VIII DISCUSSION AND CONCLUSIONS

This work is based on simplified description and generalization of shear wave spectra of strong ground motion. This representation does not evolve from a solution of some specific and deterministic source slip, but can be thought of as an intuitive collection of relevant parameters and functional relationships, which by observational understanding of the earthquake source mechanism, and use of dimensional analysis, result in a coherent picture on the main features of strong ground motion. Consequently, our extrapolation of the Pseudo Relative Velocity, $PSV(T)$, of strong ground motion into frequency bands beyond those which can be recorded by currently available strong motion accelerographs is likewise only intuitive and qualitative. Though an effort was made to make as many quantitative tests as possible, we can only hope that the real nature is not too different from these simplified average trends. Yet, the remarkable and encouraging outcome of this exercise is that the various comparisons of our model with the independent estimates of seismic moment, peak ground displacements and average dislocation lead not only to good agreements, but also to resolution and scatter which are consistent with other independent estimates.

The largest uncertainties in our extrapolation are believed to exist near $T(N_c)$, where the empirical scaling models approach the recording and processing noise. The tests performed so far suggest that the resulting $PSV(T)$ are probably very realistic for $3.5 < M < 7$ and for horizontal ground motion. The slopes and amplitudes of empirically computed $FS(T)$ and $PSV(T)$ for vertical motions suggest that near $T = T(N_c)$ our empirical models may not be reliable for $M > 6.5$. To understand these amplitudes we need more recorded accelerograms for $M > 7$ and, so, we must patiently wait for this data to become available.

Selection of the high ($f = 100$ Hz) and of the low ($f = 1/100$ Hz) frequency limits for presentation of all results in this work is arbitrary. Extrapolation of $PSV(T)$ on log - log scale by Eqn (V.30) from $T(N_c)$ (or from T_1) towards $T \rightarrow \infty$ sec (and $5T_1$) appears reasonable and agrees favorably with the known trends of seismic moment M_0, peak ground displacements and of the average dislocation amplitudes, $\overline{u}$, versus earthquake magnitude. Since the corner frequency in Fourier spectrum amplitudes, $1/\tau$, in the near-field ground motion is $\sim v/r$, where v is the dislocation velocity (typically between 2 and 3 km/sec), and r is the representative source dimension, it is seen that τ can be larger than $T(N_c)$. This is so assuming that, for the frequencies considered here, the rupture occurs as a "smooth" process. Many studies have suggested that the fault slips irregularly, with large dislocations distributed at several or at many "hot" spots, with large dislocation amplitudes, making larger events look like a sequence of smaller events. While this faulting behavior can affect τ appreciably, we do not have at present, reliable data to introduce and to verify such behavior in our analysis.

The highly "local" nature of strong motion recording, local in the sense of the proximity to the fault (often less than say 100 km), and the fact that it is $\overline{u}$ and not the overall source magnitude or moment and long source dimensions (L) that govern the near-filed strong motion amplitudes, all agree with the observed trends of strong motion amplitudes predicted by the G4RM.

Numerous further tests and studies of the relationships analogous to Eqns (V.9), (V.13), (V.16), (V.27) and (V.30) (and of the associated amplitudes, corner frequencies and scaling parameters) are possible. Also, the empirical equations exemplified by Eqn (II.1) can be used to investigate the high frequency attenuation and the trends implied by the peaks of spectral amplitudes for frequencies less than 25 Hz. Many of these studies have been completed in the process of selecting and verifying the physical basis and the equations which are presented in this paper, but their presentation is far beyond the scope of this presentation (Trifunac 1990b; 1993a,b; 1994a,b,c; Novikova and Trifunac, 1994). The picture which emerges from this work is that of detailed internal consistency and of excellent agreement with near strong ground motion and distant seismological inferences on one hand, and with the theoretical source representations on the other.