JOURNAL OF NORTHEASTERN UNIVERSITY

Volume 26 Issue 02, 2023 ISSN: 1005-3026 https://dbdxxb.cn/ Original Research Paper

DEVELOPMENT OF ORGANIZATIONAL MEASURES TO INCREASE THE SAFETY OF RAILWAY TRANSPORT INFRASTRUCTURE FACILITIES IN EMERGENCY SITUATIONS

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Abstract

This article discusses the issue of increasing the stability of the functioning of a railway facility in an emergency situation of peacetime and wartime. The issue of the stability of the functioning of the railway in emergency situations is considered.

Key words: Emergencies, landslide, mudflows, railway, damaging factors.

I. Introduction

Improving the stability of the operation of a railway facility in an emergency situation of peacetime and wartime is one of the central responsibilities of leaders of any rank. This follows from the requirements of the Law of the Republic of Uzbekistan "On the protection of the population and territories from natural and man-made emergencies" (August 20, 1999).

The stability of the operation (operation) of a railway facility in emergency situations is understood as the ability of the facility to uninterruptedly perform production (transportation for the railway) and other activities under the influence of damaging factors of emergency sources, as well as the adaptability of this facility to quickly restore its activities in case of damage (destruction) and other losses.

Stability characterizes the survivability of an object (railway) in any emergency situations in peacetime and wartime, i.e. his ability:

a) prevent the occurrence of local emergencies, railway workers in mountain stations, as well as drivers and assistant drivers);

b) resist the impact of damaging factors (during mudflows and mountain avalanches);

c) reduce possible material damage from emergencies (of a natural nature);

Submitted: 28/07/2023 **Accepted**: 18/08/2023

d) protect station workers and maintenance personnel of the station and facilities in mountainous areas, as well as passengers in case of a threat to passenger cars from damaging effects;

e) restore their activities in a short time (production, transportation, and cleaning the railway from dirt, stones, etc.).

f) Mobilize all civil defense forces to eliminate the consequences of an emergency.

II. Materials and methods

Speaking about the stability of an object in an emergency, they primarily distinguish the stability of the engineering and technical complex (ETC) of the object. The ITC of an object is understood as the leading elements on which the production (transportation) process depends to a decisive extent, and its stability is the ability of its elements to withstand the effects of damaging factors from various sources. So, at industrial facilities, the stability of the main workshops will determine the stability of the entire facility, and at the railway, the stability of those elements, as a rule, the stability limit of the object ΔR_{Fpr} is set by a higher authority, but can also be determined locally.

Safety issues should be systematically investigated at any facility, including the railway.

Development of preventive measures and adoption of primitive measures to protect railway facilities in emergency situations. The mechanical fixation of the slope (slope) is associated with the installation of single rod elements in the form of piles of various types, passing through the landslide in the form of layered pile walls of rocks or rows, injection and frozen masks, etc. (stone, concrete, reinforced concrete), wall piles - piles of large diameter, as well as pound support shafts (belts), rock piles, masonry, giant stones.

Figure 1. Protective device against falling stones and mountain avalanches in the railway.

Coatings are designed to protect the slope surface from storm and river waters. These are sand, crushed stone, gravel pounds, stone piles, paving stones, clay concrete slag, asphalt and asphalt concrete, concrete and reinforced concrete, geosynthetic films with high-strength polyethylene, clay concrete slag reinforcement, asphalt and asphalt concrete, concrete and reinforced concrete. from geosynthetic films from the reinforced high-strength polyethylene. Fish beds are often used to protect the coastal zone. The use of plants is aimed at fixing and drying the slope (Fig. 1).

III. Literature review

Artificial compaction and fixation of soils on slopes includes various injections (cementing, silicification, bituminization, oxidation), freezing of pounds, compaction by electroosmosis [10].

Ensuring the stability of structures erected in the landslide zone is aimed at improving safety, and includes: removal of an unstable massif at full capacity (up to bedrock, non-landslide hazardous rocks); laying a deep foundation based on hard rocks; arrangement of foundations from foundation piles; the use of frame structures; strengthening of steep slopes with geosynthetic meshes and frames; use of reinforced concrete belts.

Prevention of emergencies (PE) in railway transport is a set of measures aimed at minimizing the risk of unforeseen and emergency situations, as well as protecting human health, reducing environmental damage and material losses when they occur[10].

It is known that landslides from geological hazards cause great damage to settlements, wash away cultivated land, destroy irrigation canals, watersheds, destroy bridges, block dirt roads, roads and railways. The risk of landslides on the territory of Uzbekistan is 36% (Figure 1).

Breakthroughs of this group of lakes bring floods to the settlements of Namangan and Fergana regions.

The Angren-Pap railway passes through the mountainous areas of these regions (Fig.1). Based on the results of the inspection, warning information about dangerous geological areas in the area of populated areas will be prepared. For example, on the Tashguzar-Boysun-Kumkurgan railway, 28 landslides were identified on the mountain slopes, which pose a potential threat to the movement of trains and the roadway [8].

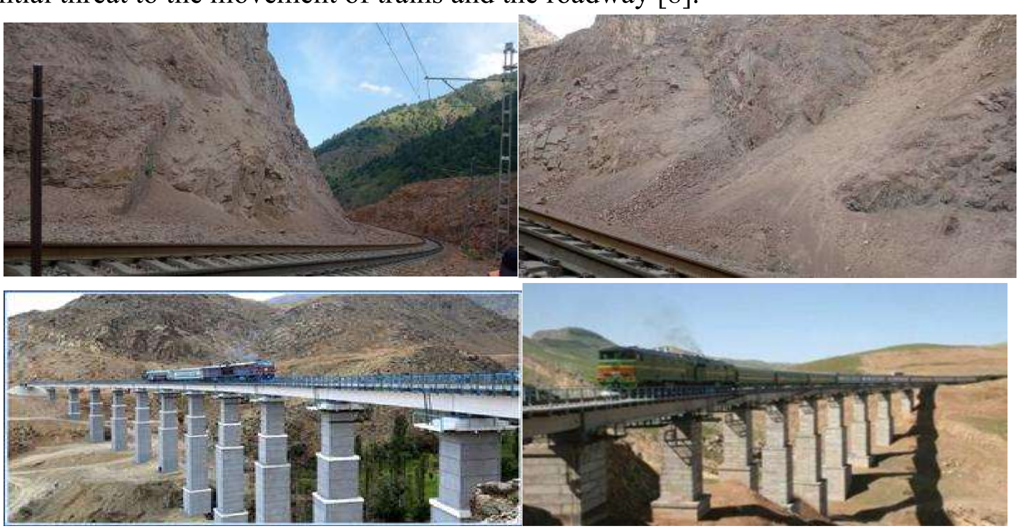

Figure 2. Railway line passing through mountainous areas (railway line Angren - Pap).

It is known that a landslide is a mechanical destruction of the rocks that make up the slope, or the movement of an array without loss of contact between the movable and immovable parts as a result of the shedding of rocks of the slope and its base. The following main elements are distinguished in the structure of landslides: a landslide dividing wall, a sliding surface, a landslide base or base, a landslide circle, a landslide body and a landslide aggregate.

A dividing wall is a surface that separates an avalanche rock mass. The sliding surface is the plane along which the rock block moves. In homogeneous clay rocks, the slip curve (in cross section) has a cycloidal shape, which, for simplicity, is taken as part of a circle. When a massif slides along a lamellar surface, tectonic or other fault, the sliding surface can be flat, discontinuous or wavy.

In shallow landslides affecting the soil layer, the sliding surface usually follows the topography. The displacement does not occur along a clearly defined surface, but occupies a certain section of the massif (displacement region) or has the character of plastic deformations. In the landslide zone, the rocks have a disturbed structure and high humidity [6].

The base or slip base is the line of intersection of the slip surface with the slope surface. There can be several landslides on one slope, their bases are located at different levels. Such landslides are called multilayer. Sometimes there is a successive displacement of land masses and a stepped landslide is formed. The surface of landslide ledges during movement often has an inclination towards the slope, which is explained by the flattening of the slip curve.

The body of an avalanche is a collection of avalanche rocks. It separates the head, the highest part of the avalanche, and the tongue, the lowest part. Slope depth or slope retention is the strength of the landslide mass measured by standards on the slope surface. The landslide circle is a dent formed as a result of subsidence on the slope, and the arcuate line bounded by the landslide circle from the side of the slope is called the margin or the dip line [9].

The appearance of landslide slopes has a number of features, with the help of which it is always possible to determine that the mountain slopes are in an unstable state. In places where rocks are stratified along the mountain slopes, a series of concentric cracks are formed. The movement of rocks leads to the slopes of the hills, especially in their lower part. Under the influence of the pressure of creeping rocks, extrusion swellings are formed at the foot of the mountain slopes. Often the external sign of landslides is the so-called "drunken forest" and broken tree trunks. Due to the movement of stones, the tree trunk loses its verticality, and sometimes splits. Similarly, telephone poles and power lines, fences and walls lose their verticality.

IV. Results

Using the experience of foreign countries on the protection of train traffic in Uzbekistan from the consequences of natural disasters (landslides)

Landslides are the movement of rock masses down a slope under the influence of gravity. They are formed as a result of imbalances and weakening of forces in various rocks and arise from natural and artificial causes.

Natural causes include the steepness of slopes, erosion of their bases by sea and river waters, seismic shocks, etc. Artificial, or anthropogenic, i.e. caused by human activities, the causes of landslides are the destruction of slopes by cutting roads, overgrazing of soil, deforestation, etc. According to international statistics, up to 80% of modern landslides are associated with human activities. The longitudinal section of the landslide is shown in fig.3.

On the site of the rock where the landslide occurred, a cup-shaped fender wall with a fence in the upper part has been preserved.

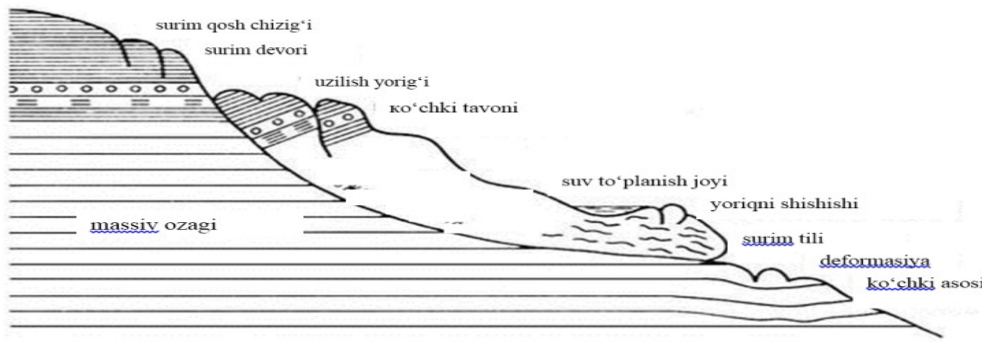

Figure 3. Longitudinal section of a landslide.

A slippery slope covers the lower parts of the slope with hills or steps. A landslide can push loose rocks in front of it, forming a landslide swelling at the foot of the slope. Landslides can occur on all slopes with a slope of 20 degrees, and on clay soils with a slope of 5-7 degrees. Landslides can occur from all slopes at any time of the year (Fig. 4).

Landslides can be classified according to the type and condition of the material. Some of them are composed entirely of rock material, others only of soil material, and still others are composed of a mixture of ice, stone and clay.

Landslides are divided into large, medium and small scales:

- large landslides, as a rule, occur for natural reasons and form on slopes hundreds of meters. Their thickness reaches 10-20 m and more. The body of an avalanche often retains its solidity.
- anthropogenic processes are characterized by medium and small landslides.

V. **Discussions**

Landslides can be active or slow-moving, which is determined by the degree of rock capture and the speed of movement of the bottom of mountain slopes, which can range from 0.06 m to 3 m/s per year.

Depending on the quantitative indicators of water availability, landslides are divided into dry, thin, wet and very wet.

According to the place of formation, landslides are divided into mountain, underwater, snow and landslides that occur in connection with the construction of artificial earthworks (pits, canals, stone fragments, etc.).

In terms of power, landslides can be small, medium, large and very large and are characterized by the volume of moving rocks, which can reach several hundred cubic meters.

Figure 4. Artificial structure against landslides in mountainous areas.

Landslides can destroy settlements, destroy agricultural land, jeopardize the operation of quarries and mines, damage communications, tunnels, pipelines, telephone and electrical networks, hydraulic structures, mainly dams. They can also block valleys, form impounded lakes, and contribute to flooding. Thus, the economic damage they cause can be significant.

The main reason for the destruction of rocks is a sharp daily change in air temperature. The daily amplitude of fluctuations in air temperature reaches 40-50°C. This causes the appearance of many cracks in the stone and its crushing. The described process is facilitated by periodic freezing and thawing of water filling the cracks. Frozen water increases in volume and with great force presses on the walls of the crack. In addition, rocks are destroyed by chemical decomposition (dissolution and oxidation of mineral particles by underground and underground waters), as well as organic weathering by macroorganisms.

Landslides are characterized by the power of the landslide process (the size of the fall of rock masses) and the scale of manifestation (the participation of the territory in the process). According to the strength of the landslide process, landslides are divided into large (rock detachment more than 10 million m^3), medium (from 1 million to 10 million m^3) and small (rock detachment less than 1 million m^3). According to the scale of manifestation, landslides are divided into large (100-200 ha), medium (50-100 ha), small (5-50 ha) and very small (less than 5 ha). Retaining walls, counter shafts, rows of piles and other structures are erected to prevent landslides. They are placed at the foot of a potential landslide and prevent soil movement by creating a stopper.

Figure 5. The consequences of the landslide.

(The press service of the Ministry of Emergency Situations reports that a landslide blocked a section of the railway passing through the Kamchik pass. On March 15, at about 10:30, a signal was received at the post of the Kamchik search and rescue department that a landslide had occurred at the 71st kilometer electrified railway "Angren - Pap" and at the 232nd kilometer of the highway A-373 "Tashkent - Osh".)

Figure 6. Aftermath of a landslide to the railroad.

Waterworks are also used for flood protection. These structures are divided into types regulating flood flow, separating flood flow, delaying flood flow, and modifying flood flow according to the nature of their impact on the flood flow.

VI. Findings

To implement active measures against the elements, it is recommended to take very simple measures that do not require the expenditure of large resources and building materials, in particular:

- to reduce the stress state of slopes, land masses are often cut off in the upper part and laid on the threshold;
- groundwater over a possible landslide is controlled by a drainage system;
- protection of the river banks is achieved by the application of sand and gravel, as well as by planting grasses, planting trees and shrubs on the slopes.

(The landslide occurred during the passage of the passenger train "Saryasiya-Tashkent" TASHKENT, May 2 - Sputnik. The landslide came down on a section of the railway and blocked the movement of a passenger train in the Kashkadarya region in southern Uzbekistan, there were no casualties, the information center of JSC "Uzbek Railways" reports .

The incident happened on April 30 at the 103rd kilometer of the mountain railway Tashguzar - Baysun - Kumkurgan)

Figure 7. The landslide occurred during the passage of the passenger train No. 081 "Saryasiya - Tashkent", the ground collapse blocked the movement of three cars.

(Railway damaged by landslide repaired in Uzbekistan April 7, 2019, 09:14

According to the company, the passengers were transferred and placed in the remaining carriages. In early April, due to a landslide, a freight train was blocked on a section of the railway in the Dekhkanabad district of the Kashkadarya region, some of the wagons derailed.

Figure 8. Consequences of loose earth.

Protective measures, in the railway, as a rule, include a number of measures carried out in advance, i.e. before the onset of an emergency, as well as other activities carried out with the occurrence of an emergency and the elimination of its consequences. With the occurrence of emergencies, an assessment of the actual situation and forecasting of the development of the situation are carried out. Naturally, the previously adopted protection plans are corrected, supplemented and brought into line with the current situation.

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