

LANDSLIDE SLOPE STABILITY FORECAST IN THE AREAS OF INDUSTRIAL FACILITIES OPERATION

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The research was carried out on actual objects of “Gazpromtransgaz-Makhachkala” aiming to develop a concept for landslide slope stability estimation using Earth’s natural pulsed electromagnetic field parameters. Preliminary work to establish ground geodynamics observation points was performed on landslide areas of main gas pipeline “Mozdok-Kazimagomed” (600-610 km) and on minor gas supplying lines “Botlikh” 95 km. We completed the following set of tasks to solve the problem:

- presurvey, survey and desktop satellite imagery interpretation to reveal areas and zones with presently active landslide processes;
- fracture-physiographic survey of landslides and adjoining slopes distinguishing landslide extension fractures, extension-shift fractures, lowered steps of extension-shift fractures, compression fractures and extrusion ridges, all of which are evidence of landslide processes development;
- mapping anomaly zones in ENPEMF, associated with geodynamic processes activation in lithosphere.

Multichannel geophysical recorders “MGR-02-16” were used. They allow to analyze both temporal and spatial variation in ENPEMF intensity, describing lithosphere dynamics. GPS navigator was used during areal survey for observation points positioning.

General idea of revealing spatial anomalies in ENPEMF intensity is the following: one recorder is used as a reference and located outside the active landslide zone, second recorder is used in route surveys, crossing the landslide area. Anomaly field is calculated as a ratio of ENPEMF spatiotemporal variations intensity measured by the route recorder to the intensity of temporal variations logged by the reference recorder. If that ratio is positive we make a conclusion that this area mostly demonstrates expansion strains, if it is negative – compression strains. The bigger ratio’s difference from 1 – the bigger the probability of exogenic geodynamic manifestations.

On the surveyed plot of main gas pipeline “Mozdok-Kazimagomed” there are three clearly distinguishable areas with expansion strains:

4. in the region of 605,9 km;
5. in the region of 607,0 km;
6. in the region of the sink at 607,5 km.

No compression strain zones were revealed along the route of this plot, that is also confirmed by geomorphological surveys.

Second survey site demonstrated more complicated geodynamical state of the rocks.

ENPEMF signals processing results in the area of GDS Zilo allow to divide the whole plot into three zones of active geodynamics with a large level of certainty. Northern part is prone to compression strains, central part demonstrates weak expansion strains, and southern part features active geodynamics with expansion strains.

The geomorphological survey results of instrumental monitoring of stress-deformed state of the rocks nearby Argvani village (57.7 km) are quite consistent with the results of ENPEMF anomaly zones mapping.

The results of the engineering geologic survey and fracture-morphological survey for landslides and adjoining slopes are congruent with ENPEMF anomaly zone mapping, indicative of landslide processes development.

The accomplished works demonstrated promising potential of ENPEMF method for instrumental mapping of dangerous geological processes. It's worth noting that method allows to indicate initial stages of exogenic processes' activation, when geodynamics is not yet reflected in current landscape. Research demonstrated the correctness of the suggested concept for risk assessment of geodynamic manifestations and their mitigation.