

**ATTENUATION OF BODY WAVES IN THE  
NEW MADRID SEISMIC ZONE**

**Mark Edward Wuenschel, B.S.**

**A Digest Presented to the Faculty of the Graduate School  
of Saint Louis University in Partial Fulfillment of  
the Requirements for the Degree of  
Master of Science (Research)**

**1991**

## DIGEST

Data from PANDA (Portable Array for Numerical Data Acquisition) have been used to study attenuation of body waves within the central part of the New Madrid seismic zone (NMSZ). The data set includes 58 local earthquakes ( $m_{bLg} = 1.3$  to  $3.8$ ) recorded at an average of 16 three-component PANDA stations. A spectral decay technique has been employed to analyze amplitude spectra of both P- and S-waves in the frequency range of 5 - 25 Hz. The spectral decay parameter  $\kappa$  is observed as a function of hypocentral distance, site, and source characteristics and is used to determine  $Q_i$ , the frequency independent component of  $Q$ , for both P- and S-waves within the study area. The technique used was successful in providing the first estimates on attenuation of direct S-waves in the NMSZ. Average  $Q$  estimates for both P- and S-waves were generally found to be less than 100 within the areas of highest earthquake activity, indicating that attenuation is high in those areas. Analysis of  $\kappa$  versus epicentral distance  $r$  data, gave an extremely low estimate ( $Q_s = 22$ ) for attenuation of shear-waves in the upper 600 meters of sediment in the NMSZ.  $Q_s \approx 1.5 Q_p$  as indicated by data for the entire study area.  $Q$  data from a subset of stations, at which  $Q_p$  and  $Q_s$  were obtained for the same event, gave a similar result with confidence of  $0.53 < Q_s/Q_p < 1.79$ . Finally, analysis of attenuation for both P- and S-waves suggests that significant azimuthal variations exist in seismic velocities,  $Q$ -structure, or both in the central part of the NMSZ.