ABSTRACT

Ensuring the stability of earth structures, particularly the earth structures of railway lines, is one of the most challenging engineering problems encountered in the natural environment. This dissertation hypothesizes that there is an empirical possibility to classify the exogenous factors and processes that destabilize the earth structures of railway lines, and that it is possible to develop a method to forecast the risk of stability loss for such structures. The different forms of stability loss have been defined as: emergency threat, structural failure, and structural catastrophe.

Based on the analysis of conditions on ten selected research sections of railway lines, ninety-four destructive factors and processes affecting the stability of earth structures of railway lines were identified. It was found that assessments made using the "0/1" method are insufficient for accurately determining the risk of stability loss of earth structures. Therefore, an "indexed method" was used, assigning weights from 1 to 5 to the individual destructive factors and processes.

Using the "indexed method", the number of points characterizing the risk of stability loss for the earth structures of railway lines was determined for each of the studied sections. Threshold values for the number of points indicative of an emergency threat, structural failure, and structural catastrophe were proposed. These values were verified through significance tests and by determining confidence interval values for the means characterizing the different forms of stability loss.

To enable the broad application of the developed method for assessing the risk of stability loss of earth structures of railway lines, an algorithm for the railway diagnostic services was developed. The application of this algorithm will create conditions for effective actions to ensure the safety of train operations and the broader protection of the natural environment.

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