ABSTRACT

Local scouring is considered one of the major causes of bridge damage or collapse in river crossings. Bridge collapse can cause severe damage and can result in serious injury or death. As such, more attention shall be given to the scour design of new bridges and to the inspection, maintenance and management of existing bridge structures.

The aim of this study is to utilize accurate numerical simulations for predicting local scour around bridge piers. More specifically, the objectives are to check the validity of using numerical model in predicting the local scour around a bridge pier; and to study the effect of pile groups, while changing the pile numbers and spacing in both longitudinal and transversal directions.

The first objective of this study has been achieved using SSIIM numerical model, where the geometry and the boundary conditions are compatible with the experimental work by Sharafaddin, (2003). The validation process have been conducted using 50 mm, 100 mm, and 150 mm rectangular piles at low Froude number of 0.21.

The second objective of the current study was done by replacing the single piles in the validated model with different arrangements of pile groups. Eight piles groups were checked. Eighty eight runs have been performed. Four runs for (2x1) piles group with four different transverse spacing ratios (ST/b=1, 2, 3, and 4). Four runs for (3x1) piles group with the same transverse spacing ratios. Four runs for (1x2) piles group with four different longitudinal spacing ratios (SL/b=1, 2, 3, and 4). Four runs for (1x3) piles group with the same longitudinal spacing ratios. Sixty four runs for (2x2), (2x3), (3x2) and (3x3) piles groups with four different longitudinal and transverse spacing ratios (S/b=1, 2, 3, and 4). In addition to eight runs have been performed for the equivalent pile which representing each group.

The results of this study indicated that for low Froude number, SSIIM numerical model can be used in predicting local scour around bridge piers, and the scour depth

decreases as the spacing between pile increases, and reaches the scour depth of a single pile at spacing ratio ranging from 7.7 to 10.3, which is in an excellent agreement with previously determined by Salim & Jones (1996).

Moreover, for specific pile group it is better to increase the total number of piles without compromising the structural requirements. It is also better to arrange these piles in rows in line with flow as it leads to smaller scour depths.