SYNOPSIS

The study of local scour and sediment transport below a sluice with shallow tailwater depth, has been undertaken. Water issuing out of a sluice forms a two dimensional horizontal jet which first flows along a rigid apron and then along an erodible bed of granular materials. Due to the action of the jet the erosion of bed materials takes place, starting from the end of the rigid apron. The flow characteristics, the scour pattern and the sediment transport at this situation have been investigated.

The experimental data collection programme was undertaken for the detailed measurements of the scour profiles at different instants of time upto the state of equilibrium, the time required to reach the equilibrium stage, the velocity distribution at the equilibrium stage at several locations along the central plane of the jet, the down stream flow depth in the undisturbed zone, the discharge through the sluice and the dynamic pressure drop in a Preston tube at the location of maximum scour at various instants of time during the development of scour hole.

In the study of the flow characteristics, the prime consideration has been given to the diffusion of jet. The diffusion characteristics of the jet have been studied following the procedure adopted by Albertson et.al. From the experimental data, the expressions for the variation of maximum velocity, the growth of boundary layer with distance from sluice, velocity distribution law within the boundary layer, the variation of boundary shear stress with time and the critical shear stress at the location of maximum scour, have been developed. The results have been compared with those obtained by other investigators for different jet flow situations. The expression for shear stress exerted over the bed has been obtained from the solution of Vón Kármán integral equation on the assumption of self preservation. Using the derived velocity distribution law and the dynamic pressure drop recorded by a Preston tube, the expression for the variation of shear stress with time during the development of scour hole has been developed.

Based on experimental data the scour characteristics has been studied through deriving various expressions for the development of scour hole with time, the time variation of maximum scour depth and its location from the end of the rigid apron and of the length of scour hole, the time to reach the equilibrium stage, the maximum scour depth at the equilibrium stage, the volume rate and the weight rate of sediment transport. The results have been compared with those obtained by other investigators for different jet flow situations. A generalised transpport equation correlating the weight rate of sediment transport to the "Fluid Power of the Jet" and the "Transport Stage" has been formulated after Bagnold; the parameter "Transport Stage" being analogous to the "Sediment Number" after Carstens.

The thesis is presented in six chapters. An introduction about the scour due to jet and related problems is given in Chapter-I, whereas a brief review of past works relevant to the present study has been presented in Chapter - II. Theoretical considerations behind the development of various empirical relationships from experimental data have been discussed in chapter - III . Chapter - IV describes in details the experimental set-up and test procedure. Analysis and discussion of test results have been presented in chapter - V . Lastly, the present study has been summarised in chapter - VI, alongwith suitable conclusions.

In the present investigation, special effort has been given to study the effects of the length of rigid apron, the tailwater depth and the grain size of erodible bed material, on the flow characteristics and local scour below sluice. The outcome of the present investigation will be useful in the design and maintenance of sluices on erodible bed.