Seismic response and seismic measures of Deze concrete face rockfill dam

Mei Wei、Yang Chaolin、Li Shu、Yang Fan：Yunnan Provincial Institute of Water Resources and Hydropower Survey, Design and Research，Kunming, Yunnan；
Fei Wenping：School of Water Resources and Hydropower, Sichuan University, Chengdu, Sichuan

Objectives

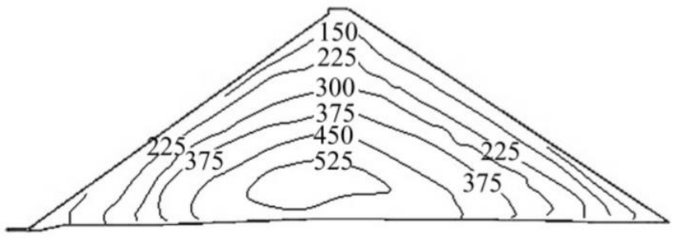
By conducting static and dynamic tests on dam materials, studying their mechanical properties, and using different calculation methods, studying the stability, stress-strain characteristics of the dam body under various operating conditions such as earthquakes during construction, water storage, and water storage periods, in order to provide guidance for dam structure design, dam material parameters, dam stability, rockfill deformation characteristics, dam crest reserved superelevation, control standards, and filling program control Propose targeted engineering measures for seismic engineering design and other aspects.

Methods

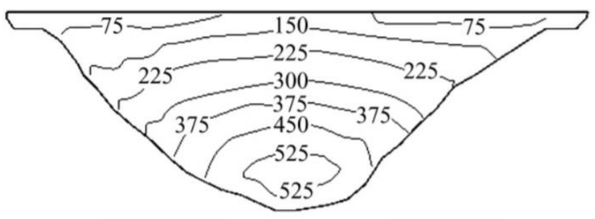
Using the method of three-dimensional nonlinear effective stress seismic response analysis and safety evaluation, the dynamic response of Deze concrete faced rockfill dam under the combined action of normal water storage level and earthquake was analyzed, including acceleration response, stress response, and displacement response. Furthermore, the seismic safety of the dam body was analyzed; The dynamic time history method and dynamic equivalent value method were used to analyze the anti sliding stability of the slope under earthquake action on the face slab and downstream dam slope; Based on the analysis of dynamic response results, corresponding seismic measures for the dam have been proposed in a targeted manner.

Results

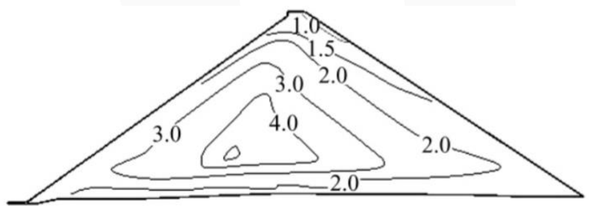
The calculation results show that there is a possibility of local dynamic shear failure and shallow local instantaneous sliding near the dam crest under earthquake action, but it will not affect the overall stability. Under earthquake action, the dynamic stress of the panel is relatively high. After the superposition of static and dynamic forces, the panel experiences significant compressive stress in the middle of the valley and significant tensile stress in the surrounding area. Reasonable measures should be taken in the corresponding areas. The dynamic calculation of the dam may result in significant seismic deformation near the dam crest, local dynamic shear failure and shallow instantaneous slip on the downstream dam slope near the dam crest, local compression failure of the panel in the valley, and tensile cracks around the panel.



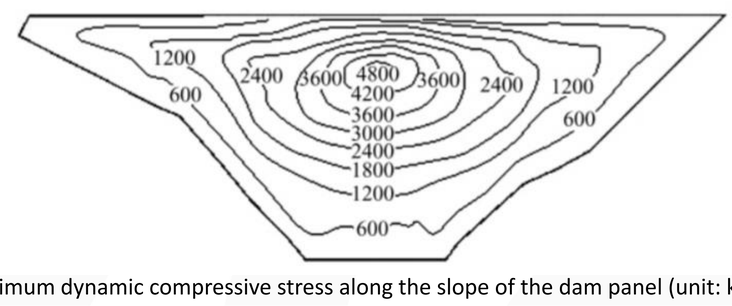
Contour of maximum dynamic shear stress in the maximum section of the dam (unit: kPa)



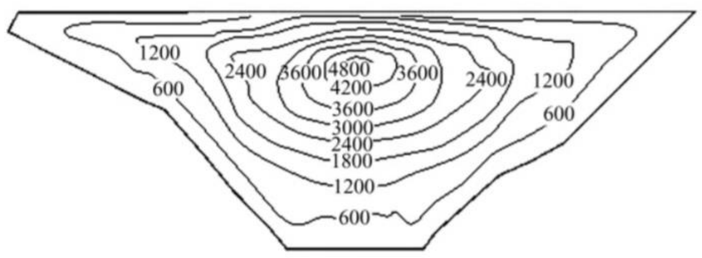
Contour line of maximum dynamic shear stress in the longitudinal section of the dam axis (unit: kPa)



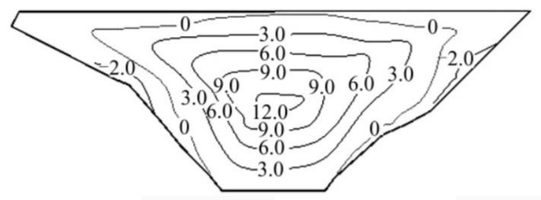
Contour of seismic safety coefficient for the maximum section unit of the dam



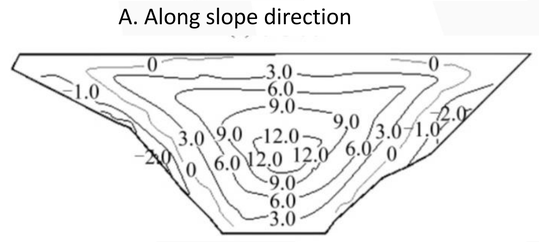
Contour of maximum dynamic compressive stress along the slope of the dam panel (unit: kPa)



Contour of maximum dynamic tensile stress along the slope of the dam panel (unit: kPa)



A. Along slope direction



B. Dam axis

Panel stress contour after static and dynamic superposition (unit: MPa)

Conclusions

The dynamic calculation of the dam can meet the seismic safety requirements under given earthquake conditions. However, local damage may occur under strong earthquakes, and corresponding seismic measures need to be taken to reduce earthquake damage to ensure the overall safety of the dam.