

Stilling Basin Design for Stepped Chutes: More than one type to consider

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Scientists with the USBR developed stilling basin design criteria for smooth chute spillways. Advances in concrete technology has allowed for the economical design of stepped chutes for maximizing energy dissipation and potentially allowing for a shorter stilling basin footprint as compared to one for a smooth chute. Modifications to the chute surface forces designers to consider the hydraulic performance of stilling basins when highly aerated flow enters the basin. Design parameters for stilling basin include Froude number, clear water flow depth, and secant flow depth. Type I, type II, type III, and type IV stilling basins for stepped chutes are being evaluated at the USDA-ARS Hydraulic Engineering Research Unit in Stillwater, OK. The evaluation includes the collection of pressures within the basin, water surface elevations, photography, and videography. Findings indicate Froude numbers based on the entering clear water flow depth for stilling basins designed for stepped chutes can range from $3.3 \leq F \leq 5.5$. Hydraulic jumps created in the stilling basin when transitioning from stepped chutes are visually observed to oscillate unless dampened and or controlled by energy dissipation blocks, end sill, or dentated sill. This research is intended to provide practicing engineers guidance on designing stilling basins for stepped chutes.