ABSTRACT

A laboratory investigation was undertaken to determine the limiting model Reynolds number above which the scour behavior of rock protected structures can be reproduced in hydraulic models scaled according to the Froude criterion. A submerged jet was passed over an initially full scour pocket containing uniform glass spheres and the rate of scour was measured as a function of time. The dimensions of the scour pocket and jet and the particle diameters were varied as needed to maintain strict geometric similarity. For each of two different Froude numbers the Reynolds number was varied over a wide range. The normalized scour rate was found to be practically independent of the Reynolds number, $\bar{R}$, (based on the jet velocity and particle diameter) at values of $\bar{R}$ above about 2.5×10^3, and to decrease with $\bar{R}$ at smaller values. A grid placed in the jet was found to have a very strong effect on the scour rate. In an attempt to explain the effect of $\bar{R}$ on the scour behavior, turbulent pressure and velocity fluctuations were measured in air flows and water flows, respectively, over rigid scour pockets having the same geometry as those formed in the scour experiments. The normalized spectra of the fluctuations were found to be nearly independent of $\bar{R}$, but the flow pattern was found to be very sensitive to the inlet condition, the jet deflecting upward or downward in a not wholly explainable manner. This indicates that scour behavior can be modelled only if the approach flow is also accurately modelled.