

THE UGHEDZOR LANDSLIDE DISTRICT (ARMENIA) AND A PROBLEM OF RUNNING OF THE STRATEGIC MOTORWAY

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Abstract. In the eastern part of the Vayots Dzor region (Armenia), in the Darb River basin (left tributary of the Arpa River), in the area between the villages of Saravan and Ughedzor, active landslides constantly damage the roadbed of the strategic highway connecting Yerevan with the south of the country. Active landslides cover both banks of the Darb River valley, therefore, as an alternative to the existing strategic road, it is proposed to bypass the entire landslide area from the north along the Jermuk highway to the Kechut reservoir and then follow the existing country road to the Vorotan River and along its left bank (a lava plateau with an existing road operated by the miners of the Amulsar field) near the village of Goraiq to connect with the strategic Yerevan-Goris road.

Key Words: Landslide, strategic road, Ughedzor

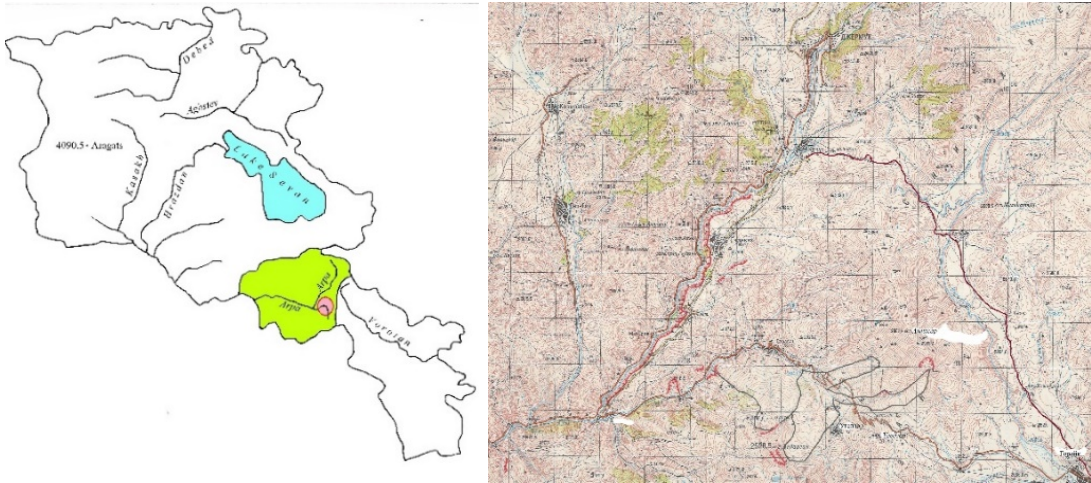
Introduction. Among the dangerous natural phenomena that cause great harm to anthropogenic objects and make significant changes in the natural environment, landslides occupy a special place. They are widespread in mountainous areas, where steep and often convex slopes predominate, the depth of dissection of the relief is significant, seismic activity is high, there are numerous tectonic faults in the zone of which creep movements of their sides are noted, rocks are strongly modified (often to a clay state), springs are frequent, etc. All this, together with human economic activity, provokes the formation of landslides of different sizes and different activity [1-7].

In Armenia, which is a typical mountainous country with all its features, more than 4% of its territory is covered by landslides. To date, there are more than 130 dangerous landslide sites in the republic, which require immediate anti-landslide measures to prevent possible disasters. Of these, a part falls on sections of roads and railways. At the same time, the greatest damage to transport communications by landslides falls on the regions of Syunik (373 km), Lori (246 km), Tavush (178 km), Shirak (158 km) and Vayots Dzor (131 km) [8].

In the conditions of the mountainous terrain of the republic, landslides that threaten the functioning of strategic communications pose the greatest danger, since with significant activation of landslides, it is difficult to find workarounds for travel. One of such problematic is the Ughedzor landslide site.

Study area. The Ughedzor landslide site is located in the interfluvium of the Arpa and Vorotan Rivers, in the eastern part of the Vayots Dzor region, just west of the border with the Syunik region, in the Darb River basin (left tributary of the Arpa River). The site is located within the Amulsar uplift (the amplitude of the neotectonic uplift of the latter is 1900 m) of the Central Armenian intensively differentiated arch-block zone [9]. The northern landslides of the site are timed to coincide with this uplift. And the southern landslides, apparently, are connected with a supposed fault that runs to the southwest of the Saravan-Ughedzor line. The landslide area covers the territory from the village of Saravan to the village of Ughedzor and extends towards the Ughedzor pass (see Fig. 1).

The landslide site includes both sides of the valley of the Darb River. Here, in the volcanogenic-sedimentary thickness, along the line of the active fault, to which the epicenter of the Vayots Dzor destructive earthquake of 735 (M=6.5-7.0) is confined, several large landslides-blocks and landslides-flows were formed, which are clearly recorded in the terrain (a), aerial (b) and satellite (c) images [2] (see Fig. 2).



a

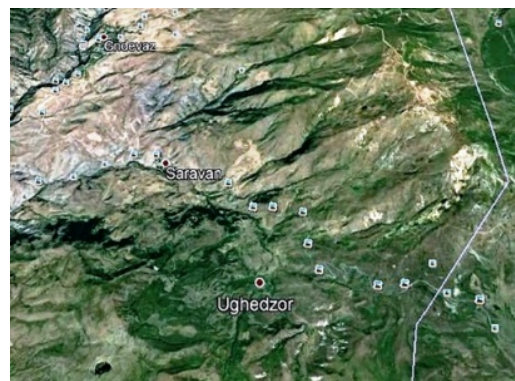
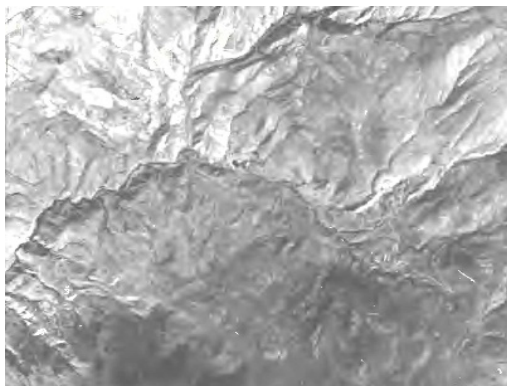
b

Fig. 1. a - The location of the Vayots Dzor region on the map of Armenia (the Ughedzor landslide site is marked with a red circle); b - Ughedzor landslide site (landslides are marked with a black outline, purple - the proposed route of the bypass road)



a

b



c

d

Fig. 2. Ughedzor landslide site: terrain photograph (a - b), aerial photograph (c), satellite image (d).

These landslides constantly deform the roadbed, which is very dangerous, because this road is the only one that connects the capital of the republic with the south of the country and is of strategic importance. The activity of the landslides of the Ughedzor site is most likely associated with the activity of the Vayots Dzor fault, along which slow movements of its sides occur [2].

Materials. In preparing this article, the materials of the author's personal field research, analysis of available maps (topographic, neotectonic [9], geological [10]), as well as 1:100 000 scale aerial photographs were used.

Results and discussion. The road near the village of Saravan passes through the volcanogenic formations of the upper parts of the Amulsar strata of the Upper Oligocene-Lower Miocene (andesites, andesite-dacites, their lava breccia, tuff-breccia), and further, to the south-east of the village, it crosses volcanogenic sedimentary formations of the Middle Eocene (sandstones, siltstones, limestones, tuff sandstones, tuff-breccia, andesite-basalts, andesite and andesite-dacite lava flows), as well as lavas of the lower Pliocene and Upper Miocene [10]. On the right bank of the valley of the Darb River there are two floodsliding that shifted from the south-western slope of the Zangezur ridge and oriented from north – north-east to south – south-west.

The northern of these floodslidings has a length of 2.5-3.3 km and a width of 0.75 km to 1.5 km in the “tongue” part. The relief of the landslide body is uneven, the body itself consists of two parts - the lower part has settled in comparison with the upper one. The power of this landslide is 50-100 m (the latter value is characteristic of its hilly parts). The displacement of this landslide and its activity are associated with the constant moistening of the waters of springs that come out at the foot of the steep part of the slope of the Zangezur ridge (the walls of the collapse of the landslide body) and are unloaded into landslide formations.

Southern floodsliding on the right bank of the Darb River is oriented in its upper part parallel to the northern landslide, but then turns due west. Its length is 4.5 km, width – 0.5-0.8 km, power – 75-100 m. The “tongue” of this landslide shifted the course of the Darb River about 250-300 m to the west. The wall of the collapse of the landslide with a height of just over 200 m is located at a distance of 1.5 km south-east of the summit of Amulsar (2987.9 m) on the south-western slope of the Zangezur ridge. The right side of the landslide, in all probability, coincides with a tectonic fault, as indicated by the straightness of the watercourse, the outlets of springs, the concave bend of the slope, etc.

The body of the landslide is heavily moistened by the waters of springs, as well as numerous ravines draining the slopes adjacent to the landslide and unloading their waters into the body of the landslide. Therefore, the surface parts of this landslide creep onto the roadbed of the strategic highway. The landslide itself is quite active, which is confirmed by the constant displacement of the roadbed down the slope and its destruction (see Fig. 3).



Fig. 3. Consequences of the landslide of the right board side of the Darb River valley.

The large power of the landslide does not allow protecting the highway from destruction only by countering the displacement of the surface strata of the landslide mass. Interception of water with a concrete tray only a

temporary measure capable of stopping the creeping of these surface strata on the road. After all, the road is destroyed not from these surface masses, but from the displacement of the floodsliding with its entire mass.

It is not possible to move the road from the right slope to the left slope or to the bottom of the valley of the Darb River, since the entire left slope up to the riverbed is a pile of landslide masses that have shifted from the north-western spur of the Zangezur ridge at the top of Aghiargan (2528.5 m) along the tectonic fault line. A large landslide body with a length of 3.0-3.5 km and a width of up to 1-1.5 km also covers the territory of the village of Ughedzor and extends up to the riverbed of the Darb River. Landslide formations with a capacity of 50-90 m on the left bank of the river have a bumpy relief with small depressions and protrusions. In places, the depressions are filled with water and are small lakes.

Conclusions. The author suggests considering, as an alternative to the existing strategic road, the option of detouring from the north of this entire landslide section along the Jermuk highway to the Kechut reservoir and then along the existing country road (it, of course, must be previously repaired) to reach the Vorotan River and along its left bank (lava plateau with the existing road operated by the miners of the Amulsar field) at Goraiq villages connect with the strategic Yerevan-Goris road. This option must always be in stock, so the road must be kept in good condition. Of course, with this option, the length of the path increases (by about 50 km) and the time to overcome the detour section, but there is simply no other option.

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