FIELD STUDIES ON THE SPRAY BY DISCHARGING

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The flow discharging on a high dam often causes strong spray and it quite different from the heavy rain. It can cause the bank slope sliding, interrupt the access to the power plant and influence the operation of switchyard or transmission line. There were several cases affected by discharging sprays during the operations. As there is a great scale effect on discharging spray in the physical model tests and there is still a difficulty on the mathematical simulation as the dispersion coefficient is changed with the projects and is very difficult obtained from the prototype operation. The field observation on the discharging spray is the best way to study this issue. The paper gives three different examples causing by discharging sprays, field measurements and studies based on these.

Lijiaxia arch gravity dam is located on the upstream of the Yellow River, the first operation by middle outlets and bottom outlet caused serious spray and banks slides as the ice load over the banks during the reservoir filling in the winter in 1996. The observation on spray gives the distributions by either right or left middle outlets operations and it helps the designer to make proper protection measures.

Ertan is the highest arch dam under the operation in China with the maximum height of 240m. The discharge facilities are 7 surface spillways, 6 middle outlets and 2 tunnel spillways. There was no experience on spray protection for such high dam and large discharge flow before it. The field observations from 1998 to 1999 on spray were carried out with the operations by surface spillways and middle outlets, tunnel spillways separately in the initial operation. The maximum discharge flow was up to the 8000 m^3/s under the design reservoir water level during the observation with the 4 surface spillways and 4 middle outlets. The observed results give the clear distributions of spray by different operations. There are two affected areas by discharging spray, one is formed by discharging through the arch dam outlets and the other is formed by spillway tunnels. The maximum spray intensity is over 1000 mm/h, which is located on the bottom of the side banks (Fig. 1). The entrances to the plunge pool and surge tank, two tailrace plate forms are all surround by high intensity of spray. The discharging sprays cause some small amount of landslide but do not affect the stability of the banks as there are some engineering measures taken during the construction. The observation results on spray are very valuable for establishing the operation rules of the discharging facilities, further protection measures on this project.

Dachaoshan Project is a gravity dam with 5 spillways and 3 bottom outlets. The access tunnels of underground power plant, transformer tunnel of the project are on the right bank

of the dissipation zone by the bottom outlets. The design of the protection gallery and its length are verified by the observation.

Some conclusions are that 1) The field observation of the spray presents that it is the best way to understand the mechanism of spray and safety of banks and structures through the prototype observation on the spray, as there is scale similarity on the physical model test. The proper measures can be taken through the measurements. 2) The measured results in prototype on sprays from the different projects are very valuable for the study on the characteristics of sprays. These can be applied for calibrating the mathematic model for predicting the spray situations, affected areas, spray intensities and distributions for a new design project. 3)The research work on spray prediction and simulation for the projects under the design or construction is also very important and is under going on, especially for a high dam and large discharge flow.

Keywords: high dam; large discharge flow; discharge spray; field observation

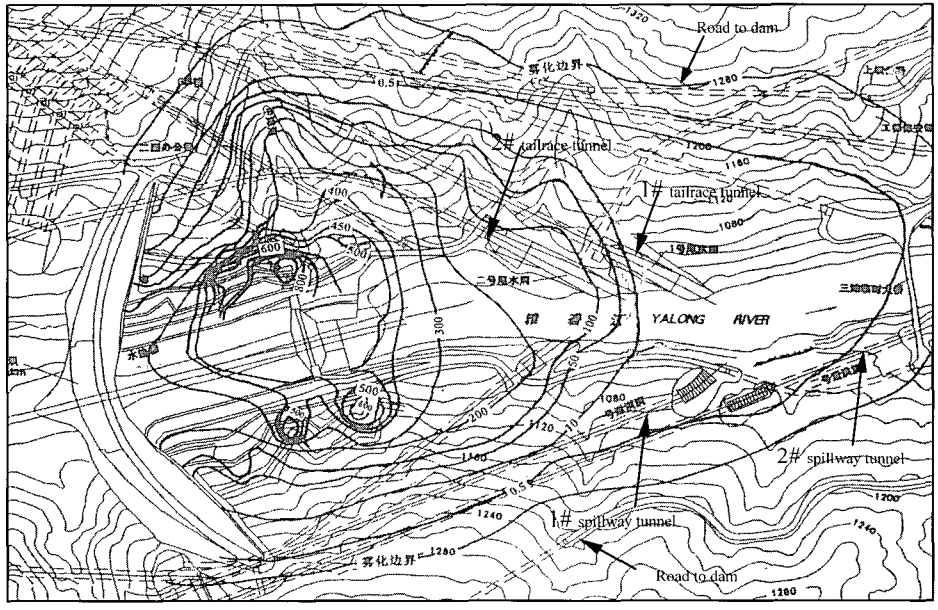

Fig. 1 Spray distributions by 1#, 2#, 6#, 7# surface spillways and 1#, 2#, 5#, 6# middle outlets (case III) in Ertan Project (mm/h)