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The Estimation of Gully Slope Stability in Urban Areas

The problem of gully slope stability is urgent for Dnipropetrovsk because a significant part of its territory is composed of types 1 and 2 loess subsident soils. Loess subsident soils make it necessary to take into account the conditions change due to hydrogeologic conditions. But most of the widely used approaches have a number of special drawbacks and cannot give accurate results.

I am engaged in investigating Rybalskaya gully soil slope stability, which includes the analysis of geological engineering surveys of Rybalskaya gully made from 1998 to 2009 to use them in further calculations in LIRA and LIRA Soft. Contour plots of gully excesses, slope ratios and groundwater levels have been performed to determine the most dangerous landslide regions of Rybalskaya gully. These data seem to be of certain theoretical importance and practical interest for future construction on gully slopes providing the correct forecast of slope stability.

Presently there are many methods of slopes stability calculation, which are considered by authors from different points of view. In Ukraine, the most applicable methods are circular-cylindrical sliding surface, a linear sliding surface method, a horizontal forces method of Maslov-Bearer and the Shahunyants method.

A slope stability calculating method using a linear sliding surface, as it is a simple one, is of interest. However, in practice this method does not allow to take into account the effect of hydrodynamic and seismic effects on the slope stability, and the minimum and maximum values of the design soil characteristics. It results in inaccurately performed estimates and projections, which lead to the slope failures.

Slope stability analysis in the methods described is reduced to determination of stability ratio and value of landslide pressure. The most unfavorable loading conditions and situations must be applied and provided, taking into account all possible factors involved for the most secure slope stability calculation. Using this approach, the calculation results obtained will fully and accurately represent the necessary conditions for the slopes stability. As shown above, current literature gives only a simplified approach for the stability analysis using the planar slip surface method, so it is important to adapt it by involving seismic and hydrodynamic factors and calculated soil characteristics depending on the loading nature.

It should be emphasized that in our opinion the use of the same design soil characteristics (the same design unit weight of soil) to determine the shear force and holding force is incorrect, because it contradicts the formation of the most unfavorable loading conditions. In order to obtain the required minimum slope stability factor it is necessary to specify the maximum shear force, which requires a maximum unit weight, and minimum retention force and a minimum weight of soil, respectively.