Results of Experiments on Full Collars: Two full collar groups (with B_{dc}/L_a of 0.25 and 0.5) were investigated in this study. The results are shown in Figure (4).

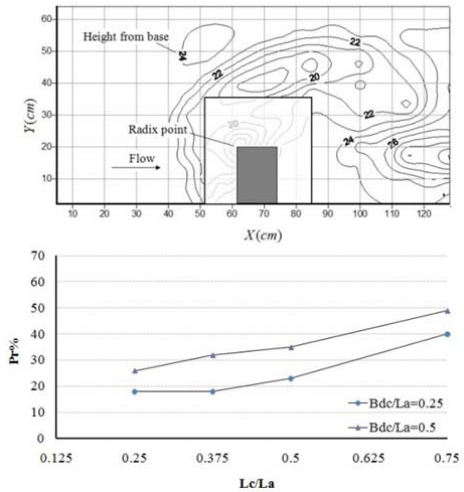

Fig. 4 Performance of full collars and erosion and sedimentation patterns around full collars ($B_{dc}/L_a = 0.5$ and $L_c/L_a = 0.75$).

4- Conclusions

The results indicated that increasing collar dimensions improves its performance for both collar types. During collar installation, sediments around the abutments are distributed uniformly. The results also suggested that protecting the bed using collars with a length of half the abutment length has no significant effect on reducing scour depth around the abutment and the collar's performance is somewhere below 30 percent. Increasing the collars length from 0.5 to more than 0.75, which is equal to 25 percent of the abutment length, causes a two-fold increase in collar's performance. Investigation of larger collars showed that full collars have lower performance compared to L-shaped collars and thus, using L-shaped collars for controlling bridge abutment scour is more efficient considering that they take up less area.

Laboratory Investigation of the Performance of L-shaped Collars on Reduction of Local scour Around Bridge Abutment

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Yousef Ramezani[3]

1-Introduction

It is a well-known fact that bridges play an important role in connecting routes. Every year, a large number of bridges are demolished or damaged due to scour at bridge piers. These damages are not only accompanied by high financial costs but in case of floods, they may even result in fatalities and various social issues. Protecting bridge piers from scour can be very helpful in preventing their destruction. Therefore, doing research and studying this issue is of great significance. The present study aims to investigate the performance of applying L-shaped collars on reducing bridge abutment scour in comparison with using full or complete collars.

2- Experimental Setup

Experiments were performed on a 9 meter long flume with a width and height of 1 meter and 0.6 meters, respectively. The flume had a constant slope of 0.0003 and was experimented on at Shahid Chamran University's Hydraulics Laboratory.

Figure (1) shows a simple schematic view of the experimental model.

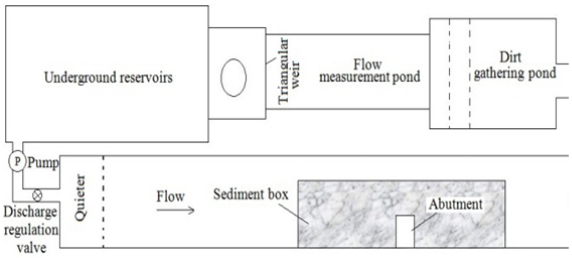

Fig.1 Laboratory model

Fig. (2) depicts a simple schematic view of the collars used in this study.

Using Buckingham's theorem and applying dimensional analysis results in equation (1):

$$\Pr = f(L_c / L_a, B_{uc} / L_a, B_{dc} / L_a, Z_c / y, Fr, L_a / B, L_a / B_a, d_s / y, G_S \text{ Re},, \alpha, \phi_1, \phi_2) \quad (1)$$

in which:

Pr is the reduction percentage of scour depth.

$$\Pr = \frac{(y_S - y_{sc})}{y_s} \times 100 \quad (2)$$

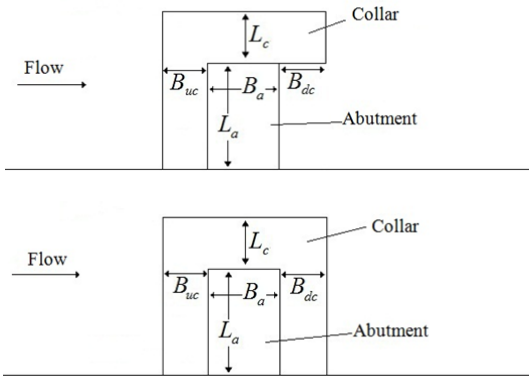

Fig.2 Simple schematic of collars from top a) L-shaped collars; b) full collars

Amongst dimensionless parameters in equation (1), the following were considered as constants:

B_{uc} / L_a, Z_c / y, Fr, L_a / B, L_a / B_a, d_S / y, G_S, α, ϕ_1 and ϕ_2.

Table (1) lists all the dimensionless parameters used in this study along with their respective values:

Table 1. Dimensionless parameters and assessed values

Dimensionless parameter	assessed value
L_c / L_a	0.25, 0.375, 0.5, 0.75
B_{uc} / L_a	0.5
B_{dc} / L_a	0, 0.25, 0.5

3-Results

Results of Experiments on L-Shaped Collar: 12 L-shaped collars, with specifications listed in Table (1) were used in this study. These collars were categorized into three groups according to their B_{dc} / L_a parameter. The results of experiments on these L-shaped collars are shown in Figure (3).

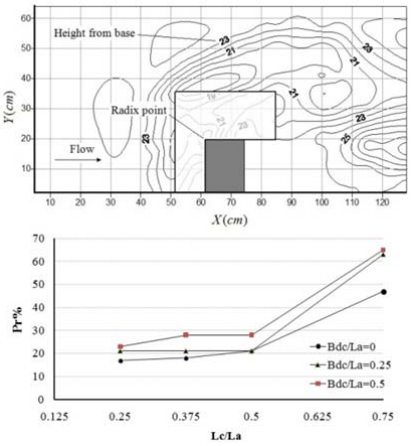

Fig. 3 Performance of L-shaped collars and erosion and sedimentation pattern of L-shaped collars ($B_{dc} / L_a = 0.5$ and $L_c / L_a = 0.75$).

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