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HYDRAULIC PERFORMANCE OF SPILLWAYS - THREE PREDICTIONS USING CFD

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ABSTRACT

The CFD technology has successfully been applied to a number of spillway upgrade projects to investigate how the spillways cope with increased flood levels [1]. In order to provide confidence in the modelling technique, validation against reduced scale model test were performed where possible. Reasonable collocation with discharge, pressure distribution and flow surface were obtained. The fundamentals of verification and validation of computational simulations [2], in particular, CFD simulations have been addressed [3]. The inter-relationship between the real world, mathematical model and computer model has been thoroughly researched and established. It should be realised that even a physical reduced scale hydraulic model is only an approximate representation of the real structure. It suffers from problems associated the scaling effects such as roughness and surface tension.

Recently, two CFD predictions were carried out prior to conducting the physical model. Another CFD model was performed and the general flow behaviour compared with an actual flow event recorded by video at the dam site. The former two cases can be regarded as Class A predictions against which the physical model results were compared. However, these physical models can only be regarded as a sub-set of the real-world representation because an actual flood event occurring at the site will be remote. The latter case may be regarded as a Class B prediction where an actual event was captured on video with some knowledge of the upstream flood level. It should be noted that the CFD model of this spillway was set up to investigate other higher flood levels prior to this real flood event. Due to the absence of measuring devices at the actual spillway site, only visual comparison can be conducted.

The computed results show that not all aspects of the hydraulic behaviour were captured, although the trend and some results were correctly computed. These results and the reasons for the discrepancies will be highlighted in the paper. The benefits and limitations of CFD models, and the need to measure the real-world performance for validation purposes will be discussed.

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