

# Abstract

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## **Effect of Upstream Cutoff Position on both Uplift and Efficiency underneath Hydraulic Structures**

Two main problems face the stability of hydraulic structures, piping and uplift. Cutoffs are used to increase the horizontal length of seepage under the apron of the hydraulic structures to overcome the effect of both piping and uplift under these aprons. The position of each cutoff is critical for decreasing the effect of both. In this study, an electrical analogue model was used to investigate the effect of the position of the upstream cutoff  $L_1$ ; the distance of the downstream cutoff  $L_t$  both measured from the upstream edge of the apron; the depth of the upstream and downstream cutoff  $D_1$  and  $D_2$  respectively on the uplift forces along the hydraulic structure; the rear and front faces head of both upstream and downstream cutoff. Each of the previous parameters were measured, unit head were calculated and compared for all of the cases under study, the lowest values for piping and uplift were determined; the highest effect of downstream and upstream cutoff were determined for the cases under study. The ratio between the distances of the upstream cutoff  $L_1$  the total length of the apron  $L_t$  ( $L_1/L_t$ ) ranged from 0 to 1. The ratio between depths of the upstream cutoff  $D_1$  and the downstream cutoff  $D_2$  ( $D_1/D_2$ ) ranged from 0.75 to 1.25. 16 models were tested with total number of 64 runs.