Featers of The Development and Influence of Landslide Processes on The Road A-149 Adler-Krasnaya Polyana in Krasnodar Region

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Abstract

The article analyzes the formation of landslide processes on the territory of the section of the road A-149 Adler-Krasnaya Polyana, Krasnodar region. The slope stability assessment was carried out, as a result of which it was found that the slope is unstable and additional measures are required to stabilize it.

Keywords: landslide processes, road, landslide slope, anti-landslide structures.

1. INTRODUCTION

The consequences of landslides are very different. They destroy homes and endanger human settlements, destroy agricultural land, make it difficult to till the soil, create danger when working in quarries. Landslides damage communication networks and infrastructure of settlements threaten hydraulic engineering and water facilities. They can form lakes and contribute to the appearance of floods, generate destructive waves in the bays. As a result of landslides riverbeds are blocked and there is a change of landscape. Landslides destroy roads and threaten the safety of road and rail traffic.

Thus, landslide processes lead to significant changes in various components of the environment significantly changing it. This necessitates the improvement of methods of monitoring, forecasting and elimination of landslide processes to maintain favorable conditions for the existence of living organisms (e.g. [1], [2], [3], [13]).

2. THEORY

Natural and climatic conditions, lithological and structural features of rocks composing the slopes, anthropogenic impact contribute to the development of many landslides on road sections in the Krasnodar region.

The territory of Krasnodar region is characterized by intensive development of exogenous geological processes, including more than 16 thousand landslides. This is due to the complex geological structure, tectonic disturbance, a large diversity of lithological composition of indigenous and Quaternary rocks, a significant steepness of the slopes and climatic features of the region.

The formation of landslide processes in this area depends on many factors: the shape of the terrain, physical and mechanical properties of soils, their ability to the processes of swelling-shrinkage, surface and groundwater regime, external load parameters, etc. the Main accompanying engineering-geological processes are: subluxation of the base, weathering, suffusion, reduction of strength during soaking and vibration. The reasons for the activation of landslide displacement may be heavy rains, seismic effects and additional loading (e.g. [10], [12], [13]).

Many roads in the Krasnodar region laid along the riverbeds.

3. DATA AND METHODS

Let us consider the influence of the river on the example of the section of the Federal highway A-149 Adler - Krasnaya Polyana, laid along the Mzymta river. As a result of the erosion of the right Bank, on km 19+500 - km 19+660 there was a destruction of the roadside and barrier fence. The high intensity of the slope processing in this area is due to the bend of the river - the flow approaches at an acute angle to the shore, destroying its base (Fig. 1).

Figure 1 - Destruction of the section of the road A-149 Adler - Krasnaya Polyana, km 19+500

4. METHODS

The task of assessing the stability of the existing landslide (there is already an actual sliding surface) is to determine the degree of stability, the degree of threatened landslide movements for existing structures and the safety of the area, as well as the establishment of the direction of anti-landslide measures to prevent their dangerous action (e.g. [4], [5],[6],[8],[9],[10]) .

When the task is to assess the stability of the slope or slope (the sliding surface has not yet formed), in this case, we mean the forecast of the possibility of landslides, the justification for the steepness of the slopes and the need for other measures to ensure their stability (Fig. 2) .

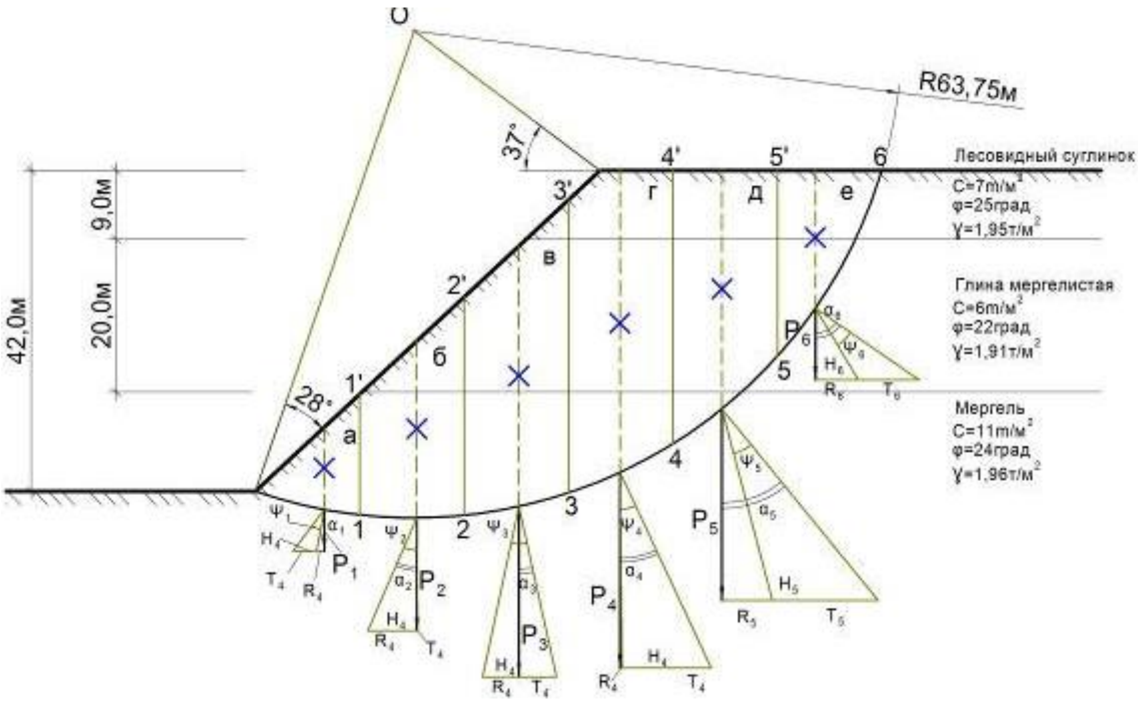

Figure 2 – Calculation scheme of the surface slope

The area bounded by the surface of the slope (slope) and the slip curve is divided into six compartments by vertical lines (e.g. [7], [14]). The zero compartment is placed under the center of the slip curve, the remaining compartments are numbered with ordinal numbers to the right. Next is the equation of moments of forces acting on the compartments relative to the center of the slip curve. The lateral ground pressure forces acting on the vertical faces of the compartment are not considered, since they are internal (e.g. [6],[11], [15]).

For each block is determined by the angle α between the vertical and normal components, drawn from the projection of the center of gravity of the block on the slip curve.

Calculate the weight of the soil in each block, found by the formula:

$$P_i = F_i \times \gamma_i \quad (1)$$

For each block, the angle α between the vertical and normal components, drawn from the projection of the center of gravity of the block on the slip curve, is determined.

The angle of shear resistance for each designated compartment is found by the formula:

$$\psi_p = arctg\left(tg\varphi + \frac{C}{P}\right) \quad (2)$$

The force *H*as a projection on the horizontal axis *N* is a thrust, that is, the pressure on the vertical wall of the lower unit, in the absence of friction and adhesion in the ground.

Force *T* is this part of the thrust perceived *H* by friction and clutch.

The results of the calculations are summarized in table 1.

Table 1 - Calculation Results

№ bloc k's	***P ,m/м***	**α,**	**ψ_i, °**	***H, t/m***	***T, t/m***
1	261,11	36,9	24,03	164,0	123,2
2	702,04	23,8	23,5	259,2	3,6
3	952,79	24,43	24,3	386,4	196,4
4	737,78	24,41	24,4	476,4	466,4
5	383,49	39,9	24,4	814,8	551,6
6	94,47	55,3	24,2	540,4	316,0
Result:				2641,2	1657,2

By calculating the sum of forces *H* and *T* on the blocks of the entire landslide slope, we can determine the corresponding factor of safety.

$$n = \frac{\sum T_i}{H_i} = \frac{1657,2}{2641,2} = 0,627 \quad (3)$$

***n*<1-** consequently, the slope is unstable, stability stabilization measures are required.

The anti-landslide dam with slopes fixed by wire anchors with conical or rotary tips will significantly increase the resistance from the landslide of the slope mounts at minimal cost, to the maximum extent to use the strength properties of the metals from which the anchors are made. All this makes the design as cheap and effective in the fight against landslide processes along the roads.

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