C-08: Hydrodynamic pressure on the Spillway

K S Jeyabalamoorthy
(*Irrigation Department, Colombo 7*)

Dynamic pressure on the spillway causes vibration in the structures or vice-versa. Vibration on the structures due to earthquakes and underwater explosions create dynamic pressure on the parts of the dam body, even when water or oil pipelines are laid on the river or canal bed. Structural vibrations due to dynamic pressure can change flow conditions. When the head over the weir is greater than the weir height the whole system vibrates as an object oscillating in flowing water. Same is true for weir with very high piers and abutments. This is a very important factor in design of water resources project structures.

Considering hydraulic parameters under investigation limits of model similarity and available resources are taken into consideration. Samanalawewa chute spillway geometric scale of 1/60 was selected for investigation and tests were carried out on this model based on Freude law of similarity. 1.5 mm diameter copper tubes were cast into the model at the appropriate places and connected through 3 mm diameter polythene tubes to pressure transducers. Pressure transducers were connected to recorder through an amplifier. In order to ensure reliability in measuring dynamic pressure, the transducers were

recalibrated several times in the course of an experiment. Transducers with ranges from O.1 to 0.5 bar were used. Dynamic pressure distributions on the chute spillway were made for several discharges varying from 100 to 3600 cumecs. Similar observations were made along the flip bucket.

Dynamic pressure varies along the weir. It is maximum in the middle of the section and zero at the edges. Magnitude of pressure depends on the depth of submergence and rate of flows. Pressure distribution on the upstream and downstream sides of ogee depends on the combination of curves and slopes which makes the shape of the ogee and chute. The pressure curves are non uniform with kinks at points of changes in curvature. It was observed that dynamic pressure variation over the ogee was high for smaller gates openings. This variation has a frequency of 10 cycles/sec and maximum and minimum pressures of 15.3 m and 14.53 m respectively.

In the flip bucket, higher variation of pressure was observed at the lip having frequency of 5 cycles/sec and maximum and minimum pressure of 35.6 m and 31.9 m respectively.