APPLICATION OF THE REFLECTIVITY METHOD TO
CENTRAL UNITED STATES
REFRACTION STUDIES

by

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CHAPTER I

INTRODUCTION

Numerous earthquakes occur in the southeastern portion of Missouri and in the southwestern portion of Illinois. In order to obtain satisfactory hypocentral locations for these events one must determine which seismic wave velocity-depth model to use for the area. This can be done by comparing travel times from known sources to those predicted by the models. If none of the models gives the desired results, an alternate model which agrees to a greater degree with the data must be constructed. This ability to improve hypocentral locations contributes to the solution of the over- all problem, defining the seismicity of the region. For the New Madrid Seismic Zone there exist four seismic velocity models which have been proposed: Stauder et. al. (1964), McEvilly (1964), Nuttli et. al. (1969), and Stewart (1968). Recent hypocentral locations for the Central United States, obtained using data from Saint Louis University's Southeast Missouri Regional Seismic Network and cooperating seismograph stations, were determined using the Nuttli et. al. (1969) model or a

modification of it. Deciding which model gives the best solution for a given earthquake is nearly impossible since one cannot calculate the hypocenter and origin time of a seismic event with the necessary high degree of certainty.

To make this decision one requires events of known location and origin time. Monitored explosions in or near the area provide the necessary well-determined sources. That model which exhibits the best agreement with the exact data provided by the explosions can be judged to be the best one to use for hypocenter determinations.

Past studies of the crustal and upper mantle structure of the Central United States, including those mentioned above, serve to delineate the upper and lower limits of layer thickness and seismic wave velocity. Any alternate model proposed in this study must conform to the observations which led to the formulation of any previous models. If any discrepancy exists, a plausible explanation must be presented.

Stauder et. al. (1964) analyzed the seismic data of the Billiken calibration shot of June 28, 1963 using geometrical ray theory to model reflection and refraction arrivals and calculate travel time residuals. The model they obtained is given in Table 1.