COMMENTS ON EARTHQUAKE RESPONSE SPECTRA

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SUMMARY

The current earthquake response spectra used in the design of structures and equipment are based mainly on accelerographs recorded on alluvium deposits. Recent studies indicate that a number of parameters such as geological conditions, peak ground acceleration level, and duration of strong motion influence both ground motion and response spectra. These influences are not currently accounted for in earthquake design spectra.

This study examines influences of geological conditions, peak ground acceleration level, and duration of strong motion on ground motion and response spectra. Statistical studies are carried out on 54 complete records from 46 recording stations in 16 seismic events. To investigate the effect of each parameter, the earthquake records (time histories and response spectra) are divided into several groups. For each group the statistical variables, the mean and standard deviation of ground motion and response amplifications are computed. The computations for amplifications are carried out for five damping coefficients and at a large number of frequencies to include the applicable range of frequencies in the design spectra. The amplifications are then averaged within the acceleration, velocity, and displacement regions of the spectra to obtain design amplifications.

The results indicate that the peak ground velocity-acceleration ratio is substantially lower for records on rock deposits than those on alluvium; it is also lower for records with a peak ground acceleration level greater than 0.20 g than those with an acceleration less than 0.20 g; and finally it is lower for records with a duration of strong motion (defined as the time interval between the first and last acceleration peaks equal to or greater than 0.10 g) greater than 10 seconds than those with a duration of less than 5 seconds. The study also shows differences in response amplifications for various groups.

For each category and each damping coefficient, design spectra are computed from the product of ground motion and the corresponding amplifications. The effects of various parameters on design spectra are discussed and recommendation are made for modifying the design spectra for alluvium deposits for the influence of geological conditions, peak ground acceleration levels and duration of strong motion.