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**A PRELIMINARY STUDY
OF THE DURATION OF STRONG EARTHQUAKE GROUND MOTION
ON THE TERRITORY OF FORMER YUGOSLAVIA**

by

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ABSTRACT

This report presents an empirical study of frequency dependent duration of strong earthquake ground motion on the territory of former Yugoslavia, using a uniformly processed database of 330 three-component accelerograms from 183 earthquakes, recorded at 60 sites in former Yugoslavia between 1975 and 1984. The duration is studied in 12 narrow frequency bands (channels). In each channel, the acceleration and corresponding velocity and displacement time histories are considered as one homogeneous data set. The duration of the strong motion part in a function $f(t)$ of ground motion (acceleration, velocity or displacement) is defined in each frequency band as the sum of the time intervals during which the integral $\int_0^t f(\tau) d\tau$ has the fastest growth and gains 90% of its final value. In each frequency band, the duration is modeled as a sum of two terms, the "basic duration"—the duration of strong motion observed at rock sites, and the "site conditions" term—prolongation due to specific geological and local soil conditions at the recording site. Two groups of empirical models are studied, one with the earthquake magnitude and the other one with the site intensity as a scaling parameter. An algorithm is presented for choosing a model depending on which earthquake and site parameters are available for a particular application. The results also includes probability distribution functions for the residuals of the models, which allows one to estimate the probability of a given duration at a site being exceeded, given the earthquake size and location (or site intensity) and the local site conditions.

The Yugoslav database is deficient in records from large magnitude earthquakes, and in records at sites on basement rock (geological classification) and on deep soil (local soil classification). Also, for many records the contributing earthquakes have not been identified, which reduced further the number of records that could be used. Consequently, independent development of regression models using only this database was not possible. Instead, models developed earlier by the authors for the Western U.S. using a more complete database were fit to the Yugoslav data.

The major trends in the regression models for the Western United States and for former Yugoslavia are the same, but there are some differences. In the Yugoslav models, the duration grows with magnitude at a higher rate for large magnitude earthquakes and at high frequencies. Also, the increase of duration with distance from the source is smaller. These differences and the pattern of the dependence of duration on intensity support the assumption of larger wave velocities and larger quality factor Q in the upper crust on the territory of former Yugoslavia than in the Western United States.

Although preliminary, the results of this study are adequate for estimating the duration of strong earthquake ground motion on the territory of former Yugoslavia. More accurate equations will be developed when a more complete database becomes available.

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