

ICOLD2026 Guadalajara, Mexico, International Symposium
Theme | Water, Energy, and Society: The Evolving Role of Dams in a Changing World
ABSTRACT TEMPLATE

PAPER TITLE (Capitalize the first letter of all major words)

An Experimental Study on Shape Optimization for the Design of Improved Ski-Jump Energy Dissipator

Relevant Topic: (Highlight Selected Topic in Bold font)

- *Water Planning, Water Management, and Climate Resilience*
- ***Dam Safety Policy and Governance***
- *Dam Construction and Rehabilitation: Innovation and Lifecycle Extension*
- *Dam Performance Monitoring*
- *Flood Resiliency in Developed and Developing Countries*
- *Sedimentation Management and Reservoir Longevity*
- *Fish Passage, Biodiversity & Environmental Integration*
- *Community Engagement in Dam Development*
- *Tailings Dam Safety*
- *Dam Decommissioning & Removal*

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ABSTRACT: Abstract shall be no more than 300 words and cannot include figures, tables, drawings, references, or equations. Abstracts should provide a brief overview of the paper, highlighting relevance to the selected topic, key findings/conclusions, and significance to the industry. Provide Spanish translation of abstract in the provided space to aid in review and selection.

PUBLISHED PAPER

or

PRESENTATION ONLY

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ENGLISH VERSION OF ABSTRACT:

The ski-jump type energy dissipation structure has been widely used as a spillway structure for gravity dams. Compared to the hydraulic jump type, which needs a large energy dissipation basin downstream of the dam, the ski-jump type requires a smaller structure, making it more cost-effective. However, in narrow gorges or valleys, there are concerns about its effects on downstream rivers, power plants, and other structures. At the model site in Laos, for instance, a power plant on the left bank downstream of the dam is at risk from water dispersion and spray. Motivated by this issue, this study proposes an improved chute design to enhance flow control and reduce spray, aiming to make the ski-jump type applicable even at sites with downstream constraints.

This study investigated the hydraulic performance of the ski-jump type energy dissipation structure using a 1/50 scale model of the dam spillway to replicate the design flood discharge. Two improvement proposals for the chute section were tested: the Cross-Fall design, which applies a transverse gradient to the chute bucket, and the deflector design, which thickens one sidewall of the chute. Adjustments were made to parameters such as slope shape and deflector width to observe changes in water flow.

The results showed that while the Cross-Fall design could change the water trajectory, it did not effectively prevent fine water spray. The deflector design improved water flow control as its width increased, but excessive width caused problems such as interference with adjacent chutes and shock waves in the flip bucket. In conclusion, a deflector width of 3 meters was found to be the best solution for the model site. The findings from this study can help improve the design of ski-jump type energy dissipation structures for new dams and address issues in existing dams with similar structures.

SPANISH TRANSLATION OF ABSTRACT:

La estructura de disipación de energía tipo trampolín (ski-jump type energy dissipation structure) se ha utilizado ampliamente como estructura de aliviadero en presas de gravedad. En comparación con el tipo de resalto hidráulico, que requiere una gran cuenca de disipación aguas abajo de la presa, el tipo trampolín necesita una estructura más pequeña, lo que lo hace más rentable. Sin embargo, en gargantas o valles estrechos, existen preocupaciones sobre sus efectos en los ríos aguas abajo, las centrales hidroeléctricas y otras estructuras. En el sitio modelo de Laos, por ejemplo, se determinó que una central hidroeléctrica ubicada en la margen izquierda aguas abajo de la presa está en riesgo debido a la dispersión y el rociado del flujo. Motivado por este problema, el presente estudio propone un diseño mejorado del canal de descarga (chute) para optimizar el control del flujo y reducir el rociado, con el objetivo de hacer aplicable el tipo trampolín incluso en lugares con restricciones aguas abajo.

Este estudio investigó el rendimiento hidráulico de la estructura de disipación de energía tipo trampolín mediante un modelo a escala 1/50 del aliviadero de la presa, reproduciendo el caudal de diseño de la avenida máxima. Se probaron dos propuestas de mejora para la sección del canal: el diseño Cross-Fall, que aplica un gradiente transversal al cubo del canal, y el diseño Deflector, que engrosa una de las paredes laterales para redirigir el flujo. Se ajustaron parámetros como la forma de la pendiente y el ancho del deflector para observar los cambios en el comportamiento del flujo. Los resultados mostraron que, aunque el diseño Cross-Fall pudo modificar la trayectoria del flujo, no fue eficaz para reducir el rociado fino. Por otro lado, el diseño Deflector mejoró el control del flujo al aumentar su ancho, pero un exceso generó interferencias con los canales adyacentes y ondas de choque en el cubo de salida (flip bucket). En conclusión, se determinó que un ancho del deflector de 3 metros es la mejor solución para el sitio modelo. Los hallazgos de este estudio pueden contribuir a mejorar el diseño de las estructuras de disipación de energía tipo trampolín para nuevas presas y a resolver problemas en presas existentes con estructuras similares.

Keyword: spillway structure, ski-jump type energy dissipator, hydraulic model experiments, water dispersion and spray

1-2 sentences on thematic relevance: Recent lessons from incidents and accidents concerning dams during the life cycle, including during construction