RELIABILITY ANALYSIS OF STRUCTURE FOUNDATION SCOUR DEPTH

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There are a lot of factors of uncertainty in predicting scour at structures in river, including model, parameter, and data uncertainties. Because the variables that effect structures scour, such as the flow velocity and depth, are stochastic, the scour depth must also be stochastic. The equations of calculation scour are deterministic; they do not account for uncertainties in the models, the model parameters, or the hydraulic and hydrologic variables. Therefore, a probabilistic approach to estimating structures scour is appropriate. Johnson and Ayyub (1992) developed a method of determining the probability of failure due to scour around a bridge pier based on a time-dependent scour model. The analysis involved simulating pier scour for a period of time and determining the probability that the bridge will fail at various points in time during that period. Johnson (1992) developed a relationship between the probability of failure due to pier scour and safety factors. Johnson and Dock (1998) developed a probabilistic framework for estimating scour using deterministic methods given in the Hydraulic Engineering Circular (HEC-18).

In this paper the uncertainty and variability of the design parameters and the variation of the scour depth are considered. Based on the present formulas and used reliability theory, the mathematical model of analysis the probability of abutment foundation depth was established. The method of solving the equation through Monte Carlo method was introduced. By the method of the paper, the reliability of structure foundation depth can be quantitative calculated, and the effect of hydraulic conditions to foundation failure also can be discussed.

Keep other quantity invariability, let velocity of flow, depth of water, etc. take place a certain increment separately, therefore cause the change of reliability of foundation depth,

which reflect its sensitive degree to the factors change (Fig. 1). Keep other quantity invariability, let every factor take place a certain increment in variance separately, caused the change of reliability by this part, which reflected its sensitive degree to every factor variance (Fig. 2). It help to further understand the every change of factor how to influent the scour depth. Through analyzing the variety of designed depth impact on failure probability, can make the designing value more economic and more reliable; contribute to constructing and allowing the deviation clearly. From the result of calculation, it can be verified the advantage and feasibility of this method.

Scour equations currently being used do not account for the risk of failure. The engineer can use this method to evaluate various design alternatives as a function of parameters such as the size, shape, and depth of the structure. Having a better understanding of the effects of the various parameters on scour should enable the engineer to design safer structure. This method provides valuable supplemental information for decision-making.

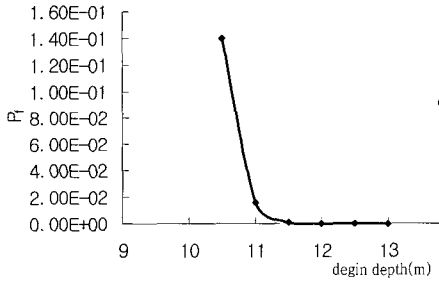

Fig.1 Effect of desin depth on probability of failture

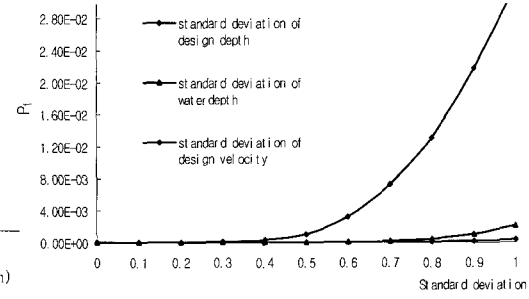

Fig.2 Effect of standard deviation on probability of failture

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