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PREDICTION OF RESERVOIR SEDIMENTATION – AN EXPERIMENTAL APPROACH

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Reservoir sedimentation has become one of the major problems facing water resources development projects in many countries around the world. It leads to reduction of the original capacities of reservoirs which affects irrigation, hydropower, flood control, water supply and recreational activities. A limited number of studies have been reported in this field and the available studies generally cover a few parameters governing the trap efficiency of reservoirs. As a result, the present knowledge on reservoir sedimentation is not very well defined. Brune curve (1953) has been widely used to estimate reservoir sedimentation using sediment trap efficiency of reservoirs, but it has several limitations. Out of these, the major limitation being that it considers only the reservoir capacity to inflow ratio for defining sediment trap efficiency. In order to investigate the factors affecting the reservoir sedimentation, a small-scaled laboratory model was set-up. It consists of an overhead tank with a sediment agitator, and a reservoir model with adjustable spillway arrangement. In this study, water inflow to the reservoir, inflow sediment concentration, reservoir capacity and spillway length were varied. The agitated sediments were fed into the reservoir through a valve and allowed to spill over the reservoir for about an hour. Then the trapped sediments were collected and quantified. The experimental results were compared with the available data on reservoir sedimentation and it was found that they are not very much in agreement since many of the existing data are mostly based on a limited number of parameters. A comprehensive analysis of collected data was performed using dimensional analysis to develop an improved relationship to estimate reservoir sedimentation incorporating many parameters governing the problem. Newly developed relationship to predict reservoir sedimentation incorporates the sediment inflow rate, reservoir capacity and spillway length. The proposed relationship clearly shows that the amount of sediment trapped in the reservoir is directly proportional to the sediment inflow rate and reservoir capacity and it is inversely proportional to spillway length which determines the reservoir outflow. However, the applicability of the proposed method is still limited only to the reservoir showing continuous spilling. In addition, only one type of sediment gradation (d_{50}) was used in the experimental runs and thus, the effect of sediment sizes might not be well represented in this method. However, the relationship developed in this study could be further improved by conducting more experimental runs by varying the other parameters which are not considered in the present study.