VI CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The work described and the results obtained from the study lead to the following conclusions:

1. Maximum Depth of Scour

The maximum depth of scour with an angle of attack basically can be expressed in term of pier Froude number as well as pier Reynolds number. An expression of the maximum depth of scour as a function of pier Froude number has been derived

$$\frac{d_{sm}}{L} = 2.0\ F_L^{0.394} \qquad \ldots(5.2)$$

and in term of pier Reynolds number as

$$d_{sm} = 0.00127\ Re^{0.876} \qquad \ldots(5.3)$$

The best formula for predicting the maximum depth of scour is expressed in term of flow parameter as follows

$$\frac{d_{sm}}{h} = 2.735\left\{ F_h^2 \left(\frac{L}{h} \right)^3 \right\}^{0.285} \qquad \ldots(5.6)$$

2. Influence of Angle of Attack

a. A skewed pier will give a larger scour depth rather than an unskewed pier. The maximum depth of scour fastly increases on the angle of attack up to 60 degrees. The analysis of the data show that sinusoidal line is a good fit of the coefficient of pier skewness ($K\alpha_L$) as a function of angle of attack.

b. Coefficient of pier skewness ($K_{\alpha L}$) which is defined as the ratio of the maximum depth of scour of a skewed pier to that of unskewed pier is better expressed as the ratio of pier Reynolds number rather than a ratio of pier width, due to the rarely situation of exactly equal flow condition. Thus,

$$K_{\alpha L} = \frac{d_{sm}}{d_{smo}} = \frac{Re}{Reo} \qquad \ldots(5.8)$$

c. The results of present study show a slightly lower value than the theoretical results from Shen et al (1966) for a round-nosed pier

$$K_{\alpha L} = \frac{\ell - b}{b} \sin\alpha + 1 \qquad \ldots(2.11)$$

Thus, this formula can be used as the upper limit on the design purposes.

d. A general relation of coefficient of pier skewness as a function of angle of attack for various value length/width ratio has been formulated as

$$\frac{K_{\alpha L} - 1}{\ell/b - 1} = 0.013 + 0.915 \sin\alpha \qquad \ldots(5.9)$$

Since the coefficients of pier skewness follow a sinusoidal function the value of $K_{\alpha L}$ for α greater than 60 degrees practically only show a small increase at about 13 % .

6.2 Recommendations

a. The flow is usually disturbed by the upstream pier at the simultaneous test of more than one pier. Therefore, a simultaneous test should be avoided to reach a good results.

b. Projected width of the pier should be strictly limited at 10 % of the flume width, hence it can be assumed as a wide flume.

c. This experiment is limited at the sub-critical flow condition and equal pier width. To extrapolate the results for design purposes it is suggested to do the same experiment with a higher flow Froude number and another variation in pier width.

d. The significance and interaction of Froude number and Reynolds number and their influences to the mechanism of local scour are still not clear yet. To clarify this problem an extensive experiments using a circular pier with a systematical variations in pier diameter, sand size, flow depth and flow velocity are needed.

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