Complex Approach to Analysis of Retaining Walls Monitoring Results

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Key words: Deformation measurement; Engineering survey; Positioning; Risk management; Displacement; Structural mechanics; ANOVA; Cluster analysis; Temperature variation; Prediction; GMDH

SUMMARY

Landslides in urban regions are dangerous and unpredictable phenomena. The retaining walls are the most common way to protect buildings and infrastructure in large cities. These walls restrain the landslides' movements, save the structures on the landslides, and protect surrounding facilities and engineering infrastructure. Insofar as the retaining walls undergo extremely high pressure from the landslide's body, complex monitoring is an essential and responsible issue. The monitoring results have to be analyzed with special attention. The considerable number of factors, e.g., environmental effect, transport effect, construction works, etc., makes the analysis complex and needs different methods. This study provides detailed information on the analysis of geodetic monitoring results of retaining walls emplaced in Kyiv, Ukraine. The complex approach to monitoring results analysis comprises statistical and structural mechanics methods. The suggested approach starts with a statistical analysis of observations. For processing, it was recommended to use the method of analysis of variance (ANOVA). One-, two-, and three-factor analyses were applied to find the relationship between epoch and retaining walls placement, the liaison between the locations of deformation targets, and the value of displacement. The results of the ANOVA analysis gave a clear picture of the deformation process. However, some factors remained unaccounted for. Among those factors, the temperature variation of the retaining walls is significant. During monitoring, the temperature differences exceeded 25C°. Therefore, this factor had to be eliminated from observation results before creating prediction models. The methods of structural mechanics were applied to manage the issue with the temperature variation. The simulation of the retaining walls showed the additional displacements, up to 5 mm due to temperature variation. These additional displacements were ruled out from measurements results before further analysis. The next stage of the complex analysis was about the determination of regions with uniform displacements. Another statistical procedure known as cluster analysis was applied to figure out these regions. Cluster analysis allowed identifying the regions for which the same prediction models can be used. The

final step was the creation of prediction models for regions with uniform displacements. The modern algorithm known as the group method of data handling (GMDH) was examined. Finally, the prediction model that accounts for displacements values, targets position, environmental effect, and observation accuracy was constructed. The considered above complex approach to the analysis of retaining walls monitoring results turned out highly efficient and allowed avoiding the wrong decision during exploitation and reparation works.