SEISMIC MODEL STUDIES OF A TRANSITION ZONE BETWEEN TWO MEDIA

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This investigation applies an experimental approach in order to verify some of the theoretical formulations regarding the propagation of seismic waves through media in which velocity and density vary linearly. For this purpose the two-dimensional model technique is used to study the reflection and transmission of dilatational waves at normal incidence. The media considered are composed of two homogeneous half-spaces separated by a transition layer of linearly varying velocity and density. The transition layer was constructed by bonding together the tapered edges of two thin plates of plexiglas and aluminum. The reflection and transmission coefficients are related to one another by Stokes' principle of reversibility.

Two models are considered: Model A composed of two half-spaces separated by a transition layer, and Model B made up of two half-spaces only. Conventional pulse methods of ultrasonic model studies are applied. Barium titanate crystals are used as source and as receiver. In both models source and receiver are positioned at opposite edges in order to ensure the detection of waves traveling normally to the

layering interface. The P waves are recorded and the initial portions of the records are digitized and a Fourier analysis performed.

The transmission coefficients are proportional to the ratio of the frequency spectra of the pulse from Model A to that from Model B. This makes it possible to cancel some of the factors affecting the wave propagation such as physical and geometrical attenuation, frequency distortion of receiver and transducer, and the effect of free surface.

The experimental results show a marked disagreement with the theoretical character of the transmission coefficients for a transition layer. The predominance of constructive and destructive interference patterns in the frequency range observed suggests the existence of discontinuities in velocity and density at the top and at the bottom of the transition layer, and a constant value of these parameters throughout the layer. In fact, if transmission coefficients are computed for a layer in which the values of the velocity and density are taken as the average of the values of these quantities in the two half-spaces, theoretical results are obtained which are comparable, in the frequency range in question, to the experimental results.

Experience has shown that the technique here used to construct transition zones in two-dimensional models seems to be quite versatile for the study of wave travel-times. The results of the present study, however, indicate that the technique is not so suitable for investigations of wave amplitude.