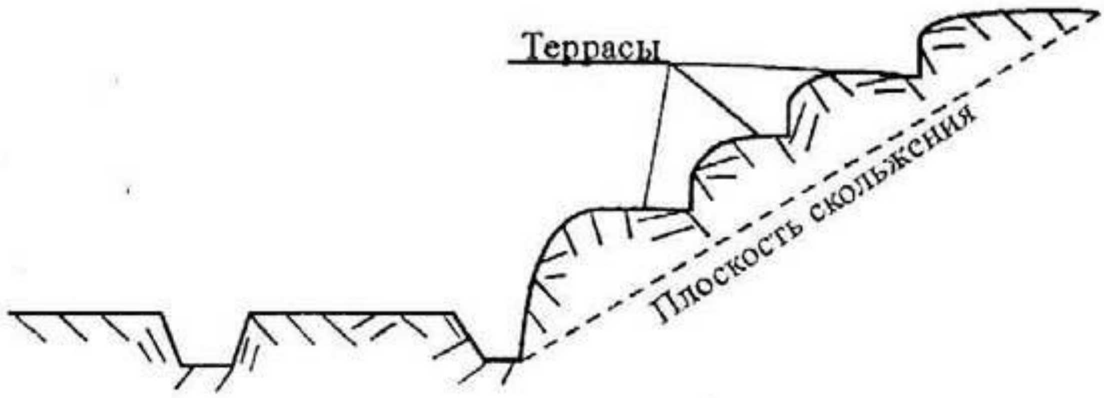


Fig.2. Scheme of terraces for unloading landslide slopes

Retaining walls are arranged in case of relatively small landslides on slopes where their stability is impaired (cutting, washing, surfacing the slope, etc.). They are built, as a rule, from prefabricated reinforced concrete or well-fired brick and stone. To increase the stability of the retaining walls, behind-the-wall drainages are arranged.

Counter banquets are a fairly effective event. They are located at the bottom 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, while the width and height depend on the stability of the landslide mass. They are usually built from soil and stone. When erecting from non-draining and weakly draining soils, it is necessary to provide for the capture of groundwater.

On the surface of the counter-banquets, measures should be taken to divert surface water and combat soil erosion, grass planting, etc.

Buttresses are retaining structures that hold the soil of slopes and slopes from displacement, and cut their soles into stable layers of soil. They are built from masonry on 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, which 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. In order to avoid violation of the stability of the slope during driving, it is advisable to install piles in pre-drilled wells. It is necessary to place pile rows in the neutral or passive (buttress) part of the landslide.

Sufficiently effective anti-mudflow measure is drainage of slopes. By design, there are four types of drains: horizontal (tubular) drainage barriers; drainage galleries; vertical and combined drains.

Horizontal drains are usually used when the aquiclude is shallow (up to 4-8 m), as 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, manholes are arranged along its route. Such drainages are arranged 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 structures of fascine drainage. The scheme of the horizontal drainage barrier is shown in fig. 1and 2.

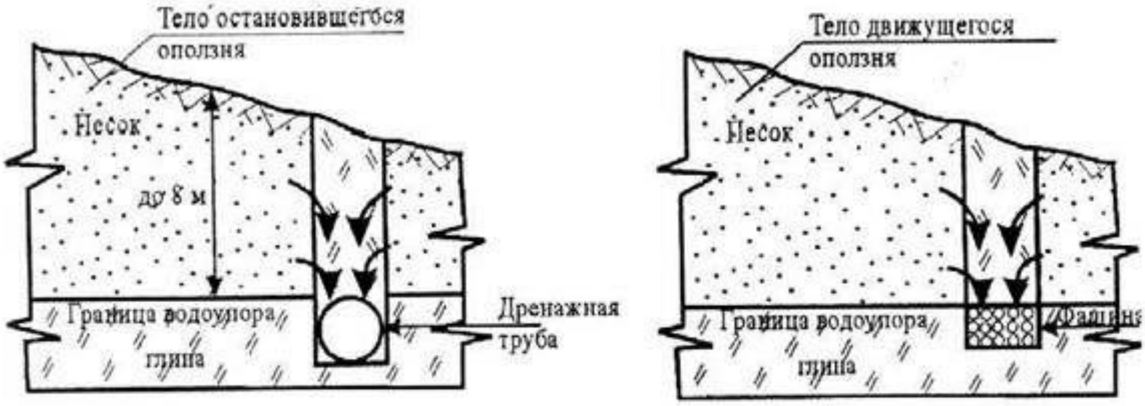


Fig.3. Horizontal drainage barriers

Drainage galleries are usually used in places of deep occurrence of the aquifer that feeds the landslide slope with water. They are effective with significant water abundance and good water yield of soils.

Vertical drainages (boreholes or shaft wells) are used when draining one or more aquifers at a great depth of their occurrence. Water is drained from vertical drains to special catchment galleries.

Combined drains are a combination of horizontal and vertical drains combined into one system. They are used on landslide slopes with several deep aquifers separated by aquifers.

Features of protection of mountainous areas from snow avalanches

Snow avalanches are a serious danger in mountainous regions. An avalanche is a mass of snow that has slipped off a mountain slope and is moving under the influence of gravity. At the same time, it carries away all the new masses of snow on its way. 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, railroads, roads, bridges, communication and power lines, mining facilities and other hazardous materials, uproot trees, blockade entire areas, and can also cause floods with a 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 the impact of an avalanche, causes significant destruction.
The occurrence of avalanches is possible in all mountainous areas where snow cover is established. The possibility of avalanches is due to the presence of a favorable combination of avalanche-forming factors, as well as slopes with a steepness of 20 to 50 ° with a snow cover thickness of at least 30-50 cm. 4.

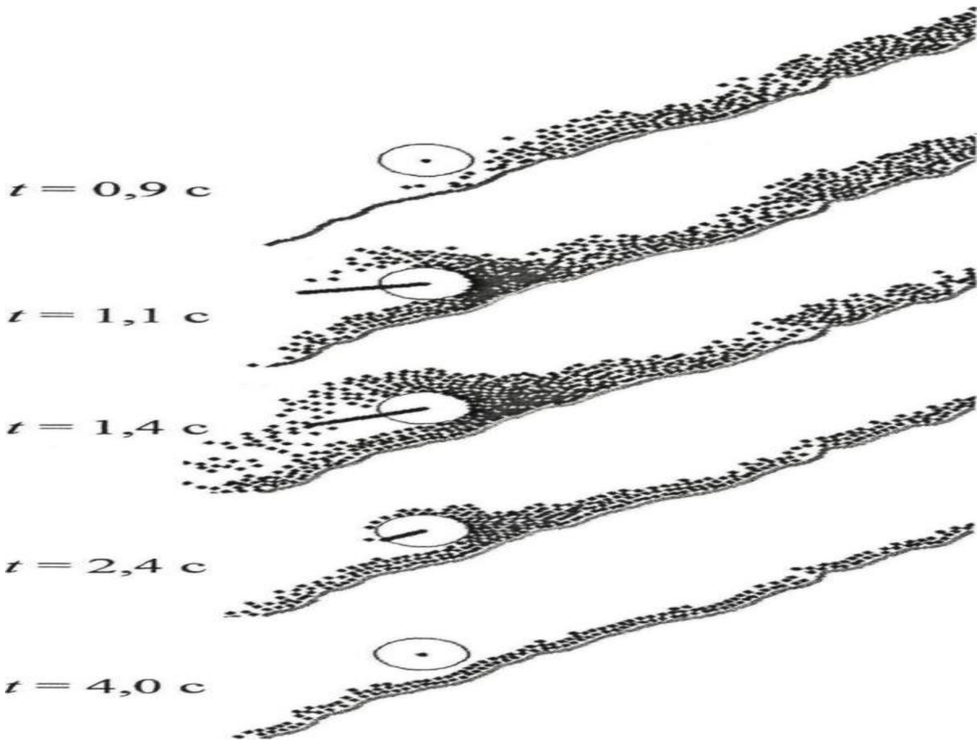


Fig.4. Snow avalanche forming situations

Avalanche-forming factors include:
snow depth;
snow density;
snowfall intensity;
snow cover settling;
temperature regime of air and snow cover;
blizzard distribution of snow cover.
In the absence of precipitation, avalanches may be the result of intense snow melting under the influence of heat, solar radiation and the process of recrystallization, leading to the destruction of the snow mass (up to the formation of a fine snow mass in the depth of this mass) and weakening the strength and bearing capacity of individual layers.
In order to protect against avalanches, they arrange avalanche cutters, galleries that protect roads from avalanches, and install windshields that regulate snowstorms on mountain slopes. To artificially cause an avalanche, those places on the slopes of the mountains 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 with them a service to save people.
The main forms of the negative impact of the industrial development of mountains are as follows:
1. Destruction of the upper layer of the weathering crust by earthmoving mechanisms and especially blasting (massive explosions for ejection with a high concentration of explosives)

during the construction of roads, overburden work in mines, quarries, etc. Such types of intervention deprive the destructible areas of soil and vegetation cover, exposing and exposing the upper layers of bedrock to intense erosion and thus preparing the material for the solid phase of mudflows. Often, blasting leads to an unstable state of significant areas and volumes of rocks, causes the instantaneous development of dense and deep fracturing, i.e., in a fraction of a second, they destroy mountain masses more strongly than centuries-old weathering processes.

2. Random accumulation of waste rock dumps in steep channels and near-channel 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 showers, snowmelt and other causes) and form very concentrated mudflows.

3. The destruction of the soil and vegetation cover on the mountain slopes also occurs as a result of the poisoning of the area with harmful gases - waste from enrichment and chemical industries. This entails the formation of mudflows, where they did not exist before. Similar mudflows have been registered in the region of Perm, on the southern coast of Lake Baikal.

4. Incorrect placement of certain objects that create obstacles in the mudflow transit zone, by their location, size and design, sharply increase the scale (volume, flow, speed) and, consequently, the damage from the passage of mudflows. Enormous damage is done to railways and main canals at those crossings through mountain streams of a mudflow nature, where the design and size of mudflow openings do not correspond to the magnitude of mudflows. Mudflow blockages are formed in such areas, 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 constructive performance and poor interface with the banks, are a source of mudflow jams. The breakthrough of such dams leads to a sharp increase in the flow and power of the mudflow.

Experience shows that reasonable economic activity in the development of mountain slopes leads to positive results and significantly reduces the mudflow hazard. First of all, it is necessary to preserve and develop the vegetation cover on the mountain slopes.

Numerous examples show that even simple preventive measures dramatically reduce mudflow hazard. Streamlining livestock grazing, proper agricultural practices, limiting construction on potentially mudflow-prone areas, prohibiting logging of trees and shrubs - all these are measures to prevent mudflow activity. Afforestation of bare areas of slopes, arrangement of terraces, especially in combination with forest plantations and flow regulation, hydrophobic coatings in mudflow pockets, biological fixation of screes, hydraulic structures and other measures may eventually also lead to the damping of mudflow activity.

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

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

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