

RESPONSE TIME DURATION OF SELECTED UNITED STATES
STRONG-MOTION EARTHQUAKE RECORDS

by

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SYNOPSIS

Velocity response envelope time duration spectra for 5 percent critical damped oscillators were calculated for the horizontal components of twenty-seven United States earthquake records (Perez, 1974)¹. Included among the records analyzed are the important accelerograms of El Centro, 1940, Olympia, 1949, and Taft, 1952, and a selection of accelerograms from earthquakes at San Francisco, 1957, Parkfield, 1966, and San Fernando, 1971. Time duration spectra are expressed in seconds or in the number of cycles, for periods varying from 0.2 seconds to 4.0 seconds. The spectra portray the cumulative time for which the response equals or exceeds a chosen amplitude value. Limits or bounds on the number of cycles for levels of 20, 40 and 60 cm/sec are briefly discussed.

COMMENTS ON THE TIME DURATION SPECTRA

Analysis of the twenty-seven accelerograms indicates that generally, the time duration of the higher levels of response are continuous for all periods, whereas the continuity is less evident at the lower levels of response. A study of the time durations for particular levels of response indicates a relationship exists between the predominant time duration, the corresponding periods, and the magnitude of the earthquake. For response levels equal to or greater than 20 cm/sec, the following observations can be made: 1) large magnitude earthquakes generally induce longer response durations, as expected, and 2) large magnitude earthquakes tend to produce predominant response durations at the longer periods. If the predominant duration is expressed instead as the number of cycles, then it appears that the maximum number of cycles is generally in the range of ten to sixteen cycles, irrespective of the period. For levels of 40 cm/sec and 60 cm/sec, the pattern is similar to the 20 cm/sec level, but with much greater scatter in the data. The maximum number of cycles in these two higher levels is less than ten cycles for 40 cm/sec and less than eight cycles for the 60 cm/sec level.

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1. Perez, V., 1974, Time Dependent Spectral Analysis of Thirty-one Strong-motion Earthquake Records. U.S. Geological Survey, Open File Report 74-48.