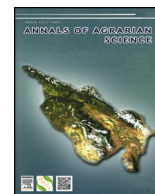




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## The forecast of stability of the landslide slope existing in the River Gldaniskhevi Valley<sup>☆</sup>,

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## ABSTRACT

At the territory of Tbilisi, in order to forecast strength of vulnerable slope, existed at the river Gldaniskhevi catchment basin, a topographical map of the located slope has been done where the characteristic section line has been chosen and 3 pores have been arranged. Soil samples have been taken out of the pores, according to the results of the laboratory researches on them lithological structure of the rocks has been determined, also the geological section of the territory has been made; physical features of the soil strength factors, characteristics of the slopes resistant in case of natural and wet states, has been determined.

According to the gained landslide body data and forecast, done with the use of approbated method, it can be said, that landslide running at the vulnerable slope of the Gldaniskhevi river is in its active phase, that poses great ecological danger to the population of Mamkoda settlement, adjoining the slope, as well as to the traffic of the autobahn.

## Introduction

Modern technical progress demands building and developing of such communicative measures as those of transport, energetically, irrigative-ameliorative and other linear constructions. Such constructions are being done at complicated landscapes. It is especially noticeable during working on highly steep dipping slopes of mountain relief when destruction of existed natural conditions of the slopes take place, that mainly cases provocation of geodynamical processes, including landslides.

The amount of natural disasters (floods, landslide, debris flow and so on) in Georgia has considerably increased, that is caused by changes in climate and by the negative influence of human being upon the natural environment.

Negative results, engendered by landslide-gravitation phenomena, among the dangerous geological processes take special place in the economics of the country. 70% of fixed landslides in Georgia are situated inside the economical-engineering zones. The lands of more than 1,5 million hectares among them have destructions of various quality.

Recently the process of loosing the ecological balance running in the catchment basins of the little rivers existing around Tbilisi the capital of Georgia, as a result of it more than 50 debris flow ravines and more

than 60 landslide zones formatted there, pose danger to the population and infrastructure of Tbilisi city [1,2].

## Objectives and methods

The river Gldaniskhevi catchment basin, in the point of view of ecological risks, is one of the important ones among the small rivers in the surrounding of Tbilisi.

Right landslide slope of the river Gldaniskhevi has been chosen for investigation. It includes upper crest part and stretches until the mountain fore-part hillsides. Its length is 180 m, width – 140 m, its grade fluctuates between 10-30° (difference of heights 70 m), the lower part is wooded, the upper part is covered partly with shrubs. The relief has landslide, wavy stepped like character. There some steps of 2,0–2,5 m high slump stand out well in relief.

Field reconnaissance researches, with purpose of forecasting the stability of the river Gldaniskhevi landslide slope have been carried out, namely, topographical measuring of the landslide slope has been realized and topographical map of the territory has been made. Division of the landslide slope according to landslide danger has been accomplished on the map (Fig. 1).

The soil physical features (moisture, plasticity number, consistency

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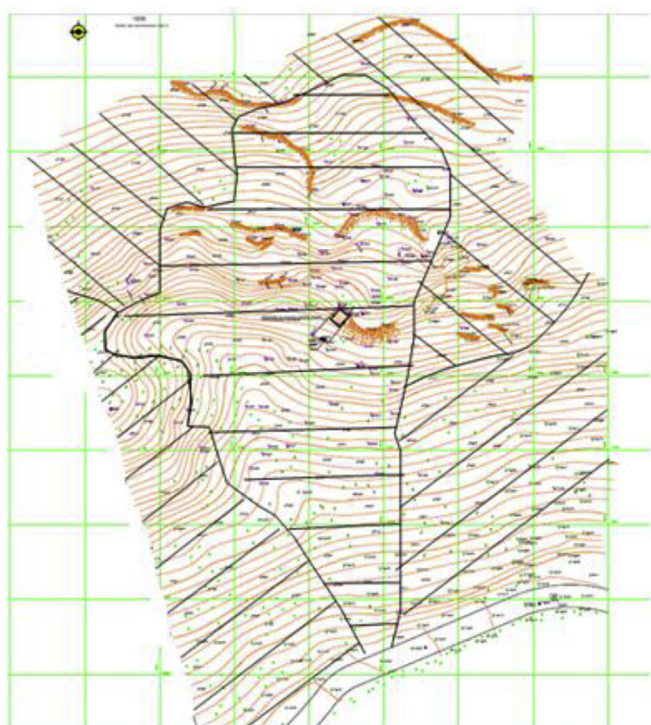





Fig. 1. Topographical map of the landslide slope. Scale: 1:200.

Designation

-  mobile landslide area
-  potential landslide zone
-  stabile area

of the soil, porosity, porosity index, grade of moisture, flow index) strength factors (angle of inner friction, cohesion), characters of slopes resistance in case of natural state as well that of moist, also with due regard for seismic factor, have been determined out of soil samples, taken from the landslide body. The computing has been accomplished by the method of computing the stability of heterogeneous creeping surface [3].

## Results and discussion

Soil, landscape-climate, structural-tectonic conditions and sharp contrasts of relief existed in the river Gldaniskhevi catchment basin, create high risk of landslide formatting and, therefore, stipulate, ecological danger towards the Mamkoda settlement at the foot of the mountain slope and towards the traffic of the autobahn existed there [4-7].

The river Gldaniskhevi catchment basin includes upper part of Gldani settlement, Gldani village, Gldanula settlement and the adjoining cottages, 8th Gldani jail and the near-by territory, Big Lakes, (Gldani Lake, White Lake), Small Lake, the surrounding, a short segment of Gldaniskhevi ravine about the Gldaniskhevi bridge and its right tributary, lower reaches of the debris flow ravine, Naserali range, the territory of Gldani old dump, the river Khevdz mari ravine and also, a segment of new railway, as well as a definite part of Gldani-Norio roundabout road.

Geologically the river Gldaniskhevi is not notable for its diversity. Its minor part is built up of quaternary floorings, alluvium, ballast, cobble stones, which are spread along in the river Gldaniskhevi ravine as narrow stripes. The most territory is built up of upper Paleogene and lower Neogene clays, argillaceous schists, rare sandstones, somewhere – of conglomerates. In the extreme south-east part geological substratum presents middle Neogene mass and waterproof clays, argillaceous schists, which in some cases are notable of high brittleness and easy

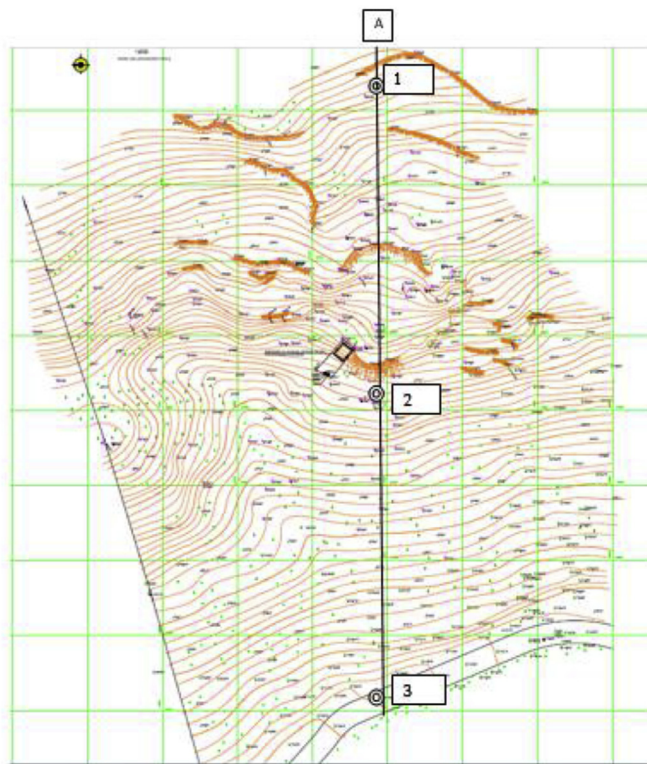


Fig. 2. Topoplan of the landslide body. Scale: 1:200.

Designation

- ⊙<sub>1,2,3</sub> pore and its number
- A — C — section line and its designation

decomposability. The mentioned condition stipulates intensity of geomorphological and geodynamical processes, namely, saturation of vulnerable rocks with water provokes soil and matrix break-away and displacement [8,9], that may be followed by catastrophic results.

The slope is built up of the Paleogene age sandstones and argillaceous schists interchange. Outcropped rocks are rather exhausted and are often found in destructed condition.

These rocks are covered with the eluvium-heluvium genesis clay-loam soil with ballast and debris switchings. Their power fluctuates until 2,0–4,5 m, though at some areas even exceeds it. These rocks, in natural condition, are of firm or half-firm consistence. In moist condition the strength characteristics sharply reduce, that is one of the reasons for development of landslide phenomena.

Characteristic cross-cut line has been chosen at the investigated slope (A-C) (Fig. 2) where a pore has been arranged. Soil samples have been taken out of the pore and laboratory researches have been accomplished to determine lithological structure of the soil.

Geological cross-cut of the territory has also been built up according to the soil samples, taken from the pore, installed at the vulnerable slope of the river Gdaniskhevi (Fig. 3).

The method of computing the condition of the landslide bodies having inclined heterogeneous creeping depth has been used according to the use of laboratory research of the rocks, for the purpose of estimation the investigated slope factor for the natural condition of the rocks as well as for that of moist [10-12].

Seismic character of the region and its role in strengthening the running moving forces had been taken into consideration. The calculated values of the coefficient K of condition of the landslide slope are as follows:

Natural condition of soils without due regard for seismic coefficient – 1,4;

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