A COMPARISON OF THE PROPERTIES OF ELASTIC WAVES GENERATED BY EXPLOSION AND IMPACT SEISMIC SOURCES

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The general properties of elastic waves, including frequency spectrum, propagation characteristics and wave type (P, SV, SH etc.), are known to be dependent on the nature of the seismic source. This thesis presents the results of field experiments which were designed to describe quantitatively the properties of the first arriving elastic waves generated respectively by small explosions and by falling weights, and to compare these results. The investigation included studies of wave amplitude decay with increasing distance, change in wave shape with distance, and particle motion near the source.

In order to reduce the number of variables to a minimum the data were taken under identical field conditions using subsequent explosion and impact type seismic sources. The work was done in a field for which the physical properties were known from refraction seismic data, electrical resistivity results, and a limited amount of coring.

The study of amplitude decay was accomplished in two parts. The refracted first arriving waves were recorded on equipment comprising twelve vertical com-

ponent velocity sensitive geophones, an electronic amplification unit, and a galvanometric-photographic recording unit. This equipment was periodically calibrated in the field concurrently with the collection of data. The calibration was such that the amplitude of a wave having passed any given geophone could be determined relative to the amplitude of this same wave at a reference geophone. These relative amplitudes were assumed to follow power law of decay, viz., $A = (\text{constant})\ d^{-m}$, (d is the source-detector distance), and least squares analyses were performed to determine the values of m. The direct waves close to the source were recorded on three-component displacement meters and the amplitudes of the first arriving waves were analysed using the method described above.

The three-component seismograms also enabled the construction of particle motion diagrams. From the velocity records it was attempted to detect a change in wave shape by plotting the first quarter period (the time from the break to the first peak on a record) versus distance.

Upon comparison of the analyses of the explosion generated and impact generated data, the following observations were made:

1. There was no significant difference in the amplitude decay exponent (m) determined from the head

waves of explosions from that determined by impact sources.

2. The amplitude decay exponent determined from the direct waves of explosions was significantly greater than that determined from impacts.

3. A significant amount of wave broadening with distance was observed in the range of distances involved (less than 200 feet), but no more broadening is characteristic of explosion generated waves than of impact generated waves.