

**A JOINT HYPOCENTER VELOCITY DETERMINATION
FOR
THE NEW MADRID SEISMIC ZONE**

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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)

1987

DIGEST

The Saint Louis University (SLU) regional seismic network has evolved with the support of both the USGS and the NRC from a 16 station network in 1974 to include 32 stations at present. As of September, 1984 over 2000 earthquakes have been located in the New Madrid seismic zone using the SLU network.

Over 300 earthquakes from the SLU archive have been selected based on the number of observing stations and locations within the New Madrid seismic zone. These events are relocated using the joint hypocenter velocity determination (JHVD) algorithm developed at Saint Louis University. The JHVD simultaneously inverts the earthquake data for crustal P-wave velocities and corresponding station travel-time delays. The velocities are calculated using a fixed interface plane layered model. The earthquake data are broken into several subregions based on seismicity patterns and then are relocated separately. The JHVD inversions are constrained using refraction blasts with known locations as fixed events and by holding constant the travel-time correction for stations near the blasts.

Velocity models from the JHVD inversions are reasonably uniform throughout the New Madrid seismic zone. The velocity results do not indicate the presence of a large scale shallow low velocity zone in the Mississippi embayment. Station corrections from the JHVD inversions correlate with surface geology. Relocated earthquakes show an increase in clustering when compared with starting epicenter maps. Vertical profiles taken along and across each of the seismicity trends are much improved in the relocations and offer the best indication of strike and dip of active

faults portrayed for the New Madrid seismic zone.

Composite focal mechanism solutions are constructed for each of the seismicity trends. In order to provide a high degree of confidence in the first motion, acceptable data are limited to digitally recorded observations. The choice for preferred nodal planes of the resultant solutions are constrained by the vertical profile data for all but the GRT trend.

The vertical profiles of hypocenters and composite focal mechanisms are discussed briefly in the context of the tectonics of the New Madrid seismic zone.