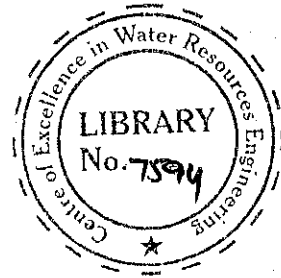
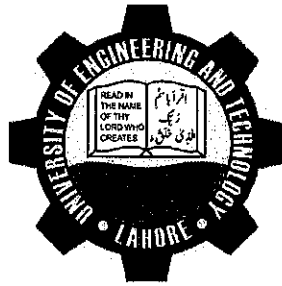


STUDY OF HYDRAULIC CHARACTERISTICS OF ROOSTER TAIL BEHIND SPILLWAY PIER



by

Hafiz Kamran Jalil Abbasi
2017(F)-MS-WRE-11

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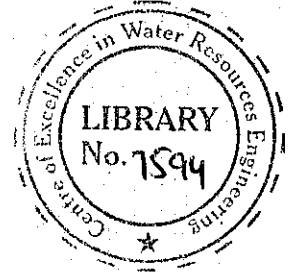
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Centre Excellence in Water Resources Engineering
University of Engineering and Technology, Lahore

**STUDY OF HYDRAULIC CHARACTERISTICS OF ROOSTER TAIL
BEHIND SPILLWAY PIER**

Submitted By

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(2017(F)-MS-WRE-11)



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in

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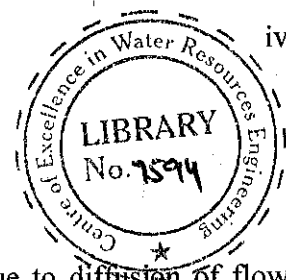
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ABSTRACT



Rooster tail is generated behind the spillway piers due to diffusion of flow downstream of the pier. They usually occur when fluid boundaries suddenly change downstream of spillway pier. An extreme rooster tail can overtop the spillway side wall and also it can induce vibration in spillway structure. As a result, the operation during flood discharge could be affected and pose a danger to the spillway structure.

There is a lack of studies on rooster tails for spillways with flat slope chutes (5° to 10°). Consequently, it is necessary to study the formation and characteristics of rooster tails on flat slope spillway chutes. For this purpose, spillway model of Mohmand dam was constructed in Model Tray Hall of CEWRE.

The objectives of the present research include, the study of hydraulic characteristics of rooster tail on flat spillway chute and development of an empirical relation for the estimation of rooster tail height.

Physical model of the spillway of Mohmand Dam Hydropower Project consisting of only two bays was designed by Froude number similarity criteria between model and prototype structure and constructed in Model Tray Hall of Center of Excellence in Water Resources Engineering.

In the design of the model, geometric similitudes were observed between the model and the prototype by means of a geometrical scale ratio of 1:100. The accepted equations of hydraulic similitudes, based on Froudian relations, were used to express the mathematical relationship between the dimensional and hydraulic quantities of the model and those of the prototype.

Different experiments were performed to analyze the rooster tail on flat spillway chute and to study the factor affecting the characteristics of the rooster tail. To

investigate the hydraulic characteristics of rooster tail, model was operated for free flow conditions by varying the reservoir levels from 541 m amsl to 558 m amsl (with an increment of 1m). Experiments were performed by varying the spillway chute slopes between 5° to 10° and shape of the pier. Results were plotted b/w observed rooster tail height and the reservoir levels which shows that in geometric alteration M_1 & M_3 the rooster tail height increased with the increase of discharge till the reservoir level 541 amsl but with further increase in discharge the rooster tail height start to decrease. Whereas, in geometric alteration M_2 & M_4 the rooster tail height continuously increased with the increase of discharge. The results indicated that rooster tail is significantly influenced by spillway slope ratio, pier width and type.

Rooster tail height also increased with the increase in dropping angle (δ), when the slope angle of the spillway and the width of the pier remain constant, which means that the rooster tail's height is markedly affected by the dropping angle and also it was observed that all the pressure peaks occur at the bottom near the tail part of the pier due to the generation of rooster tail.

It was concluded that the height of rooster tail can be minimized by installing the semi elliptical pier on tail part of main pier. Further modifications in the geometry of extended tail part of pier is recommended for elimination of the rooster tail.