

The study of the effect of parallel wall on hydraulic performance of bridge abutment

Abstract

Failure of the bridges is mainly due to scour of their abutments. Therefore, prediction of the scour and methods to reduce it is an important problem. The aim of this study is to investigate the effect of the hydraulic performance of the parallel wall permeability in bridge abutments. The tests performed in a flume with 10 m length and a width of 30 cm. In all experiments, a vertical wall with a length of 8 cm was used. The length of the parallel walls selected as a proportion of abutment length, i.e., (2, 1.5, 1.25, 1, 0.75, 0.5), equivalent to 16, 12, 10, eight, six, four cm. Two submergence ratio, i.e., 25 and 50 percent and three permeability ratio, i.e., 25 and 50 percent were used for parallel walls. A control experiment was conducted without the presence of parallel walls. Uniform diameter sediments with average diameter of about one millimeter with clear water and the threshold flow rate for incipient motion of sediments ($U/U_c = 0.95$) were applied. Upstream parallel walls were installed parallel to the walls of the flume to the upstream. Test for the scour hole continued until equilibrium was reached. So, the duration of each experiment was four hours. After each test, the flume water was drained slowly and a dimensionless scour depth and the topography formed in the bed measured by laser meter with an accuracy of $1 \pm \text{mm}$. The results show that parallel walls can considerably change the flow pattern around the abutment, and drive the maximum depth of scour away from upstream side of abutment and transit it to the parallel wall. By increasing the proportion of the length of the parallel wall relative to the abutment, decreases the depth of scouring near parallel wall. According to the results, using the parallel wall with a length of 1.25 times the length of the bridge abutment, with 50% permeability and submergence ratio of 25% decrease the dimensionless scour depth in the upstream and near parallel wall equal to 45 and 67 percent, respectively, compare to the control experiment.

Keywords: Scour, bridge abutment, submergence ratio, parallel wall, flow pattern, permeability.



**University of Zabol
Graduate School
Water Engineering Department of
Faculty of soil and water**

**The Thesis Submitted for The Degree of M .Sc
(in The field of Animal Science)**

**The study of the effect of parallel wall on
hydraulic performance of bridge abutment**

Supervisors
**Dr. Pervez Haghghatjoo
Dr. Yusuf Ramadan**

By
Hadi Tnhazadeh

September 2017