INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The scour around bridge piers is a contributor to the waterway bridges failure. Prediction of scour depth is one of the most significant problems in designing of bridges. The present research work experimentally investigates the flow field and its consequences on scour geometry around bridge piers. The experiments were carried out in a straight flume with the bed made up of non-uniform sands. Two different diameters of piers and two different types of sands used for experimentation. Experimentation has been done for single pier and tandem piers. An important feature of sand bed channels, downward seepage, was considered in the present work. The present work focuses on the effect of downward seepage on flow statistics and bed morphology around piers. Two different seepage percentages, 10% and 15%, were considered for exploring the change in flow characteristics with respect to no seepage case. From the measurements of turbulent characteristics such as time-averaged streamwise velocity, Reynolds stresses; a strong reversal flow near the bed at upstream of piers and near the free surface at downstream of piers have been observed. The turbulent characteristics are found to be increased near the edge of the scour hole. The flow field around tandem piers is more complex than single pier as the rear pier hinders the wake region behind the front pier. With downward seepage, the reversal flow at upstream and downstream of piers due to flow separation is decreased. The decreased magnitude of turbulent statistics at upstream of pier on the application of seepage shows the hindered erosive capacity of flowing stream. In case of tandem piers, the scour depth at front pier is greater than the scour depth at rear pier due to sheltering effect of front pier. The scour depth at both single and tandem piers is reducing with increasing seepage percentages. The rate of development of scour depth is more in case of no seepage runs than with seepage runs. The scoured material is deposited behind piers, forming a dune like structures. Empirical relationships have been developed for estimation of scour depth and dune morphology around single piers in the presence of downward seepage. The celerity of migrating scour depth is decreasing with time as well as decreasing with increasing downward seepage. The decreasing celerity of migrating dune like structure with respect to time and downward seepage shows the faster movement of smaller bedforms relative to larger one at downstream of tandem piers.