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Seismic Re-evaluation of Cable Bridge Using Modal Pushover Analysis

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Abstract

In case of revision in the expected seismic hazard at site or revision in safety classification of the structure, seismic re-evaluation of the structure needs to be per-formed. Seismic performance expected for revised seismic level needs to be com-pared with post-seismic functionality of the structure. In past, Cable Bridge of Nuclear Power Plant (NPP) was designed for spectrum corresponding to SSE (Safe Shutdown Earthquake) level ground motion developed based on deterministic approach available at that time. Subsequently the spectrum was revised following the probabilistic approach and uniform hazard spectrum has been developed for arriving revised SSE spectra. It was decided to re-evaluate the structure for revised SSE spectra. In the present study, Seismic Re-evaluation of Cable Bridge of a NPP has been performed using Modal Pushover Analysis technique. This paper contains structural description, detailed methodology followed, analysis results and conclusion of the study. Structural behaviour of the Cable Bridge has been checked for SSE condition using modal push over analysis methodology presented by Chopra and Goel. (2002). A three-dimensional mathematical model of Cable Bridge has been developed in SAP2000. In the mathematical model, beams and columns are modelled as frame elements with plastic hinge properties defined as per Federal Emergency Management Agency, FEMA356. Capacity Curves of the structure are obtained by performing pushover analysis for significant modes of vibration in each direction. Capacity curves obtained are compared with demand spectra (corresponding to SSE condition) to obtain performance points. Seismic responses of structure at performance points for different modes of vibration are combined to obtain response of the structure under SSE condition. In order to ensure the safety and functionality of the Cable Bridge, response of the structure under SSE condition is checked with respect to required performance objective as per FEMA356. In the present study, it is concluded that the Cable Bridge is safe under revised SSE level ground motion and desired post-earthquake performance has been demonstrated.

Keywords: Modal push over analysis, Cable bridge, Safe shutdown earthquake, Plastic hinge