

## EXPERIMENTAL STUDY OF TURBULENCE MANIPULATION IN STEPPED SPILLWAYS. IMPLICATIONS ON FLOW RESISTANCE IN SKIMMING FLOWS

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Abstract : Current expertise in air-water turbulent flows on stepped chutes is limited to laboratory experiments at low to moderate Reynolds numbers on flat horizontal steps. In this study, highly turbulent air-water flows skimming down a large-size stepped chute were systematically investigated with a  $22^\circ$  slope (Fig. 1). Turbulence manipulation was conducted using vanes or longitudinal ribs to enhance interactions between skimming flows and cavity recirculating regions (Fig. 2). Systematic experiments were performed with seven configurations. The results demonstrated the strong influence of vanes on the air-water flow. An increase in flow resistance was observed consistently with maximum flow resistance achieved with vanes placed in a zigzag pattern.

Keywords: stepped spillway, flow resistance, turbulence, turbulence manipulation, air entrainment, physical modelling.

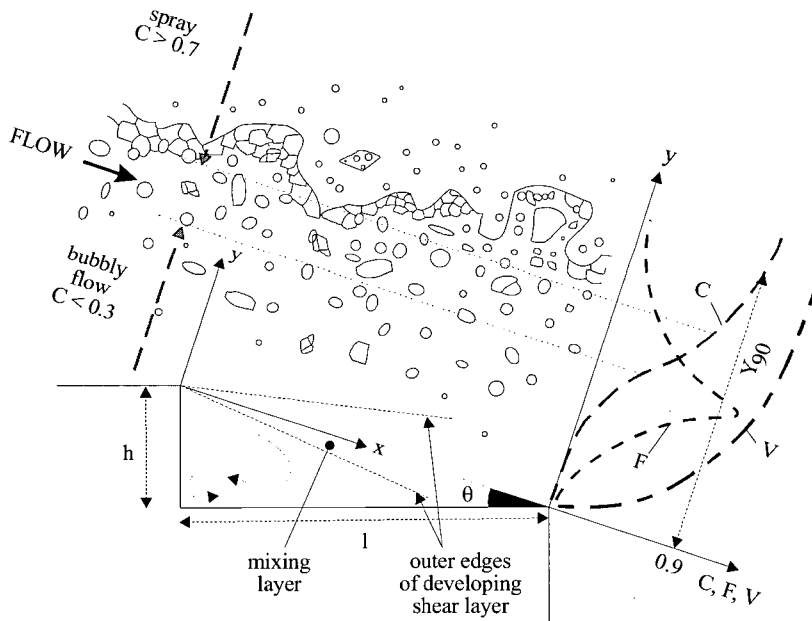


Fig. 1 Sketch of skimming flows down a moderate-slope stepped spillway

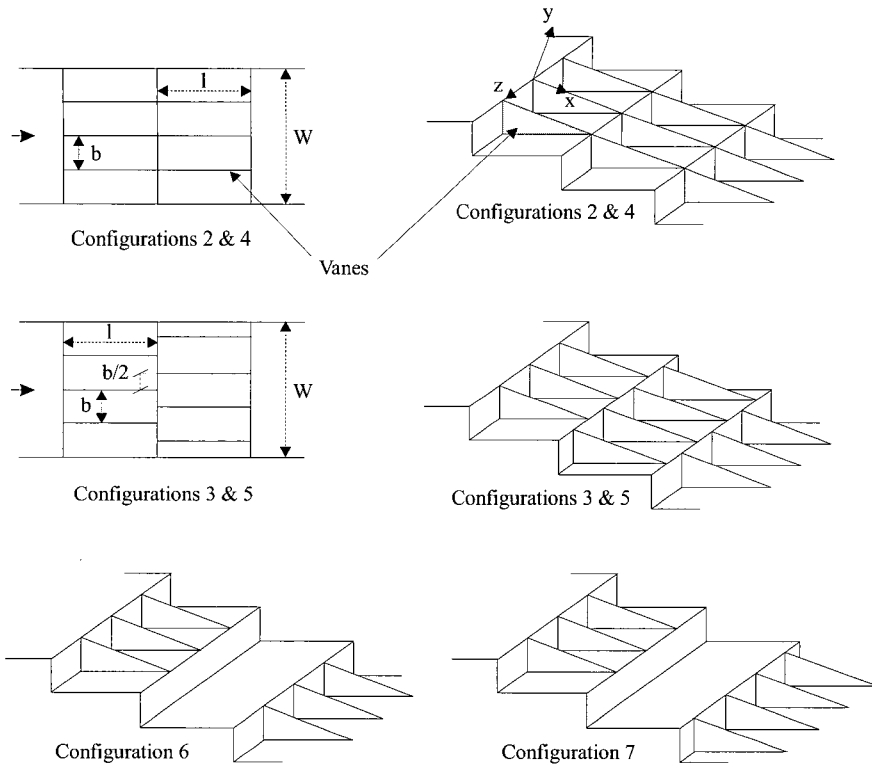


Fig. 2 Sketch of the vanes configurations