Retrospective Analysis of Victoria Dam

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Built across the river Mahaweli at Theldeniya during 1980-84, Victoria is a doubly-curved arch dam of 122 m height that impounds a reservoir of 722 million cubic meters capacity. It is the largest concrete dam in Sri Lanka. Equipped with three 70 MW generators for a total installed capacity of 210 MW, Victoria provides about 780 GWh of energy annually to the national grid. From the energy point of view alone, Victoria dam assumes great importance to the country's economy.

During construction the dam was provided with extensive instrumentation to continuously monitor its behaviour. Among these instruments are, normal and inverted pendula, crest leveling studs, and survey targets on the downstream face. Over the past 27 years, they have yielded a great volume of data regarding the deformations of the dam, among other things. Such data can be used in two ways. First is that they can be compared with the expected behaviour to verify compliance with design assumptions, and in the case of any deviations, to understand the reasons for such deviations. Second is that they can be used to develop models to predict the future behaviour of the dam which will assist engineers in making operation, maintenance, and repair decisions. In fact these can be two phases of a single process. The present study attempts the first task: comparing observed deformations with those expected. A linear elastic, 3-d finite element analysis was performed to estimate the expected deformations. In view of the approximate symmetry, only one half of the dam was modeled. Even though there are some galleries inside the dam (the cross sectional area of which is about 2.35 % of that of the dam) and a set of openings for spillway gates near the top of the dam, they have been neglected in the model. Fixed boundary conditions are employed at the base and the abutments of the dam.

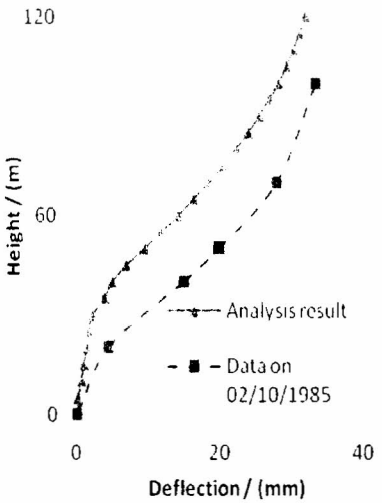

Fig. 1

Comparison of deflections on the dam cross section at the centre line (Fig.1) shows reasonable agreement with respect to the deflection pattern between the finite element analysis and data obtained by means of the pendula soon after impounding. This indicates the validity of the adopted approach. However, it is noted that the finite elements consistently underestimate the observed values. This may be due to (a) possible variations in the Young's modulus (b) non-inclusion of the dam galleries and the spillway gate openings in the finite element model, and (c) the assumption of fixed boundary conditions. It is believed that the rectification of these shortcomings could improve the co-relation between finite element estimates and actual observations.

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