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EFFECT OF FOUNDATION STIFFNESS ON THE PERFORMANCE OF A FINITE ELEMENT MODEL OF THE VICTORIA DAM

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Victoria is a doubly curved concrete arch dam constructed across the river Mahaweli in 1985. Data accumulated since then suggests a slow expansion of the concrete in the dam which is suspected to be due to Alkali Aggregate reaction. As a prelude to investigating this issue, a finite element analysis had been performed previously. Even though results showed the same trends as the observed deflections their values did not match exactly. It had been suggested that one of the possible reasons for this deviation might be modeling the foundation as fixed. The present study investigated the effect of modelling the foundation rock also as deformable.

Borehole data of Victoria site investigation showed the foundation rock type as mainly biotite gneiss. A range of material properties corresponding to this rock type were used in the calculations. Concrete in the dam was assumed to be perfectly bonded to the foundation rock at their interface. The finite element model of half of the dam that had been used in the previous study was modified by the addition of 3-d solid elements to model the foundation rock. Analysis was done for different values of the ratio of foundation stiffness to concrete stiffness. The deflection results were compared with measured values.

Two loading cases were used in this study: hydrostatic load only and (self weight + hydrostatic loading). The former case was also included because it might be more appropriate to compare the observed displacements with finite element estimates for the dam under hydrostatic loading only as the deflection measurements have been performed only after completion of construction of the dam.

The results indicated that the stiffness of the foundation substantially influenced the finite element results. Stiffer foundations seemed to achieve better agreement with measured data. In fact under hydrostatic loading, finite element results for the fixed foundation model were closest to the measurements. This demonstrated that modeling the foundation rock and selecting appropriate values for the foundation stiffness are important for improving the performance of a finite element model of the Victoria Dam.

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