عنوان مقاله:

Effect of Soil-Structure Interaction on Seismic Risk of FAN Type Cable Stayed Bridges

محل انتشار:

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خلاصه مقاله:

Probabilistic Risk Analysis (PRA) of fan type cable stayed bridges is presented to determine their probabilities of failure under random ground motion. Seismic input to the bridge support is considered to be a risk consistent response spectrum. The bridge deck is modeled as a beam supported on springs at different points. The coupled stiffness matrix of the springs is determined by a separate ۲D static analysis of cable-tower-deck system in which flexibility of the tower base due to soil-structure interaction is included. Damping due to soil is incorporated by the equivalent modal energy method. The response of the bridge deck is obtained by the response spectrum method of analysis for multi-degree of freedom system. The PRA includes uncertainties of responses due to the variation in ground motion, material property, modeling and method of analysis, and uncertainties of the capacity due to the variation of ductility factor and damage concentration effect. Failure mode of the bridge is assumed to be bending failure of the bridge deck at the point of maximum bending moment. Probability of failure of the bridge deck is determined by First Order Second Moment theory of reliability analysis. A three span double plane symmetrical fan type cable stayed bridge is used as an illustrative example. The fragility curves for the bridge deck failure are obtained under a number of parametric variations. The parameters include, base flexibility, degree of correlation of ground motion, angle of incidence of earthquake, ratio of the components of ground motion, and seismic input. The study shows that flexible base condition provides significantly less value of probability of failure as compared to the fixed base. Further, angles of incidence, degree of correlation, ratio of components of ground motion and input response spectrums have considerable effects on theprobability of failure.

کلمات کلیدی:

Bridges, Structural Response, Soil–Structure Interaction, Reliability analysis