



GEOPHYSICAL, NUMERICAL AND STATISTICAL METHODS AS A PART OF REVIEWING OF THE DAM SAFETY

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ABSTRACT

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The first dams were built in Slovakia more than 500 years ago. They are interesting not only because of their height (for example dam Rozgrund (1743) was until the end of the 19th century the highest dam in Europe - $H = 30.2$ m), but also because of their courageous arrangement of cross sections. Basic features of these historic hydraulic structures can be seen in the structures, built later in the 20th century. Determining factor of their typology and safety are engineering-geological and geotechnical conditions of the natural environment. Most of them are built from local materials. These are particularly heterogeneous earth-fill or rock-fill dams. A natural material used for the construction of dams and located in their subsoil is characterized by wide variability. Therefore, issue of assessing safety of dams from the local materials is an important part of reliable operation of reservoirs. The assessment is based on monitoring, which observes the behaviour of dams during operation. The values measured in situ are confronted with the assumptions of the project, limit eventually critical values. In some cases, the measured values reports anomalous development. At that time for clarification of these effects it is appropriate to use complementary methods of inspection - geophysical, numerical and statistical.

The application of mentioned methods in Slovakia has a long tradition. In particular, geophysical methods of measurement of the filtration velocities in wells in several cases discovered a potential risk of failures in filtration stability. Here contributed not only the knowledge on the intensity of the filtration flow, but mainly the time trend of the development of filtration velocities and concentration of maximal intensity of flow and its confrontation with critical values. These are important factors, without which it is not possible reliably assess the risk of failures in filtration stability. Knowledge on the maximum values of filtration velocities, confirmed by repeated measurements motivated treatment works on hydraulic structures Veľká Domaša, Klenovec, Vlčia dolina, Rozgrund and others.

Application of statistical methods in connection with a large database of measured values in situ represents a rational approach of a comprehensive assessment of the safety of dams especially in terms of the impact of long-term operation. Statistical methods allow more closely analyse the reliability of the monitoring, but also the possible occurrence of negative events. The increasing trend of correlation coefficients, reflecting the interconnection between water levels in wells and water level in reservoir may indicate risk of occurrence of preferred seepage paths. On the contrary, a decrease in correlation coefficients can be accompanying phenomenon of clogging of the environment. Mentioned method of assessing safety of dams is complementary, but from a practical standpoint beneficial.

Reliability of determining the properties of soils and rocks is marked by the methods of their estimation. This is reflected in the issues of design, construction and operation of dams and control of their safety. To detailed clarification of some anomalies may besides reliable monitoring contribute also numerical methods. In addition to their use in the design stage are essential in the validation of the reliability of hydraulic structures. In this article are mentioned the results of application of complementary methods of investigation in Slovakia.