A response spectrum method for analysis of bridges crossing faults

Proper seismic design of bridges requires accounting for the effect of ground motion spatial variability, which can significantly influence the structural response. For bridges crossing faults, the main source of spatial variability is the mirror-image nature of the slip-parallel components of the ground motion on the two sides of the fault. In this paper, the problem of estimating seismic demands for bridges crossing faults is investigated within the framework of the Multiple Support Response Spectrum (MSRS) method, originally developed by Der Kiureghian and &euenhofer (1992). The MSRS combination rule estimates the peak structural response in terms of the response spectra of the support motions and a coherency function that characterizes the spatial variability of the ground motion random field. A coherency function is developed to describe the variability in the support motions for a bridge crossing a strike-slip fault, under the assumptions of stationarity and zero residual slip. The stationarity and broad-bandedness of the seismic input are basic assumptions inherent in the MSRS method. These assumptions are not realistic for ground motions in the near-fault regions and, thus, the applicability of the MSRS method in such regions may be questioned. However, comparisons with time-history analyses in an example application demonstrate the ability of the MSRS rule in conjunction with the proposed coherency function to provide good estimates of the peak structural response for narrowband and strongly nonstationary seismic input.

Keyword: Bridges, Near-fault, MSRS rule, Spatial variability

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