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EXPERIMENTAL STUDY OF THE EFFECT OF SKEWNESS ANGLE OF BRIDGE PIER ON BACKWATER CURVE

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Abstract

The construction of bridge in any water course required to install the pier in the flow path. So, the study of backwater around bridge piers is very important for safe design of piers and other hydraulic structures. Sometimes we need to install the bridge pier at certain angle with flow direction in order to change the flow direction or change the flow characteristics. So, in this study the effect of skewness angle on backwater curve has been studied by using laboratory flume having 12 m length and 0.5 m for each height and width by using semicircle pier. Different five discharge range from 0.0075 m^3/s to 0.035 m^3/s with four diffrent skewness angle (0^0,15^0, 45^0, 60^0). The results of this study show that the degree of skewness angle and the value of discharge have a direct effect on backwater rise. Also, this study show that when used (0^0,15^0, 45^0, 60^0) skewness angle the percentage increase in backwater was approximately (43,46,117,141) % respectively compare with normal depth in case of maximum flow 0.035 m^3/s. Also, in this paper the using of Artificial Neural network (ANN) with one hidden layer , two input layer and used log sigmoid as a transfer function to forecast the backwater rise give agreement result with correlation coefficient R equal to 0.98 and Mean Square Error (MSE) equal to $9*10^{-4}$.

Key words: Skewness angle, Backwater, bridge pier, ANN, Froude number

1. Introduction

The construction of bridges over watercourses is very necessary to provide communication links between population areas **[1]**. Therefore it is important to study any cause may negatively impact on the bridge stability. Backwater represent a real problem caused by pier which is obstruct the flow because of it is location in the waterway and lead to increase the water level upstream bridge**[2]**. Also, in 1987, floods have been occurred in New England and New York were destroyed and damaged about 17 bridges **[3]**. Also, In a study of the cause of failure of 143 bridges worldwide, it was found that 70 failed due to flood events **[4]**. Therefore, the backwater upstream bridges considered the most important problem effect on the hydraulic structure **[5]**. Generally, a crossing bridge represents an change of the natural geometry of the river section, so creating an obstacle for the river flow that, as it approaches the bridge, has to vary its own natural pattern. In subcritical situations, which are typical in alluvial rivers, this flow change results in the so-called backwater effect as shown in Figure 1, an increase of the water surface level upstream of