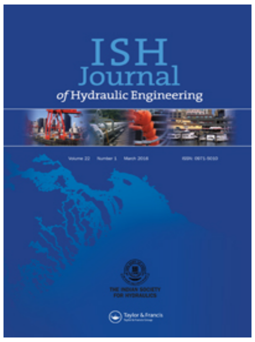

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Discussion of "Scour hole characteristics of two unequal sized bridge piers in tandem arrangement" by Mubeen Beg and Salman Beg (2015)

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This paper is about the discussion of "Scour hole characteristics of two unequal sized bridge piers in tandem arrangement"; Mubeen Beg & Salman Beg (ISH Journal of Hydraulic Engineering, 19th Jan 2015, vol. 21, no. 1, pp. 85–96).

Estimation of scour in bridge piers is required for proper foundation design. Any underestimation will result in failure of the bridge, whereas overestimation will lead to prohibitive cost. IRC method (IRC:SP:13-2004; IRC:5-1998; IRC:78-2000) of computing pier scour in India is based on Lacey's theory (1930). Limitations of IRC method of scour computations have been outlined by Mazumder and Kumar (2006) and Mazumder and Dhiman (2014), who had worked out scour depths by different mathematical models to show that IRC method overestimates scour both in both fine and coarse soils. Recently, a subgroup on scour appointed by IRC (discussor is one of the members) has recommended that for fine alluvial soil of $d_{50} < 2$ mm and $\sigma_g < 1.3$, IRC method may be used; but for $d_{50} > 2$ mm and $\sigma_g > 1.3$, local scour should be computed by improved mathematical models by Richardson and Davis (1995), Breussers and Raudkivi (1991), Melville and Coleman (2000), Kothyari et al. (1992).

This paper is definitely an excellent addition to the ongoing research on bridge pier scour. There is very little information on the mutual interference on pier scour when piers are placed in tandem as in the present study. In India, a lot of roads are being widened from two to multiple lanes which requires construction of new bridge by the side of old ones, needing new piers by the side of old ones. Obviously, this paper will help in decision-making with regard to scour around the piers – both the old and the new. Discussor would, however, like to get certain clarifications from the authors as pointed out in the following paragraph.

(1) In Table 3, authors have not mentioned maximum observed scour depths for the 66 mm pier.
(2) d_s/ds_i-values given in Figure 2 for 66 mm pier are found to vary from 1.67 (at $X = 0$) to a maximum of 1.86 (at $X = 10$) times the scour depths of 33 mm pier. The scour values d_s for 66 mm pier should have been compared with ds_i-values for 66 mm pier in order to find interference effect. Since maximum scour depth is proportional to pier dia, d_s/ds_i scour for the 66 mm pier compared to 33 mm pier should have been 2 instead of 1.86. Perhaps the measured scour depth was not under equilibrium stage.
(3) In Figures 3(a), 3(b) and 3(c), maximum scour depths are not indicated either for 33 or 66 mm pier.
(4) At $X/b = 90$, when there is no mutual interference, the maximum scour depths observed are 12.45 and 6.95 cm for 66 and 33 mm piers, respectively. These correspond to values of $d_s/B = 1.88$ and $d_s/b = 2.10$, respectively. However, the maximum local scour depth in uniform sand ($\sigma_g < 1.3$) at threshold condition as found by most of the research workers is about 2.4 times the pier width. Thus, it appears that the scour depths measured by the authors are under transient state.
(5) The time required to attain equilibrium condition (t_e in days) of scour in the present case is given by the following equation (Melville and Coleman 2000):

$$t_e = 30.89\ D/V[V/V_c - 0.4]x[Y/D]^{0.25}$$

where, t_e is number of days, D is the dia of circular pier, V is mean velocity of flow, V_c is critical velocity and Y is flow depth. For the larger pier with $D = 66$ mm, $V = 0.391$ m/s, $V_c = 0.4127$ m/s and $Y = 140$ mm, t_e-value is found to be 3.423 days i.e.82 h, whereas the duration for the run was 10 h only.

(6) Since the river bed at design flood is mostly under live bed conditions, authors may extend further study on mutual interference under live bed conditions.

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