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## Earthquake effect on a Weir

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The recent tsunami disaster has brought into focus the need for consideration of disasters caused by such infrequent events. Even though earthquakes have hit Sri Lanka more often than tsunami, fortunately the earthquakes struck during the recent past were not of intensities sufficient to cause destruction of significant scale. Nevertheless, earthquakes of greater intensity may strike the country, and in such an event the adverse effects may not be confined to the coastal regions but spread throughout in the country. It is recognized that damages caused by an earthquake on structures essential for public life particularly during the post-disaster period are of serious concern.

The aim of this study is to investigate the response of a weir to earthquake loading. A fictitious structure of typical configuration applied for diversion of streams for irrigation or hydropower generation purposes was used in this study.

A two dimensional (plane strain) stress analysis was carried out on the weir cross-section using SAP2000 finite element code. Four-node quadrilateral isoparametric elements were used for the analysis. The bottom boundary was considered as a rigid base and it was fixed against both vertical and horizontal displacements. This approximation was considered to be reasonable enough since the bedrock can be considered to be rigid compared to the weir. The weir is constructed using Grade 25 concrete.

Analyses were done for ultimate limit state condition and the results are compared and discussed in this study. The combination of loads on the weir due to hydrostatic pressure at the upstream and downstream, the self weight of the weir and the load due to water in the stilling basin, was mainly considered in the analysis. In addition to the above load cases, moderate earthquake effect was

considered ranging from10 to 50 percent of ground acceleration along the flow direction and through the weir as well.

Based on the analysis results of ultimate limit state load case, it was observed that the highest tensile stresses are developed at the upstream toe whilst compressive stresses are found in other areas. With the earthquake load increased along the flow direction, it was observed that the tensile stresses in upstream toe further increased while the other areas were still under compression. Nevertheless, no considerable effect was seen for the earthquake load increased along the weir. The study portrays the extent of special treatment for moderate earthquake effects.

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