

SEDIMENTATION – A SERIOUS ISSUE FOR WATER RESOURCES AND DAMS

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Abstract

Tarbela dam is one of the largest earth filled dam in the world used for power generation and irrigation purposes. Indus basin is also regarded as backbone of Pakistan as it is the biggest source of electricity generation and is called as a food factory for Pakistan. Like all reservoirs the sediments inflow in the Tarbela reservoir has also resulted in reduction in water storage capacity and is also causing damage to the tunnels, the power generating units and ultimately to the plant equipment. The main source of the River Indus is the glacial melt water from the Himalayas with an annual flow rate of 94 MAF which carries along huge amount of sediments and the gross capacity of the reservoir has reduced. The annual suspended sediment load is about 430 million tons meaning that, over time, the reservoir will fill. The life of the dam and reservoir was estimated to be somewhere around fifty years in 1976 when the dam was constructed, meaning that the reservoir will be full of sediments by 2030 and will not be functional anymore unless maintained. This study presents life prediction of Tarbela reservoir in terms of its storage capacity, erosion rate and strength of the tunnels for different times of the year i.e. during flooding (summer) and drought (winter) situations.

In addition to the reservoirs of Tarbela and Mangla Dams; almost all barrages and most canals are reasonably full of sediments. Important issue with reservoirs to dredge out sediments is the closing of the dams as they are a major source of electric power as per most recommendations of experts. In addition, sediments are increased observed going into the tunnels hence damaging inner liners and turbine machinery and choking filters etc. This means without closing power supply, there is a great need to study the sediments flow patterns, dredging patterns, land slide patterns and many others.

As such kind of work has not been done so far in any of the hydel power plants in Pakistan; the numerical methods developed provide a base for the study of the behaviour of water and sediment flows in Tarbela Dam reservoir, spillways and tunnels and strength analysis of the tunnels using FSI. The developed methodology can also be implemented to study the water and sediment flow behaviour of water in other reservoirs, dams, rivers, barrages and canals present throughout in Pakistan in specific; provided the required data for those are available.

As Erosion is observed in the tunnels and of turbine blades and other components; so erosion rate density measurement studies due to sediments and cavitation are carried out with different compositions of sediments (Sand, silt, clay); different flow rates i.e. quantity of flow of sediments through tunnels; different sizes and shapes of particles (circular, triangular, square, etc) for line and area cutting; different injection techniques and others parameters.

Sedimentation Issue needs Serious Consideration as projects on other tunnels, and that can result in delta initiation for movement and suction of sediment. Inlets on Tunnels need to be raised to control sediments. Dredging of sediments needs to be considered through simulations. A comprehensive integrated plan for power generation, water management considering sediments needs attention. Academia / research organizations can help in indigenous studies and can help saving huge amount of foreign exchange.